

# Community Health Workers Literature Review: Health Systems Linkages

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# Acronyms

ACT	Artemisinin-based combination therapy
ANC	Antenatal care
CHW	Community health worker
iCCM	Integrated community case management
MeSH	Medical subject heading
MNCH	Maternal, neonatal, and child health
MoSQUIT	Mobile-based surveillance quest using information technology
PMI	U.S. President's Malaria Initiative
RA	Rectal artesunate
RDT	Rapid diagnostic test
SBC	Social and behavior change
USAID	U.S. Agency for International Development
WHO	World Health Organization

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# Operational Definitions

Due to differences in understanding of key terms across disciplines, this literature review used the following operational definitions:

**Health System:** According to the World Health Organization (WHO), a health system “comprises all the organizations, institutions and resources that are devoted to producing health actions” (WHO, 2000). This review focuses largely on national health systems which are usually government led and guided by national policy or strategy.

**Community Health Worker:** According to WHO, “Community health workers (CHWs) are health care providers who live in the community they serve and receive lower levels of formal education and training than professional health care workers such as nurses and doctors. This human resource group has enormous potential to extend health care services to vulnerable populations, such as communities living in remote areas and historically marginalized people, to meet unmet health needs in a culturally appropriate manner, improve access to services, address inequities in health status and improve health system performance and efficiency” (Scott et al., 2018). This review used “CHW” to describe this cadre of health professionals, despite the variation in titles that countries may use (e.g., community health volunteer, health extension worker).

**Compliance:** In the context of this literature review, compliance refers to either a provider’s adherence to local, regional and national health service guidelines or a client’s adherence to care instructions from a health care provider.

**Integration of CHWs in the Health System:** “The process or extent and pattern of acceptability and adoption of the health intervention—in this case a CHW program—into critical functions of a health system” (Atun et al., 2010). This literature review considers CHWs as always part of the health system, but the level of integration and recognition within the health system varies by context.

**Linkages:** This review uses “linkages” to describe discrete points of intersection or overlap between CHWs and the health system of which they are a part, either in an integrated fashion or as an added service or program to existing roles of the health system (often externally funded).

**Behavioral lens:** A behavioral lens refers to the examination of how structural, policy, psycho-social and other stimuli external to an individual may explain or influence the specific behaviors of those individuals as actors within the health system.

# Executive Summary

Community Health Workers (CHWs) have an essential role within the health system, particularly in reaching underserved populations and improving access to health services in hard-to-reach areas. However, the connection between CHWs and the health system may be compromised by barriers such as lack of complete inclusion of CHWs in the overall health system, lack of communication and data management tools between health facilities' supervisors and CHWs, and limited stock management and referral systems. Furthermore, CHWs working in remote and isolated communities often lack adequate support from the health system for various clinical and non-clinical aspects of their work. CHWs can positively impact and strengthen linkages with their communities if they receive better support from the broader health system. This creates an opportunity to be leveraged further in most contexts where CHWs operate.

To increase support for CHWs, there is a need for in-depth understanding of both the behavioral factors that influence the relationship between CHWs and the health system and potential interventions that may foster meaningful interactions therein. In response to this need, Breakthrough ACTION, a social and behavior change project, conducted the present literature review with funding from the U.S. President's Malaria Initiative (PMI) to inform strategies for the continuous inclusion of CHWs in the broader health system. The literature review aimed to better understand two topics: (1) the range of behavioral factors associated with the relationship between the CHW and the health system at various touchpoints (e.g., stock management, referrals, data management, and supervision), and (2) examples of interventions that succeeded at fostering meaningful interactions and linkages between CHWs and the health system.

The first research topic explored the factors related to the relationship between CHWs and the health system, specifically structural, environmental and social factors.

## Structural and environmental factors

- The role of CHWs in the health system.<sup>1</sup>
- The integration of CHW services into the health system.<sup>2</sup>

## Social factors

- CHWs with social and political roles in their communities.<sup>3</sup>
- The linkages between the health system and the community.<sup>4</sup>

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<sup>1</sup> Moh et al., 2022; Das & Ravindran, 2010; Enguita-Fernández et al., 2021; Tuyisenge et al., 2020; Zulu et al., 2013; Nkosi-Gondwe et al., 2018

<sup>2</sup> Paul & Pandey, 2020; Singh et al., 2016; Napier et al., 2021; Green et al., 2019; Wickremasinghe et al., 2021; Laurenzi et al., 2020; Schuster et al., 2016

<sup>3</sup> Masunaga et al., 2022; Ahluwalia et al., 2010

<sup>4</sup> Moh et al., 2022; Napier et al., 2021; Altobelli et al., 2020; Tuyisenge et al., 2019; Enguita-Fernández et al., 2021; Mamo et al., 2019; Langston et al., 2014; Mvumbi et al., 2019; Ahluwalia et al., 2010

The second research question identified interventions to foster meaningful interactions and linkages between CHWs and the health system, specifically at typical touchpoints in which CHWs commonly interact with the health system: stock management, referrals, data management, and supervision.

### Stock management

- Digital platforms, such as automated stock management.<sup>5</sup>
- The presence of stock outs (because this was a common theme, this review detailed some of the causes).<sup>6</sup>

### Referrals

Reviewers distilled literature findings on referrals into the following categories: digital platforms, pre-referral procedures, social support for CHWs, prevention of missed referrals, referral compliance, and participation of community members in referral services. Interventions and examples follow:

- **Digital platforms:** mobile phone applications,<sup>7</sup> availability of mobile phones for basic communication through SMS and calls,<sup>8</sup> as well as other digital tools.<sup>9</sup>
- **Pre-referral procedures:** Use of rectal-arterunate prior to referrals for severe malaria care at a health facility<sup>10</sup> and procedures prior to referring pregnant women for antenatal care.<sup>11</sup>
- **Social support from CHWs following referrals:** Materials such as referral slips for follow-up care and <sup>12</sup> the value of follow up visits.<sup>13</sup>
- **Factors that prevent missed referrals:** Health record linkages<sup>14</sup> and knowledge by CHWs, patients and providers.<sup>15</sup>

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<sup>5</sup> Rajvanshi et al., 2021) and data systems (Biemba, Chiluba et al., 2020; Davlantes et al., 2019; Chandani et al., 2017

<sup>6</sup> Mengistu et al., 2021; Kachwaha et al., 2022; Kalyango et al., 2012) and consequences (Mengistu et al., 2021; Lohfeld et al., 2016; Davlantes et al., 2019; Mondala & Murhekarb, 2018; Bagonza et al., 2014; Ngwira et al., 2021; Stekelenburg et al., 2003; Boakye et al., 2021; Napier et al., 2021; Das & Ravindran, 2010) related to stock outs, as well as how these could be addressed with stock replenishments (Fasawe et al., 2020; Chandani et al., 2017; Davlantes et al., 2019

<sup>7</sup> Nigussie et al., 2021

<sup>8</sup> Hackett et al., 2019; MacDonald & Diallo, 2019; Nishimwe & Mchunu 2021; Fasawe et al., 2020; Mangwi et al., 2016

<sup>9</sup> Schaeffer et al., 2019

<sup>10</sup> Lee et al., 2021; Phiri et al., 2016; Lal, Ndyomugenyi, Paintain et al., 2016; Mvumbi et al., 2019; Green et al., 2019; Lal et al., 2018; Lal, Ndyomugenyi, Magnussen et al., 2016; Strachan et al., 2018

<sup>11</sup> Ayodo et al., 2021; Sevene et al., 2021; Nuamah et al., 2016; USAID, 2013; Nishimwe & Mchunu, 2021; Schuster et al., 2016; Namazzi et al., 2013; Kambarami et al., 2016; Agu et al., 2021

<sup>12</sup> Nigussie et al., 2021; Burnett-Zieman et al., 2021; Ndiaye et al., 2013; Give et al., 2019

<sup>13</sup> Burnett-Zieman et al., 2021; Nalwadda et al., 2012; Nalwadda et al., 2013; Schuster et al., 2016; Nanyonjo et al., 2015; Nishimwe & Mchunu, 2022; Altaras et al., 2017

<sup>14</sup> Darmstadt et al., 2010; Lal et al., 2018

<sup>15</sup> Littrell et al., 2013; Nalwadda et al., 2012; USAID/Benin, 2012; Bajaria et al., 2020



- **Referral compliance** (i.e., interventions aimed at ensuring complete referrals): Referral slips<sup>16</sup> and transportation<sup>17</sup>.
- **Community member participation in referral processes**: Social support from CHWs themselves, family, and others;<sup>18</sup> ongoing engagement between the health system and communities.<sup>19</sup>

### Data management interventions

- Digital platforms: use of a central database for synchronization of data<sup>20</sup> and monitoring activities.<sup>21</sup>
- Mobile phone applications for uses such as disease surveillance.<sup>22</sup>
- Electronic forms.<sup>23</sup>
- Standardization of CHW services,<sup>24</sup> and efficiency.<sup>25</sup>
- SMS communication.<sup>26</sup>

Lastly, the supervision section focused on digital platforms, supervision in integrated health programs, incentives, and supportive supervision.

### Supervision interventions

- **Digital platforms**: Mobile phone applications for counseling,<sup>27</sup> performance data,<sup>28</sup> and communication between CHWs and supervisors,<sup>29</sup> as well as mobile phones for text messages and calls.<sup>30</sup>
- **Supervision in integrated health programs**: Training to improve these programs.<sup>31</sup>

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<sup>16</sup> Nishimwe & Mchunu, 2021; Phiri et al., 2016; Nanyonjo et al., 2012

<sup>17</sup> Ngwira et al., 2021; Altaras et al., 2017; Namazzi et al., 2013; Sevene et al., 2021; Var et al., 2020; Strachan et al., 2018; Nuamah et al., 2016; Sakeah et al., 2014; Nishimwe & Mchunu, 2021; Green et al., 2019; Darmstadt et al., 2010; Rane et al., 2020

<sup>18</sup> Dalal et al., 2022

<sup>19</sup> Burke et al., 2021; Regeru et al., 2020; Chanda et al., 2011; English et al., 2016

<sup>20</sup> Moh et al., 2022; Davis et al., 2019

<sup>21</sup> Zaidi et al., 2020; Little et al., 2013; Billah et al., 2022; Ndiaye et al., 2018

<sup>22</sup> Patgiri et al., 2022; Win et al., 2021; Francis et al., 2017

<sup>23</sup> Rinawan et al., 2021; Modi et al., 2019

<sup>24</sup> Schaeffer et al., 2019; Nigussie et al., 2021; Srinidhi et al., 2021

<sup>25</sup> Kayastha et al., 2021; Hackett et al., 2019

<sup>26</sup> USAID/Benin, 2012; USAID, 2012; Nishimwe & Mchunu, 2021; Sayinzoga et al., 2019

<sup>27</sup> Billah et al., 2022; Hackett et al., 2019

<sup>28</sup> Nigussie et al., 2021; Yang et al., 2021

<sup>29</sup> Little et al., 2013

<sup>30</sup> Biemba, Chiluba et al., 2020; Reinders et al., 2020

<sup>31</sup> Mengistu et al., 2021; Nsibande et al., 2018; USAID/Madagascar, 2014; Nsona et al., 2012) and the use of checklists (Kachwaha et al., 2022; Nsona et al., 2012; Nalwadda et al., 2012; Orji et al., 2017

- **Approaches to incentives for CHWs:** Incentives using voucher systems,<sup>32</sup> those based on CHW performance,<sup>33</sup> and others such as provision of bicycles,<sup>34</sup> and financial incentives, including performance based-financing.<sup>35</sup>
- **Supportive supervision:** Supervision training,<sup>36</sup> whether they were training on supervisory skills for supervisors or general training for CHWs, supervisory visits and meetings,<sup>37</sup> collaborative relationships,<sup>38</sup> one-on-one sessions,<sup>39</sup> peer supervision,<sup>40</sup> provision of feedback,<sup>41</sup> and strengthening case management.<sup>42</sup>

The results from this literature review support efforts to include CHWs as part of the overall health system, specifically regarding interventions related to stock management, referral procedures, data management, and supervision of CHWs. This literature review revealed that treating CHWs as integral actors of the overall health system is beneficial for relationships between CHWs and health facility staff and between CHWs and community members. Such connections enable CHWs to have greater social and structural support from the health system. Examples of such support include consistent supervision and stock management, referral, and data management systems to be shared between CHWs and health facility staff.

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<sup>32</sup> Rane et al., 2020

<sup>33</sup> Schuster et al., 2016

<sup>34</sup> Kambarami et al., 2016

<sup>35</sup> LeFevre et al., 2015

<sup>36</sup> Jahir et al., 2021; Westgard et al., 2018; Lal, Ndyomugenyi, Paintain et al., 2016; Robertson et al., 2015; Nalwadda et al., 2012; Nsona et al., 2012

<sup>37</sup> Gopalakrishnan et al., 2021; Kachwaha et al., 2022; Tiruneh et al., 2019; Reinders et al., 2020; USAID/Benin, 2012; Das et al., 2014; LeFevre et al., 2015; Kim et al., 2015; Langston et al., 2014; Littrell et al., 2013; Nalwadda et al., 2012; Robertson et al., 2015; Burke et al., 2021; Billah et al., 2022; Napier et al., 2021; Orji et al., 2017; USAID, 2014; USAID, 2013; Lal, Ndyomugenyi, Paintain et al., 2016; Thurman et al., 2018

<sup>38</sup> Juarez et al., 2021; Reinders et al., 2020; Orji et al., 2017; Agu et al., 2021; Ambaye et al., 2014; Nsona et al., 2012; Biemba, Chiluba et al., 2020; Napier et al., 2021; Biemba, Mulenga et al., 2020; Thurman et al., 2018; Mondala & Murhekarb, 2018

<sup>39</sup> Jahir et al., 2021; Kim et al., 2015; Orji et al., 2017

<sup>40</sup> Mohan et al., 2011; Neogi et al., 2016; Langston et al., 2014

<sup>41</sup> Ludwick et al., 2018; Nigussie et al., 2021; Biemba, Chiluba et al., 2020; Biemba, Mulenga et al., 2020; Uddin et al., 2021; Kim et al., 2015; Nishimwe & Mchunu, 2021; Schuster et al., 2016; Chanda et al., 2011

<sup>42</sup> Akinfemi et al., 2018; Das et al., 2014

# Background

CHWs play an essential role in the delivery of fundamental health services for malaria; maternal, neonatal, and child health (MNCH); nutrition; and other areas, particularly among hard-to-reach populations (Perry et al., 2021). They provide their communities with social support, necessary health information, and, in many cases, integrated case management and preventive services. They also play a central role in many social and behavior change activities to increase the practice and maintenance of healthy behaviors within the communities they serve (Schaaf et al., 2020). Skilled, equipped, and motivated CHWs contribute significantly to progress in the fight against malaria, in particular, and overall improve equity in access to health services and information for the most underserved populations.

Similar to facility-based health workers, CHWs have crucial links to the broader health system. They rely on the health system for training, compensation, encouragement, supervision, mentorship, and connection to supply chains and stock management. Additionally, CHWs interact with the health system through data management and reporting functions, such as when they report on the services they have provided. The intermediary nature of CHWs, situated between the community and the health facility, poses an opportunity to strengthen community–facility linkages. However, in many contexts, including remote and isolated communities, CHWs often lack adequate support for various clinical and non-clinical aspects of their work. For example, factors such as respect and acknowledgment from health facility staff towards CHWs, functioning referral systems, and workable stock management systems (LeBan et al., 2021) can help improve the relationship between CHWs and the health system. With greater functional relationships with the health system, CHWs stand to accelerate improved community health.

Viewing the touchpoints between CHWs and the health system through a behavioral lens allows for a deeper exploration of this relationship, as the successful outcomes of the interactions at those touchpoints depend, in part, on the actions of the people involved. This may include quality supervision, mentorship, and support from CHW supervisors and stock managers, which, in turn, could impact the quality of the work of CHWs. The behaviors of CHWs, health facility staff who interact with CHWs, and community members are influenced by existing policies and structural factors, as well as individual-level factors, including attitudes, social norms, perceived self and response efficacy, risk perception, and knowledge. The behavioral patterns of CHWs and supervisors during their interactions may deter or enhance a CHW's work. Addressing the challenges CHWs face cannot occur without first understanding these behavioral patterns and factors that underpin the relationships between CHWs and the health system.

Existing literature does not explore, in a comprehensive way, the relationship between CHWs and the broader health system from a behavioral lens. To inform strategic approaches for the continuous inclusion of CHWs in the health system, Breakthrough ACTION, a social and behavior change (SBC)

project, conducted a literature review, at the request of the U.S. President's Malaria Initiative (PMI), to understand the behavioral factors associated with the relationship between CHWs and the health system. The project structured the literature review to focus on four specific health system touchpoints for CHWs (stock management, referrals, data management, and supervision) and identified interventions that have successfully fostered meaningful interactions and linkages between CHWs and the health system from a behavioral standpoint.

The role of structural factors and interventions in SBC offers a particularly salient perspective throughout this review. While the field of SBC has placed emphasis on individual factors and interventions to change behavior, SBC practitioners increasingly recognize that they need to pay more attention to structural factors, including policies, because of their significant impact on behavior. Structural factors, which create favorable or unfavorable conditions for behavior change, are often not addressed in SBC programming. Behavioral economics is a useful approach for designing SBC interventions to address structural factors, as it facilitates people's ability to make decisions and take desired actions. This approach helps the intended audience change their surroundings or perspectives by changing their physical environment, social context, set of choices, mood/affect, time/timing and chronic scarcity, and perspectives of present bias or hassle factors. Changes in data flow, referral systems, stock monitoring, default practices and processes, and supervisory activities can all be viewed as behavioral interventions in that they modify the systems and structures in which health systems actors operate. As such, this literature review embraces such structural perspectives and interventions which influence CHW interactions with the health system.

The results from this literature review support efforts to view and include CHWs as part of the overall health system in specific interventions related to stock management, referral procedures, data management, and supervision of CHWs. Reviewers found that, according to the materials explored, treating CHWs as integral actors of the overall health system benefits the CHW and health facility staff relationship as well as CHW and community member relationships. Such connections enable CHWs to receive greater social and structural support from the health system. Examples of such support include consistent supervision and structured stock, referral, and data management systems shared between CHWs and health facility staff.

## Objective and Research Questions

Reviewers' objective was to understand the factors associated with the relationship between CHWs and the health system at four specific touchpoints: stock management, data management, supervision, and referrals. This literature review sought to answer the following research questions:

1. What behavioral factors influence the bi-directional relationship between CHWs and the health system?

2. What interventions, including those using human-centered design and behavioral economics approaches, may foster meaningful interactions and linkages between CHWs and the health system for stock management, referrals, data management, and supervision?

## Methods

### Search strategy

Breakthrough ACTION used several systematic review approaches to ensure the high quality and relevancy of findings, including developing and using extensive search concepts and pre-specified eligibility criteria.

The literature review pulled from multiple sources. For peer-reviewed journal articles, reviewers used the following bibliographic databases: CINAHL, Embase, PsycINFO, and PubMed. In addition, they also searched grey literature, such as technical and program evaluation reports, using relevant online resource sites, including the U.S. Agency for International Development's (USAID's) Development Experience Clearinghouse, WHO's Institutional Repository for Information Sharing, the Compass for SBC, and the Malaria Evidence Database.

The project applied and tested various Boolean and medical subject heading (MeSH) operators to develop the core search strategy (see [Annex 1: Literature review search terms](#)), adjusting them to each source as needed. The search strategy included four concepts:

1. Malaria and other related health fields, including MNCH and nutrition.
2. CHWs.
3. Health system (public health systems research, delivery of health care, health care system, integrated health care system, community health system, health information system).
4. Malaria-endemic countries, including Asia, Latin America and the Caribbean, and sub-Saharan Africa.

Breakthrough ACTION conducted the literature search between mid-April and mid-May 2022. Search results were filtered for papers published since 2010 and written in English. Reviewers then retrieved and organized the search records in an Excel (Microsoft, Seattle, WA) spreadsheet. They also consulted subject matter experts to obtain recently published articles while drafting this literature review and the references of included articles.

### Eligibility criteria

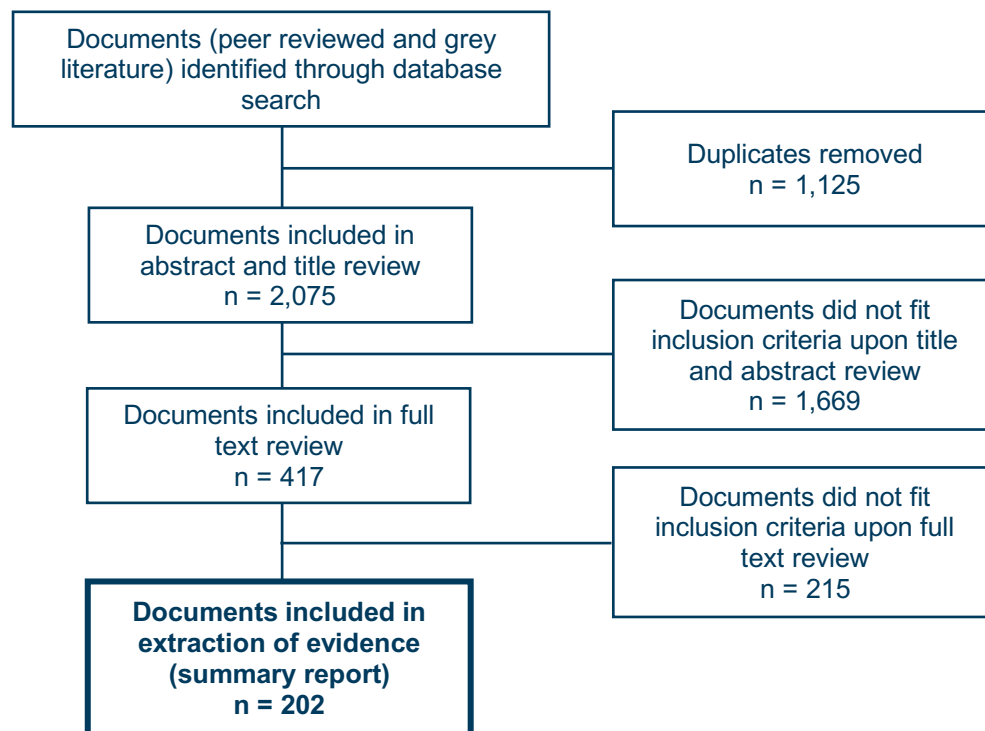
Articles pulled from the databases were screened for inclusion, beginning with the title and abstract.

Reviewers removed articles with titles and abstracts that did not fit the search criteria and removed commentaries and opinion papers that did not present concrete research findings.

A full-text review further screened articles that passed this preliminary title and abstract screening. Papers moved forward in the screening process if they met the following content requirement regarding any of the following CHW-health system touch points:

- Supervision
- Referrals
- Data Management
- Stock Management

Out of 3,211 identified documents, 202 met the criteria for analysis. **Figure 1** displays the search and selection process.



## Analysis and synthesis

Reviewers coded each selected article by various categories to analyze trends, including the following:

- Project/activity location.
- Program focus.
- Study methods and approaches.
- CHW-health system touch points (supervision, referrals, data management, stock management).
- Inclusion of a behavioral intervention intended to improve the outcomes of interest.

They then organized excerpts from the papers into a document to synthesize notable themes manually.

Out of the 202 papers reviewed, this review cites 132. Articles not cited but included in the review are available for reference in [Annex 2: Additional Articles Reviewed](#) because of their rich findings, which could be helpful in future research.

## Results

### Description of papers reviewed

This section describes the characteristics and trends of the 202 papers reviewed and included in the literature review. [Annex 3: Article Characteristics](#) includes additional information about the articles.

#### Document types

The main content presented in this report draws from published peer-reviewed articles (n = 195), with the remaining being from evaluation reports (n = 7). While the year of publication spread widely, from 2010 to 2022, more publications from 2019 to 2021 were available, and the highest number was from 2021 (n = 40), followed by 2020 and 2019 (n = 33 and n = 28).

#### Intervention focus

Out of 202 included papers, 54 articles examined interventions related to malaria exclusively. The breakdowns of other related health topics were integrated community case management (iCCM) (n = 31), MNCH (n = 89), and nutrition (n = 14). A few articles (n = 14) consisted of general information about CHW programs.

#### Geographic focus

This literature review represents a variety of countries and regions. The majority of the documents focused on one country (n = 191). Eleven papers covered more than one country (six covered two countries, and five covered four or more). The most frequently mentioned countries were India (n = 24) and Uganda (n = 22), followed by Ethiopia (n = 19). The remaining countries described in the included literature are listed alphabetically for each region as follows:

- Sub-Saharan Africa: Benin, Burkina Faso, Burundi, Cameroon, Côte d'Ivoire, Democratic Republic of Congo, The Gambia, Ghana, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, South Sudan, Tanzania, Zambia, and Zimbabwe.
- Asia/Oceania: Afghanistan, Bangladesh, Cambodia, Indonesia, Iraq, Lao, Myanmar, Nepal, Pakistan.
- Latin America and the Caribbean: Guatemala, Honduras, Nicaragua, Peru.

#### Research methods

Most papers in the sample used quantitative methods (n = 87), qualitative methods (n = 74), or mixed methods (n = 41). Quantitative studies covered a wide variety of data collection tools. These data came from cross-sectional surveys, cluster-randomized controlled trials, non-randomized community intervention trials, baseline/endline assessments, structured questionnaires, longitudinal studies, quasi-experimental studies, mobile applications, and surveillance data, among others. The most commonly used qualitative data came from in-depth interviews and focus group discussions, as well as a few case studies. Many mixed-methods studies combined interviews and focus group discussions with cross-sectional surveys.

## Research question 1: What behavioral factors influence the bi-directional relationship between CHWs and the health system?

Existing documentation consistently shows that when CHWs are part of a systematic, strategic national health system plan, and they have been fully integrated, funded and efficiently utilized into the health system, they add incredible value to the health of communities. Moreover, CHWs serve as a major source of data on community member health and are an essential link between the community and health system (Afzal, et al. 2021). Much of the literature, however, evaluates pilot programs, which treat CHW services as “add ons”; in these cases, CHWs receive training and funding from sources external to the country’s official health system.

The first research question addressed behavioral factors related to the bi-directional relationship between CHWs and the health system. Based on the available literature, reviewers categorized findings along three factors: (1) structural, (2) environmental, or (3) social. The vast majority of the existing literature pertaining to this research question centers on these three factors as they impact the behaviors of CHWs, supervisors, and community members, which in turn impacts the bi-directional relationship between CHWs and the health system.

### 1.1 Structural factors: Degree of integration of CHWs into health systems

CHWs are found to improve the quality and coverage of their work in service to the health of communities when they are an integral part of the overall health system (Moh et al., 2022). The level of CHW integration into the local health system is influenced by formal national CHW or health system policy. Integration is defined as “the process or extent and pattern of acceptability and adoption of the health intervention—in this case a CHW program—into critical functions of a health system (Atun et al., 2010).” Some of the studies reviewed here involve integrating CHW services into the health system in general, while others examined CHW services as an “add-on” that sits outside of the formal health system. The difference between these models is that full integration provides access to services and resources within the overall health system, whereas operating as an add-on poses limitations as resources and infrastructure may need to be sought elsewhere.

Integrating CHW services into the overall health system (Paul & Pandey, 2020; Singh et al., 2016) depends on numerous factors, such as the government’s capacity to adapt national policy (Napier et al.,



2021) to provide CHWs with reliable commodities and transportation, training, and supportive supervision, while also improving community engagement by training CHWs to address issues regarding timely uptake of, for example, malaria services (Green et al., 2019). In a study in Nigeria, integration posed benefits for CHWs, such as being quickly accepted within the health system, having opportunities to work with a supportive health system staff, and being recognized by the community for their effectiveness (Wickremasinghe et al., 2021).

A program in South Africa operated as an “add-on” to the government health system rather than a full integration of CHW services into the health system. Instead of being folded into the local health system, the CHW program relied on a functional health system infrastructure and strong linkages to that infrastructure. The authors noted an absence of adequate health services from the local infrastructure as well as patients experiencing structural barriers to accessing health facilities. In turn, a lack of local health system resources and infrastructure limited the CHW program (Laurenzi et al., 2020). Similarly, a study in Mozambique observed that non-integration into the health system may prevent CHW efforts from impacting positive health outcomes (Schuster et al., 2016).

In Ghana, a qualitative study about expanding volunteer CHWs’ roles to include iCCM, noted that many obstacles faced by the program stemmed from CHWs not being a part of the formal government health system. The findings noted that CHWs were unpaid, poorly supervised, regularly out of stock, and lacking in essential equipment, and noted the need for policymakers to secure this program as a government-led policy (Daniels et al., 2015). Finally, one benefit noted by introducing iCCM by community volunteers in Nigeria was the potential to reduce the workload of overburdened health facilities when CHWs are a component of the health system that can provide services otherwise only provided at the health facility level (Oresanya et al., 2019).

National policy dictates the degree to which CHWs are integrated into the local health system. A study conducted in Rwanda provided an example of the successful integration of CHWs into the primary health care system. Integration of CHWs into the primary health care system allowed communities to collaborate in strengthening the health system (Langston et al., 2014). Another example of such integration is community election of CHWs and health facility care professionals working alongside one another (Tuyisenge et al., 2020). The Ministry of Health in Zambia developed a cadre of CHWs called community health assistants to standardize and formalize the role of CHWs from a national level and implemented a training program (Zulu et al., 2013).

## 1.2 Environmental factors

Community engagement and buy-in to national policy is a key factor in the success of the policy by creating an environment conducive to its implementation. A study in Zambia stressed the value of stakeholder involvement in the creation of CHW-focused policy, noting limited stakeholder participation

can lead to policies that do not reflect community desires and can affect the implementation and uptake of the policy (Zulu et al., 2013).

CHW-related policy can also be an opportunity to create a more enabling environment for the success and scale up of CHW programs. In Myanmar, a study identified a need for intensified policy interventions to ensure the retention of CHWs working in MNCH. Such policies focused on hometown work placements after graduation, incentives, support and supervision, travel allowances, and provision of supplies (Wangmo et al., 2016). In Nicaragua, a study found that a more positive health policy landscape, achieved by seeking structural and community solutions to challenges in iCCM, enabled environment where CHWs could successfully implement iCCM (George et al., 2011). Health systems that provide CHWs with capacity development, training, continuous monitoring, supervision, and provision of necessary logistics presented a more enabling environment for CHWs to be incorporated into the formal health sector in India (Das & Ravindran, 2010) and for successful CHW interventions in Côte d'Ivoire (Moh et al., 2022).

CHW feelings of appreciation and respect by the formal health system is also important to the enabling environment. In Malawi, a qualitative study completed alongside a clinical trial explored the feasibility of CHWs reminding caregivers to give preventive malaria chemotherapy medication to children who had been recently hospitalized for malaria. The study measured CHW's adherence to the protocol of conducting three required visits to a child's home over the 10-week period following hospitalization. CHWs who reported they felt respected and valued because of their role within the health system completed all three visits. CHWs who did not complete all of the visits noted they felt they were being "used" by the health system because they felt they received no personal benefit (Nkosi-Gondwe et al., 2018).

### 1.3 Social factors

#### 1.3.1 CHWs with social or political roles

In a clinical trial aimed at treating malaria index cases and asymptomatic compound members in The Gambia, CHWs served both health/clinical and political roles as that the authors termed as "health diplomats." The community selected the CHWs to serve as trial implementers based on their regard as trusted public figures with social and political status. They also found that many CHWs saw their role as a way to gain political status. Additionally, many CHWs used their role to advocate for community health issues to be addressed. When CHWs received support in their health, social, and political roles, their performance in service delivery was more likely to improve. Findings showed that after 16 months of working with upskilled CHWs, utilization of their services increased from 40% to 64%. The authors argue the importance of supporting CHWs medical, social and political roles (Masunaga et al., 2022). Another study in Tanzania found that discussions of health matters, such as transport systems, at village assembly meetings helped support and link CHW activities to the community's political systems (Ahluwalia et al., 2010).

#### 1.3.2 Linkages between health system and community

CHWs can link the health system and the community by strengthening the relationships between them and improving access to services (Moh et al., 2022). Linkages can occur in various forms and programs. For example, in Peru, CHWs connected households to health services, allowing families to acquire information, resources, and referrals while addressing health behaviors in a culturally sensitive way (Altobelli et al., 2020). In addition, in a study in Rwanda, implementing community initiatives such as village meetings increased community participation in the health system (Tuyisenge et al., 2019). In another case of building linkages, the health system used awareness campaigns to announce CHWs' arrival in the community (Enguita-Fernández et al., 2021).

CHW feelings of connectedness and support from colleagues in the health system are important for health system and community linkages. In Ethiopia, CHWs worked closely and successfully with other health cadres and community leaders to create more sustained connections between the community and the health system (Mamo et al., 2019). Another study in Rwanda found that the formation of CHW peer support groups facilitated increased interactions between CHWs and health facility staff (through supervision and reporting functions). The authors posit that these increased interactions led to more effective linkages between the community and the health system and may have contributed to an observed increase in care-seeking at health facilities (Langston et al., 2014). The peer support groups were considered to have increased CHW visibility and accountability to the community, gaining trust of care-givers of children under 5.

## Research question 2: What interventions (including those using human-centered design/behavioral economics approaches) may foster meaningful interactions and linkages between CHWs and the health system?

This paper considers a significant number of evaluations of pilot studies, tools and programs, to improve primary areas of linkage to the health system, including stock management, referrals, data management, and supervision. These interventions aim to change CHWs' contexts, environments, and contextual defaults to influence their behaviors within their roles as CHWs. Within these four areas of CHW-system linkages are a number of recurring types of interventions, each of which feature slightly different ways to change how CHWs interact with the health system.

### 2.1 Stock Management

Supply chain interventions, particularly when focused on the use of digital platforms, enable CHWs to make stock requests and maintain a record of commodity availability, stock, and use. In addition, these interventions facilitate communication between CHWs and their supervisors and health facilities, who then respond to stock requests.

#### 2.1.1 Commodity Stock outs

CHW commodity stock outs were reported in at least 14 articles. Stock outs lead to interruptions of CHW services, influence CHWs' motivation to continue to provide their services and affect community utilization and perceptions regarding the quality of the services provided. Commodity stockout mitigation is clearly one important element to quality performance by CHWs and illustrates a strong linkage with the health system.

When health facility staff and CHWs regularly discuss stock replenishment as part of an intentional intervention to involve them more in the health system it creates opportunities for sharing experiences and additional mentoring that can help strengthen linkages (Fasawe et al., 2020). In a study conducted in Rwanda and Malawi, authors observed that supply chain procedures need to account for the overall health system and ensure staff at different levels of quality improvement teams (e.g., CHWs, health center staff, district managers) are aware of the supply chain availability to improve supply chain processes and availability (Chandani et al., 2017). The higher levels would likely need to be involved in facilitating the efficient movement of community products to resupply points and data from all levels of the health system (Chandani et al., 2017). If CHWs work to improve the communication and coordination between staff of different levels, supply chain performance, and action planning, they can help address supply chain problems (Chandani et al., 2017).

In a study conducted in Mozambique, authors recommended formalizing a method for CHWs with excess iccm commodities that would soon expire to share supplies with other CHWs or their assigned health facility (Davlanges et al., 2019). The authors referenced similar, successful approaches to streamline CHW supply chain procedures in nearby countries. Improvements to the overall supply chain system at a health system need to be considered, as there have been instances where health facilities keep CHWs' supplies for themselves rather than delivering them to CHWs (Davlanges et al., 2019).

Stock outs occur due to not only interruptions in supply chain but also the limited skills of CHWs in supply chain management (Mengistu et al., 2021). For example, in one study in India, CHWs had a limited ability to estimate product demand (Kachwaha et al., 2022), which indicates an opportunity to improve CHW linkages with the health system by providing additional training and mentorship on estimating product demand. A study in Uganda observed that stock outs could also occur due to CHWs having inconsistent delivery times to obtain drugs from different suppliers, as some drug suppliers may take long periods to deliver them (Kalyango et al., 2012). These articles highlight the need for training to inform CHWs about when to request stocks.

Consequences related to stock outs include low utilization of CHW services (Mengistu et al., 2021; Lohfeld et al., 2016) and lack of perceived credibility of CHWs by the community (Davlanges et al., 2019; Mondala & Murhekarb, 2018; Bagonza et al., 2014). According to one study, interruptions in drug supply affected the utilization of CHW services and contributed to the perception of poor-quality service provision in Ethiopia (Mengistu et al., 2021). In addition to affecting the utilization of services, a study in Malawi reported that stock outs affected CHW performance as well as affected the integration of services, such as MNCH and family planning (Ngwira et al., 2021). One study in Zambia documented the

association between poor performance of CHWs and irregular and unreliable supply of drugs due to stock-outs (Stekelenburg et al., 2003).

Boakye et al. (2021) found that in Kenya, rapid diagnostic test (RDT) replenishment could take weeks because of stock outs at the health facility level. Some of the CHWs reported never having received medications after their initial CHW training, while others noted that the initial drug stock they received post-training was not replenished when it ran out. According to this same study, when left without medications, CHWs had to refer clients who tested positive for malaria to a health facility for further care. These referrals would have been unnecessary if essential supplies were available in the community; instead, community members faced incurring transportation costs (Boakye et al., 2021). Napier et al. (2021) reported few stock outs for malaria commodities, including artemisinin-based combination therapies (ACTs) and RDTs, but gloves and first aid kits, needed for malaria treatment and diagnosis, were inconsistently available (Napier et al., 2021).

A study in India reported that repeated stock outs at community drug distribution centers might lead to the increased usage of CHW services who may have the supplies that the community drug distribution centers do not. Including CHWs in the overall health system ensures CHWs have the necessary supplies and skills to provide their services. An uninterrupted supply chain ensures consistent credibility for the CHWs (Das & Ravindran, 2010).

#### 2.1.2 Digital platforms for stock management and data capture

The following three articles reported on digital platforms for stock management, such as an automated stock management system and the use of mobile phones for submission of reports and stock requests in an effort to enable adequate supply and increase data visibility.

##### *2.1.2.1 Automated stock management system for stock requests*

In India, a mobile application was designed by the Malaria Elimination Demonstration Project to aid in malaria surveillance, human resources, and supply chain management for CHWs. The mobile application rollout also aimed to eliminate paper-based reporting. Through the application, an automated stock management system projected needs for upcoming months, enabling CHWs to understand their needs and make stock requests themselves. CHW supervisors received stock requests, collected the physical stocks, and delivered the stocks to the CHWs. CHW supervisors then notified their District Officer that supplies had been received (Rajvanshi et al., 2021).

##### *2.1.2.2 Data systems for submission of reports, requisitions, and data visibility for adequate resupply*

In Zambia, CHWs and supervisors implemented an mHealth-enhanced iCCM supportive supervision and supply chain management tool. CHWs used the DHIS2 platform on mobile phones to report on children with iCCM-supported conditions and make commodity requests. The use of the mobile phone application for stock management was associated with an increase in the proportion of CHWs who received supplies they ordered, with prevalence ratios ranging from 2.62 for RDTs (95% confidence interval [CI]; 1.37, 5.04) to 3.59 for amoxicillin (95% CI; 1.79, 7.20) (Biemba, Chiluba et al., 2020). Also, in

India, supervisors used communication between CHWs and the health system efficiently to maintain an uninterrupted supply of commodities (Das et al., 2014).

In Malawi, an enhanced management intervention was developed by the Supply Chains for Community Case Management Project (SC4CCM) to oversee the implementation of cStock, an SMS and online logistics management information system. CHWs used cStock through their own mobile phones to transmit stock data. cStock then automatically calculates resupply needs and sends the resupply needs to supervisors and as well as more than 10 supply chain indicators to program managers to facilitate monitoring and supervision. cStock formed the basis for informed and regular resupply. This increased data visibility at all levels of the supply chain, allowing CHWs to regularly monitor supply chain performance and health facility staff to respond in a timely, targeted manner (Chandani et al., 2017).

## 2.2 Referrals

Referrals serve as a bridge between clients and the health system as they allow CHWs to connect their clients to health facilities for further care or for services not offered by CHWs. CHWs often perceive themselves as key in linking the community to the health system and recognize their role improves the referral system; supervisors and community members also recognize this role (Give et al., 2019). In some instances, the health facility staff wrote a counter referral or provided a feedback slip to document the services that were delivered and the need for any follow-up care (Nigussie et al., 2021; Burnett-Zieman et al., 2021; Ndiaye et al., 2013).

### 2.2.1 Referral compliance

#### 2.2.1.2 Referral slips

When performing referrals, health workers and facility staff should use a referral form throughout all stages of referral: first, a CHW may provide one to a patient or caregiver, then the patient takes it to the health facility, and then health facility staff received it. A referral slip typically contains the information about the referral regarding the patient's conditions and needs for further care. In one example in Rwanda, CHW gave referral slips for health facilities to caregivers when they identified suspected danger signs for illness in newborns (Nishimwe & Mchunu, 2021). In a study in Malawi, signed referral slips served as key motivators and predictors of patients' referral completion. Caregivers complained that without a signed referral slip, their referred child had to wait in line with the non-referred children (Phiri et al., 2016). A study in Mozambique observed that referral slips CHWs gave to send patients to the local health facility helped the referral system function better, and community members were more likely to accept referrals as attractive tools for connecting them to health facilities. Specifically, the system

provided a fast track for those with referral slips to bypass normal administrative processes (e.g., registration at health facility) (Give et al., 2019). A study in Uganda demonstrated a clear indication of trust between CHWs and the staff from health facilities, because staff asked for referral forms from CHWs (Nanyonjo et al., 2012). However, patients did not always complete their referrals to the health facility, which could be addressed through community sensitization activities that target caregivers and CHWs and focusing on the importance of completing the referral slip (Phiri et al., 2016).

#### 2.2.1.3 Structural factors

Structural barriers continue to limit clients' ability to complete CHW referrals to health centers, including the lack of transportation, functional communication systems, accessible roads, and emergency supplies. To avoid delays during the referral process, communities where CHWs provide their services need both transportation to health facilities (Ayodo et al., 2021; Sevene et al., 2021; Nuamah et al., 2016) and adequate communication systems for making referral calls (USAID, 2013). The lack of communication systems in place for CHWs and health facilities prevents CHWs from calling or messaging health facilities ahead of time to alert of a referral or to request transportation (Nishimwe & Mchunu, 2021; Schuster et al., 2016). Even when transportation is available, such as through community ambulances, their reach might be limited. Adequate supplies were associated with more pregnancy referrals from CHWs (Kambarami et al., 2016).

#### 2.2.2 Participation of community members in referral services

##### 2.2.2.1 Social support from CHW, family, and others

CHWs had a supportive role in accompanying patients and ensuring the completion of their referrals. For example, a study in India identified social support, specifically by a partner or family member or a CHW, as a prominent facilitator of referral care for travel and care navigation specifically (Dalal et al., 2022). In addition, having someone to accompany patients to the referral facility ensured better compliance, as opposed to failure to complete referrals when accompaniment was nonexistent, even when no other barriers existed (Dalal et al., 2022).

##### 2.2.2.2 Ongoing engagement between the health system and CHWs

The communication and referral data exchange between CHWs and the health system was another key area to improve the referral system. For example, a study in Burkina Faso identified that partnerships between CHWs and health facilities could foster ongoing engagement and facilitate strong referral connections (Burke et al., 2021). However, as observed in a study in Kenya and Malawi, the poor linkage (e.g., poor data management and poor supervision) between CHWs and health facilities often accounted for an inability to track community referrals (Regeru et al., 2020). In Zambia, this finding confirmed the need for a system that could record the referrals exchanged between CHWs and health facilities and could contain more patient education on the value of complying with the referral advice (Chanda et al., 2011). A study in Uganda concluded that specific strategies could be used to improve and maintain referral compliance, including use of routine programmatic data to monitor the referral system and

ensure timely feedback and independent evaluations to ask caregivers about their referral experience and compliance (English et al., 2016).

A study in Nigeria assessed a capacity-building and supportive supervision intervention on malaria control and changes in CHW perceptions of community involvement in promoting referral for cases of fever among pregnant clients. The intervention significantly improved CHWs' perception of the need for community involvement in promoting referrals for pregnant women with fever to a health facility from both community volunteers and other community members. The supervision intervention also encouraged CHWs to promote the use of intermittent preventive treatment for malaria during pregnancy and overall improved CHW performance (Agu et al., 2021).

### ~~2.2.3 Referral procedures with potential to strengthen the link between CHWs and the health facility~~

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### 2.2.3 Social support from CHWs following referrals

Referrals generally involve a more robust procedure than just submitting a referral slip to inform the next facility. For that reason, tracking referrals and ensuring referral compliance occurs for both the facility and the client (i.e., the facility was providing the necessary services and the client was adhering to referral), necessitates social support from CHWs.

A study in Kenya identified that during follow-up visits, CHWs benefited from having available materials to aid them in the home visits, such as a visit schedule register of their own visits, a CHW household handbook, and a set of community health job aids (Burnett-Zieman et al., 2021).

Follow-up visits also helped CHWs consult with patients about the care they received in health facilities where they had been referred; CHWs ensured they complied with the instructions provided initially by CHWs and then by health facility staff to perform any necessary follow-up care. However, challenges arose when CHWs did not provide follow-up care. A study in Uganda mentioned that if CHWs did not follow-up for post care, it "may contribute to a false sense of security [by CHWs and facility-based staff] about referral compliance as well as the quality of care provided at the health facility" (Nalwadda et al., 2012, p. 51). Without follow-up, CHWs might assume that clients complied with referral instructions.

In addition to the follow-up visits following completion of a referral, follow-up visits to remind patients to complete a referral were also recommended to occur within 24 hours after referrals are made (Nalwadda et al., 2013; Nalwadda et al., 2012). Emphasizing the need for referral compliance and conducting post-referral home visits to confirm compliance is particularly important in cases of severe malaria, in which CHWs have administered rectal artesunate (RAS) as a pre-referral treatment (Mvumbi



et al., 2019; Strachan et al., 2018). Following up with patients who received referrals from CHWs ensured the referral system was effective (Schuster et al., 2016; Nanyonjo et al., 2015). When CHWs' roles are integrated into health facilities' work—meaning both CHWs and health facility staff are aware of their roles and how they complement one another—this made it more likely health care providers understood their role to provide counter referral forms when follow-up care from CHWs was needed. This highlighted the need to integrate CHWs into the health system and ensure that CHW communicated referral messages effectively to patients (Schuster et al., 2016; Nanyonjo et al., 2015). At times, as observed in a study in Rwanda, referral forms were not provided because CHWs were not aware of the importance of ensuring community follow-up care (Nishimwe & Mchunu, 2022). A study in Uganda found referral systems could benefit from social and behavior change communication tailored toward referral actors so each one knows how to perform their tasks and responsibilities and understand why they are important (Altaras et al., 2017).

According to research performed in Bangladesh, linking assessments made by CHWs at home to staff-created hospital-based assessments helped identify whether patients were complying with referrals. Evaluators conducted these assessments for the purposes of surveillance during this study and served as a record linkage tool for evaluating patient referral compliance (Darmstadt et al., 2010).

CHWs— and facility-based health care workers need continuous training to learn how to adhere to referral guidelines and recognize symptoms requiring referrals (Littrell et al., 2013; Nalwadda et al., 2012; USAID/Benin, 2012). Moreover, a study in Tanzania found that if CHW were experienced in previous health work, their increased understanding of their job requirements helped improve outcomes related to referrals. This study also found CHW prior education level was not associated with referral success (Bajaria et al., 2020).

#### 2.2.4 Digital Mobile Platforms for Referrals

The automated nature of mobile applications helps CHW referral processes more efficiently and strengthens communication between CHWs and health facilities. In addition to improving the communication between CHWs and health facilities, mobile applications, depending on their exact function, may also help CHWs by providing job aids and other tools. The use of digital platforms for better communication and referral slips can strengthen the referral system and ensure better patient compliance, if facilitators such as accessible and affordable transportation and social support are present.

One study in Ethiopia used a platform with a closed user group system that saved ongoing activities and contact information of CHWs and health facilities staff for them to connect to discuss any ANC client cases (Nigussie et al., 2021). Through this ANC application, CHWs referred clients to a specific health facility, which then received a notification and arranged to receive the client (Nigussie et al., 2021). After the client completed the referral, the health facility updated the application with the services delivered, and the application notified the CHW about any necessary follow-up care. One year after implementation, a process evaluation found the application strengthened two-way referral linkages,

notifications, and feedback systems. For example, CHWs could more easily identify defaulters and message them through the application to follow-up instead of going by foot to each village. CHWs also reported that client adherence to the pregnancy continuum of care improved because the application allowed CHWs to provide standardized care and counseling services with real-time information. The application also allowed for more timely referrals because CHWs were able to identify danger signs and complications more easily and quickly (Nigussie et al., 2021).

A study in Tanzania described improved communication between CHWs and health facility staff using SMS messages for real-time communication when referral information was needed (Hackett et al., 2019). One study in Senegal described an application on mobile phones distributed to CHWs where they could enroll to track pregnant women throughout pregnancy, birth, and postpartum and offer referrals to health providers (MacDonald & Diallo, 2019). Given the successful use of mobile applications for improving communication between CHWs and health facilities, access to a handset and cell line can ensure referral completion.

Nishimwe & Mchunu (2021) and Fasawe et al. (2020) noted that the availability of mobile phones directly influenced the ability to respond urgently during referrals (Nishimwe & Mchunu, 2021; Fasawe et al., 2020). Another study in Uganda described timely care-seeking as possible due to initial phone calls from CHWs to health facility staff to alert them about a referral (Mangwi et al., 2016). In addition to facilitating communication for CHWs, specific tools can help them improve their referrals-related work (Schaeffer et al., 2019). This study in Bangladesh mentioned that CHWs found the built-in calculation tools, a one-minute timer, and a summary page helpful in guiding their clients' referrals. This mobile technology also allowed for the auto-generation of follow-up visits, facilitating timely check-ups (Schaeffer et al., 2019).

## 2.3 Data Management

Key to integrating CHWs fully into the health system is the level to which the health system reports data on and acknowledges their activities and services. Interventions intended to strengthen data management within the health system support CHWs' efforts to collect and report on health data, including client records from home visits and disease surveillance data from communities, in an accurate and timely manner. Data management interventions also help CHWs receive feedback, communicate with their peers and supervisors, and keep track of appointments and task completions (e.g., conducting home visits, monitoring appointment details). Collectively, the evidence suggested these interventions led to improvement in motivation and performance among CHWs as well as increased efficiencies in the health system.

### 2.3.1 Digital Platforms for Data Management

Digital platforms for data management, mainly consisting of mobile applications, were abundant in this literature review.

#### 2.3.1.1 *Electronic application for synchronization of data from field to central database*

Approaches ensured remote synchronization of data from the CHWs to a central database. For example, in Côte d'Ivoire, an electronic application compatible with the existing national information system facilitated the transfer of data collected by CHWs, thus integrating the CHWs into the health system (Moh et al., 2022). Specifically, the provision of data collection tools, such as tablets, allowed CHWs to input real-time data, without the need for internet access, while completing medical records of their patients. Health facility staff verified the data saved in the tool and then uploaded it, using a 3 gigabyte flash drive, to a server connected to the Health District (e.g., at the level of a neighborhood, sub-prefecture, village, or camp) (Moh et al., 2022). Another technological intervention used a nationally-designed electronic toolkit to conduct periodic data quality checks by accessing data which CHWs entered into a digital reporting system that feeds community-level data to a national system (Davis et al., 2019).

#### *2.3.1.2 Monitoring activities and feedback through a central database*

In addition to providing opportunities for CHWs to submit their data to the health information system, a central database proved to be useful for monitoring activities and sharing feedback. In one study in Afghanistan, CHWs used mobile phone applications to enter data from their clients, eliminating the need to carry heavy registers in the field. The app allowed CHWs to synchronize the data with a central server, although CHWs had to travel long distances (e.g., three hours) every week to transfer the data because of a lack of internet connection (Zaidi et al., 2020). Similarly in Ethiopia, an intervention used a data collection platform designed for workers in the field, especially those with poor internet access, to enter data and submit them to a central server once a connection becomes available (Little et al., 2013). In another study in Bangladesh, a web-based information management system allowed data from the field to be linked to a central database which recorded the completion status of CHW visits (Billah et al., 2022). Field supervisors and the central team also used the system to monitor activities and provide feedback to CHWs. A study in Senegal found that when CHWs reported data through a mobile phone application, reporting on safety data from SMC administration and timeliness of notifications both improved—as long as CHWs received adequate training and supervision, the community received sensitization to the process, and a central team was available to process data reports and provide feedback to CHWs (Ndiaye et al., 2018).

#### *2.3.1.3 Mobile applications for disease surveillance from CHWs to health facilities*

Health facilities used certain mobile phone applications monitor disease surveillance data coming in from the communities. One study in India developed the Mobile-based Surveillance Quest using Information Technology (MoSQuIT) application, which allowed CHWs' data to transfer to the server, where data was stored and analyzed. Health facility staff could then validate the data could, and stakeholders such as medical officers, laboratory technicians, and health authorities could access it. Like most applications, MoSQuIT required an internet connection and diligence on the part of CHWs to enter data promptly when connection was available to ensure real-time surveillance (Patgiri et al., 2022). However, an app described in a study in Myanmar did not require an internet connection for data collection, although a connection was necessary for data transfer (Win et al., 2021). In a study conducted in Tanzania, mobile technology allowed CHWs to acquire malaria surveillance data (fever

episodes and monitoring of treatment failure) and transmit it to a database in remote areas to further improve malaria case management and drug resistance surveillance (Francis et al., 2017).

#### *2.3.1.4 Use of electronic forms in mobile applications*

Mobile applications made electronic forms available and allowed them to be stored in one single place (Rinawan et al., 2021; Modi et al., 2019). For example, a study in India described a mobile phone application where CHWs conducted home visits based on a scheduled task list that was available on the mobile phone application (Modi et al., 2019). In this study, researchers expected CHWs to complete electronic forms, detail information they collected during scheduled home visits (such as health complications and immunizations), and submit them to close out their completed task. The app generated a performance report based on the data submitted on the first day of each month, shared it with the CHW, and automatically calculated performance-based incentives. Similarly to other interventions, this mobile application only required the internet to transfer data but not for data entry (Modi et al., 2019).

#### *2.3.1.5 Mobile applications for standardizing and supervising CHW services*

Mobile applications also allowed for monitoring appointment dates and exchanging information between CHWs and the health system. For example, in Bangladesh, a phone application allowed CHWs to assess an infant's condition with a questionnaire provided in the application. Based on the information entered by CHW, the application provides case management advice and follow-up dates dependent on the assessment. Use of this application contributed to improving accurately identifying dangerous symptoms in newborns; CHWs using the applications were 13.1 times more likely to recognize newborn infants with severe weight loss (Schaeffer et al. 2019). Some applications helped CHWs identify pregnancy danger signs more easily, thus leading to more timely referrals (Nigussie et al., 2021; Srinidhi et al., 2021).

A mobile phone application described in a study in Ethiopia allowed CHWs and health workers to exchange information and monitor their clients' appointment details. Both CHWs and health workers could register a new client in the application, and both parties would receive notifications with necessary information, such as services provided and time and place of the next appointment (Nigussie et al., 2021).

#### *2.3.1.6 Mobile phone applications and SMS to improve efficiency within the health system*

In addition to assisting in scheduling appointments and recognizing danger signs, mobile applications also aided in improving data collection systems and increasing health-seeking behaviors. For example, a study in Nepal identified that CHWs found the systematic source of information nature that the application possessed led to a better performance of maternal health related CHW tasks (Kayastha et al., 2021). In addition, mobile applications also helped CHWs keep their collected data in one place, leading to increased efficiencies at various levels of the health system. In Tanzania, a study demonstrated that using SMS messages for real-time referral information needs enhanced

communication between CHWs and health facility staff. Implementing this application streamlined follow-up visits by storing patient information for quick accessibility (Hackett et al., 2019).

In addition to mobile phone applications, mobile phones themselves helped CHWs communicate with the health system through the use of SMS (USAID/Benin, 2012; USAID, 2012). Specifically, they can more easily relay client follow-ups upon referrals, call for an ambulance, or contact health facility staff (Hackett et al., 2019; Nishimwe & Mchunu, 2021; Sayinzoga et al., 2019). In Rwanda, a study showed that when CHWs received mobile phones and their duties involved rapid SMS feedback regarding referral completion, they were more motivated to complete their duties. (Sayinzoga et al., 2019).

### 2.3.2 Data task shifting

A study in Burkina Faso observed that when instructing CHWs to record and report data, CHWs found this challenging, so they needed to receive adequate support from the health system (Burke et al., 2021). At times, health facility staff and CHWs were expected to work with data management in different phases. For example, according to a study in Kenya and Malawi, health facility staff were responsible for reporting data but worked together with CHWs, who often collected the data (Regeru et al., 2020). Another study emphasized the importance of a supportive environment for data management among different parties (Burke et al., 2021). CHWs and health system staff needed to ensure timely submissions facilitated by the presence of regular meetings with supervisors, availability of data collection and reporting tools, and management of different priorities (Regeru et al., 2020).

Efficiencies in the system were also observed in a study in Myanmar where CHWs and their supervisors utilized a mobile phone application for malaria surveillance. Supervisors could spare human resources, time, and money by not having to collect and manage paper reports, since CHWs would record, report, and refer malaria cases on the app (Win et al., 2021).

## 2.4 Supervision of CHWs

CHWs often perform better when they work under supervisors that provide necessary support and guidance. Supervision is a key component of the relationship between CHWs and the health system as supervisors are often staff from health facilities.

Once again, the use of digital platforms supports communication between CHWs and supervisors, who can receive real-time updates and questions through mobile phone applications and SMS. Along with ensuring a communication method is in place, the environment needs to be supportive in nature rather than punitive. A supportive environment does not only involve the way in which supervisors engage with CHWs but also what they bring to CHWs, such as training, regular visits and meetings, one-on-one sessions, and the overall ability to engage CHWs in a collaborative relationship and focus more on improving CHWs' problem-solving skills and less on evaluating CHWs' performance in their tasks.

This review also confirmed the role of supervision in bridging the health system and the community, just as it also connects health facilities and CHWs (USAID/Madagascar, 2014). In fact, a study observed that

in Nigeria, supervision helped formally connect CHWs to the overall health system; CHWs became fully institutionalized within the health system rather than treated as add-ons (Wickremasinghe et al., 2021). In Uganda (Singh et al., 2016) supervisors who supported CHWs in services related to the overall health system contributed to improved understanding of roles and further integrated CHWs into the health system. A different study in Rwanda found a monitoring system could help integrate planning and supervision at the community level (Nishimwe & Mchunu, 2021).

#### 2.4.1 Supervision Touchpoints with CHWs

Various platforms documented in this review were found to aid supervisors in connecting with CHWs in terms of communication or data sharing between the CHWs and their supervisors. These platforms enable CHWs to request and acquire information from their supervisors and vice versa without the need for supervision to occur in person.

This review identified different types of mobile phone applications which better facilitated supervision. For example, counseling mobile phone applications helped CHWs enhance and practice their counseling skills and allowed supervisors to monitor activities and performance as well as provide feedback on CHWs' counseling skills (Billah et al., 2022; Hackett et al., 2019). In a study in Tanzania, both supervisors and CHWs' clients shared the opinion that phone applications served as a guidance tool for CHWs, providing them with counseling on what to say and do during CHW visits (Hackett et al., 2019). In addition, in a study in Ethiopia, CHWs benefited from supervision occurring through a mobile app that tracked real-time performance data of CHWs through digital performance reports. Supervisors and CHWs regularly discussed these reports to provide timely feedback (Nigussie et al., 2021). Another instance where performance data was evaluated occurred in a study in Mali, where the use of a mobile phone application improved the quantity and quality of CHW supervision while also improving CHW performance during home visits. In this study, supervisors were able to monitor performance indicators related to timeliness, amount of home visits, and quality of care through a supervision dashboard found in the application (Yang et al., 2021).

This review also captured different uses of mobile phones, such as, on one hand, a dashboard app to transmit data between CHWs and their supervisors and, on the other, text messages and calls. A study in Ethiopia developed an analytics dashboard and a mobile scorecard that allowed CHWs and their supervisors to track the progress of pregnant mothers and exchange information with each other. The dashboard showed an overall picture of activities and performance indicators from different health posts (CHWs) and health facilities (supervisors), while mobile scorecards showed information related to upcoming visits (e.g., appointments, deliveries, and risk factors associated with them) so preparations could be arranged promptly. Data collection and visibility in the mobile phone app were possible without internet connectivity, which was only required when uploading the data (Little et al., 2013). Technology also aided the communication between CHWs and their supervisors through the use of text messages and phone calls, which allowed CHWs to receive prompt feedback from their supervisors (Biemba, Chiluba et al., 2020; Reinders et al., 2020).

#### 2.4.2 Supervision models

In addition to the use of digital platforms to improve supervision, other aspects, such as providing training and using checklists, help improve supervision within integrated health programs. Training to improve integrated health programs involved competency-based training for CHWs complemented with supervision to better support CHWs (Mengistu et al., 2021; Nsibande et al., 2018; USAID/Madagascar, 2014). In a study focused on scaling up iCCM in Malawi, senior CHWs received training to improve their supervisory skills so they, rather than facility-based staff with clinical responsibilities, could serve as supervisors, strengthening CHW linkages to the health system (Nsona et al., 2012). In addition to training, the use of checklists by supervisors also improved integrated health programs (Kachwaha et al., 2022; Nsona et al., 2012; Nalwadda et al., 2012; Orji et al., 2017). For example, in Nigeria, supervisors used a performance checklist as an assessment tool to determine the overall quality improvement of the performance standards among CHWs (Orji et al., 2017).

#### 2.4.3 Supportive supervision

##### 2.4.3.1 Supervision trainings

A study in Bangladesh observed that supervision training—consisting of either training provided by supervisors for CHWs or training for supervisors to enhance their supervisory skills—ensured a supportive environment for CHWs, where they gained more confidence to carry out their job responsibilities (Jahir et al., 2021). Facilitators often conducted CHW trainings alongside supervisory visits and meetings complemented the activities (e.g., on behavior change materials, RDTs, case management, referral guidelines, supervisory roles and use of supervisory materials, and data reporting tools) with close supervision (Westgard et al., 2018; Lal, Ndyomugenyi, Paintain et al., 2016; Robertson et al., 2015; Nalwadda et al., 2012). Training might also focus on supervisory skills (Nsona et al., 2012).

##### 2.4.3.2 Supervision visits and meetings

Supervisors also observed visits and community meetings with CHWs. A study in India observed that CHW performance improved through supervisor meetings with CHWs, because they introduced accountability measures, and supervisors helped increase the CHWs' knowledge and skills (Gopalakrishnan et al., 2021). Supportive supervision visits helped CHWs solve problems, increase their accountability (Kachwaha et al., 2022), and maintained consistent case management skills (Tiruneh et al., 2019). Monthly supervisory visits, whether in-person or tele-visits, promoted a supportive environment where supervisors maintained a closer working relationship with CHWs (Reinders et al., 2020; USAID/Benin, 2012) and provided CHWs with a structured learning process (Das et al., 2014). During these visits, supervisors provided ongoing support, training, and materials to the CHWs (Reinders et al., 2020). Supervisory visits also involved knowledge assessments, feedback on work performance, work planning, and additional training (LeFevre et al., 2015), and service delivery reinforcement (e.g., observing CHWs counsel their patients and checking supply chain) (Kim et al., 2015; Langston et al., 2014; Littrell et al., 2013). Supervisors also checked CHW registers during their visits (LeFevre et al., 2015; Langston et al., 2014; Littrell et al., 2013; Nalwadda et al., 2012). A study in Tanzania observed that CHWs greatly appreciated their supervisors who visited a community and met with CHWs in front of

the community members (Robertson et al., 2015). In addition, as seen in a study in Burkina Faso, monthly meetings provided an opportunity for supervisors at health facilities to review CHW data and perform a quality check of the data collected by CHWs (Burke et al., 2021). Meetings focused on monitoring activities, refresher training (Billah et al., 2022) and submission reporting, stock replenishment, and mentorship (Napier et al., 2021). Monthly supervision meetings occurred in community or health centers (Orji et al., 2017; LeFevre et al., 2015; USAID, 2014; USAID, 2013). In a study in Uganda, monthly meetings meant other supervisory interventions needed to be scaled back “to reflect typical levels of supervision under programmatic conditions” (Lal, Ndyomugenyi, Paintain et al., 2016). In addition, a study in South Africa associated supervisory meetings with CHWs’ high satisfaction levels while interacting with supervisors (Thurman et al., 2018).

#### *2.4.3.3 Collaborative and non-punitive relationships focused on problem-solving, coaching, and mentoring*

Articles described supportive supervision as entailing collaborative and non-punitive relationships with CHWs, focusing on improving CHWs’ problem-solving skills, providing coaching, or mentorship. Collaborative relationships helped CHWs solve problems rather than solely evaluated their performance; they emphasized implementing feedback loops between CHWs (Juarez et al., 2021; Reinders et al., 2020). Supervisors also provided mentorship (Orji et al., 2017; Agu et al., 2021) and coaching sessions (Ambaye et al., 2014) for feedback and support and for periodically reinforcing certain skills (e.g., assessment and decision-making skills needed for referrals) of CHWs (Nsona et al., 2012). During mentorship meetings, which sometimes occurred at health facilities rather than in the community (Biemba, Chiluba et al., 2020; Napier et al., 2021), health facility supervisors provided feedback about patients’ outcomes to CHWs regarding facility patients referred by CHWs (Biemba, Chiluba et al., 2020; Biemba, Mulenga et al., 2020). A study in Zambia noted automated reminders sent to CHWs from their supervisors’ phone numbers added to a sense of mentorship (Biemba, Mulenga et al., 2020). South African CHWs who thought mentors were influential, approachable, and respectful were more likely to remain CHWs (Thurman et al., 2018). In addition, a study in Bengal revealed that productivity and efficiency could be improved if supervisors were seen as mentors (Mondala & Murhekarb, 2018).

#### *2.4.3.4 One-on-one, peer supervision sessions, and provision of feedback and guidance*

One-on-one supervision sessions helped create a supportive environment where supervisors showed care and attention to CHWs. CHWs appreciated one-on-one supervision and reported that communicating with their supervisors gave them the confidence to carry out their job responsibilities (Jahir et al., 2021). Supervision conducted individually at the communities also occurred, as did group supervision, at the health facilities (Kim et al., 2015; Orji et al., 2017). CHWs viewed peer supervision—where one of the CHWs was trained as a supervisor to support other CHW—as an innovative way to provide supportive supervision (Mohan et al., 2011; Neogi et al., 2016). Another study found that peer supervision helped compensate for health facility staff limitations, such as lack of time, transport, and human resources to provide regular supervision visits to CHWs. Peers often had better access to CHWs and served as an intermediate level between the facility and the community (Langston et al., 2014).



Providing constructive feedback during supervision, according to one study, which contributed to establishing positive relationships between CHWs and their supervisors (Ludwick et al., 2018). A common theme emerging in this review was that supervisors provided feedback during not only mentoring sessions but also regular supervision sessions. Supervisors provided feedback via multiple routes and topics, such in mHealth app reports (Nigussie et al., 2021), on referred patient outcomes (Biemba, Chiluba et al., 2020; Biemba, Mulenga et al., 2020), on activities conducted by CHWs (Uddin et al., 2021; Kim et al., 2015), about what works and what does not (Nishimwe & Mchunu, 2021), and in general (Schuster et al., 2016). In some instances, as observed in a study in Zambia, supervisors did not provide feedback unless they received training to do so (Chanda et al., 2011). Effective feedback included clear guidance (Burke et al., 2021) and direct observation (Littrell et al., 2013) to ensure quality delivery of CHW services in the community.

#### *2.4.3.5 Strengthening case management*

Malaria case management studies depicted supportive supervision in different ways. A study conducted in Nigeria listed supportive supervision among other factors associated with the correct prescription of antimalarial drugs (Akinfemi et al., 2018). Another study showed that supportive supervision improved CHWs' case management of febrile cases while also increasing community engagement and facilitating supply chain processes. Supervision activities in this study, which took place in India, included sensitization on transmission, diagnosis, and treatment of malaria; hands-on support for performing and interpreting RDTs; administration of the correct dosage of ACT and follow-up to ensure compliance; management of malaria surveillance records; and orientation on community and health center engagement (Das et al., 2014).

#### 2.4.4 Results from supportive supervision

Supportive supervision, which focused on skills and knowledge strengthening, often helped increase CHWs' knowledge and performance (Gopalakrishnan et al., 2021; Das et al., 2014). In a study in India, CHWs who received a greater intensity of supportive supervision (defined as more than one-half of the year's activities) had 70% higher odds of better performance compared to those who received a lower intensity. CHWs who received more intense supervision improved performance due to increased accountability measures and mentoring opportunities (Gopalakrishnan et al., 2021).

A study in Nigeria coupled training with supportive supervision, which further influenced CHWs' knowledge as well as performance (Agu et al., 2021). This added another layer of support with a welcoming spirit by creating space for CHWs to ask questions. Other studies similarly highlighted the value of coupling supportive supervision with capacity building of CHWs, such as training sessions which increased CHW knowledge of malaria (Nsibande et al., 2018, Agu et al., 2021).

To ensure CHWs feel appreciated and supported in the overall health system, health systems can develop incentive schemes to motivate CHWs, thus improving the efficiency of health system services (Sakeah et al., 2014). Compensation does not necessarily have to be in the form of cash or gifts; it could

also relate to communities helping CHWs in “their farms or household chores, as long as the incentives are culturally appropriate” (Sakeah et al., 2014).

## 2.5 Challenges and Recommendations

In some instances, the articles documented challenges with accompanying suggestions, but the interventions did not specifically address them. In those cases, researchers made specific recommendations for future interventions.

### 2.5.1 Stock Management

#### 2.5.1.1 *Struggle for commodities between facilities and CHWs*

Health facility supply chain systems need strengthening if CHWs are to be able to carry out their duties in full (Oresanya et al., 2019). One way to help is to offer onsite training for CHWs regarding supply chain management; meanwhile government stakeholders need to ensure availability at the national-level, enabling the efficient movement of commodities (Chandani et al., 2017). Training can entail how to manage stocks (e.g., ACTs, gloves, cotton balls, RDTs) (Lal, Ndyomugenyi, Magnussen et al., 2016) identify minimum stock levels for drugs so CHWs can submit supply requests and receive their supplies in a timely manner (Kalyango et al., 2012). Health facilities need accountability measures to ensure they are providing CHWs with adequate and sufficient stocks. This includes identifying and addressing bottlenecks of stock delivery and establishing a timeline and accountability for problem-solving (Mohan et al., 2011; Chandani et al., 2017).

#### 2.5.1.2 *Monthly Review Systems*

Supply chain bottlenecks caused stock outs due to delays in demand estimation, differing methods of stock estimation at different levels of health facility staff (Kachwaha et al., 2022), insufficient stock (Chipukuma et al., 2020; Mohan et al., 2011; Ishizumi et al., 2021), inconsistent stocks of essential first aid kit commodities (Napier et al., 2021; Boakye et al., 2018), transportation issues (USAID/Madagascar, 2014), or poor management on the part of CHWs (USAID, 2014). The literature reviewed found that, to address these bottlenecks, systems needed to develop monthly or quarterly review systems to track stocks and identify bottlenecks while also being cautious about the regularity of the functioning of these systems (Kachwaha et al., 2022).

#### 2.5.1.3 *Timely Requests*

Interruptions in the supply chain posed challenges to the availability of drugs and other essential supplies (Mengistu et al., 2021). To avoid such interruptions, supply chain requests should be prompt, while accounting for the “long and varied lengths of time needed to obtain drugs from different suppliers” (Kalyango et al., 2012, p. 11). To ensure timely supply chain requests, avoid inadequate stocks, and improve the consistency of drug supply, CHWs need training on how to quantify, forecast, and order drugs adequately (Mengistu et al., 2021; Bagonza et al., 2014; Nsona et al., 2012), while also ensuring stocks are available for delivery from health facilities or other distribution centers in a strong supply chain system (Kachwaha et al., 2022; Higi et al., 2021).

#### *2.5.1.4 Stock Monitoring and Supervision Systems*

In addition to monthly review systems and timely requests, an uninterrupted supply chain system requires monitoring and supervision (Higi et al., 2021). Furthermore, strengthening the supervision of CHWs can help alleviate stock outs, because supervisors can bring medicinal supplies to CHWs. In addition, the rollout of standard operating procedures for logistics management information systems can strengthen supply management (Nsona et al., 2012).

#### 2.5.2 Referrals

##### *2.5.2.1 Transportation vouchers*

Many articles identified lack of transportation as a barrier to completing CHW referrals (Sevene et al., 2021; Dalal et al., 2022; Altaras et al., 2017; Give et al., 2019). One study found children treated with RAS by CHWs for severe febrile illness incurred 100% more out of pocket expenses than children not treated with RAS; the main driver for the difference in cost difference transportation to the health center (Castellani et al., 2018). A facilitator for patients to complete referrals from CHWs was the availability of a transport voucher system to reduce costs related to transportation to reach health facilities. One study pointed out changes in transport voucher charges due to high inflation and increased fuel prices, recommending a regular review of voucher charges to ensure enough transporters are available in remote areas (Namazzi et al., 2013).

##### *2.5.2.2 Clear Guidelines*

Delays in referral completion may occur due to the lack of adequate resources, such as ambulances, as well as less tangible assets like caregivers' understanding of and ability to comply with referrals. To strengthen the link between health systems and CHWs, a study recommended referral systems contain clear guidelines for CHWs and health facility staff on proper instructions to give to caregivers on the referral process (Ayodo et al., 2021).

##### *2.5.2.3 Activities to Improve Referrals*

To be sure CHWs complete referrals correctly, they need training and continued practice of assessment and decision-making skills. One paper called for continuing education where they can practice observation, role-play vignettes, and participate in photo and video exercises (Nsona et al., 2012).

##### *2.5.2.4 Incentives for Referrals Accompaniment*

Authors of two studies recommended providing financial incentives to CHWs to accompany patient visits to health facilities to ensure proper referral follow-up. This facilitated better communication between CHWs and health systems (Dalal et al., 2022; Sakeah et al., 2014).

#### 2.5.3 Supervision Challenges and Recommendations

##### *2.5.3.1 Administrative burdens*

At times, supervisors could not provide supportive supervision to CHWs due to competing priorities such as administrative tasks (Kachwaha et al., 2022). To overcome this challenge, authors recommended they provide constructive feedback, coaching, and problem-solving during supervisory and monitoring visits

(Kachwaha et al., 2022). Different studies highlighted the need for a change in the supervision culture, switching from supervisory work surrounding administrative functions and performance reviews to supervisors who instead offer training, problem-solving, and coaching support (Kachwaha et al., 2022; Juarez et al., 2021).

#### *2.5.3.2 Regular supervision*

Irregular supervision was a barrier to supportive supervision (Higi et al., 2021; Nalwadda et al., 2012; Kim et al., 2015). Delayed feedback and irregular supervision occurred because of long distances between health facilities and CHWs (Higi et al., 2021) and limited time to schedule meetings to provide feedback (Bagonza et al., 2014).

Supervising CHWs closely through regular field visits was challenging due to coordination and resource gaps (Napier et al., 2021), such as insufficient funding for supervisor travel, a limited number of supervisors and resources (Daviaud et al., 2017), and transportation issues (Burke et al., 2021; Napier et al., 2021; Kok et al., 2015; Bagonza et al., 2014). Some studies suggested, as an alternative, conducting monthly CHW–supervisor group meetings at health facilities (Napier et al., 2021; Daviaud et al., 2017). Often, a single supervisor worked with many CHWs from different locations which posed barriers to providing effective supervision for each (Napier et al., 2021). This could be resolved “by shifting supervision to the health facility and compensating CHWs for their transport to and from” (Napier et al., 2021, p. S106).

Close supervision, such as through routine meetings, ensures high quality service delivery, motivates CHWs, and creates learning opportunities for them (Stratil et al., 2021).

#### *2.5.3.3 Scheduled supervision*

The absence of regular monitoring and evaluation by supervisors challenged CHWs’ optimal performance (Gebretsadik et al., 2020). Since this might have been due to the absence of scheduled supervision, scheduled supervision should be in place so the performance of CHWs can be improved (Gebretsadik et al., 2020). To overcome any challenges regarding CHW performance, researchers recommended supervisors have adequate knowledge, conducted routine supervisions, and use standard supervisory checklists (Chipukuma et al., 2020).

#### *2.5.3.4 Linkages between health post and health facility*

One study associated weak community–health system linkages with lack of program-specific use of data for decision making or supportive supervision (Tareke et al., 2020). Another study documented the lack of communication between CHWs and the health system, in addition to other challenges such as lack of respect among CHWs and supervisors (Njeru et al., 2021).

#### *2.5.3.5 Proactive and autonomous engagement of CHWs in their activities*

Supervision focused solely on data collection and reporting can discourage CHWs. Supervisors should assist CHWs in feeling empowered and have agency over their own work (Oguma et al., 2020). Proactive

and autonomous engagement of CHWs, encouraged by supervisors but without their constant oversight, can help CHWs to overcome this challenge and continue to conduct their activities (Oguma et al., 2020).

#### *2.5.3.6 CHWs as CHWs' supervisors*

One study suggested promoting and using experienced CHWs as CHWs' supervisors as they understand their roles and the reality of the community (Singh et al., 2016).

#### *2.5.3.7 Training for new supervisors*

Routine high turnover can lead to losing trained supervisors and replacing them with untrained ones. This results not only in poor support for CHWs but also for the supervisors (Daniels et al., 2015). Health systems therefore need to create and reserve resources to train new supervisors to replace those who are no longer available.

## Discussion

### Main takeaways

This review discusses how four specific CHW-health system touchpoints—stock management, referrals, data management, and supervision—are bi-directionally influenced by the behavior of the actors involved and in need of strengthening. The studies and interventions reviewed highlight that CHW programs face multiple challenges, and that in any given context, all four of the touchpoints merit examination to identify behavioral interventions that can improve interactions between CHWs and the health system. Underpinning many of the findings of this review is the importance of fostering positive relationships between health facility staff, CHWs and the community for improving the touchpoints, and this can be achieved through a range of interventions. Like those described in this review, many promising interventions may differ from what are typically considered “behavioral” interventions and yet, they can all exert a direct influence on behavior of the health system actors.

An overarching structural finding is that the incorporation of CHWs in the formal health system promotes closer connections within these touchpoints, and potentially better health outcomes, than when CHW programs are implemented as a separate entity from the health system.

Regarding stock management, digital platforms can better aid the communication between CHWs and their supervisors, while enabling CHWs to make stock requests and supervisors to respond to those in a timely way. Stock-requesting applications can also document current inventory, which helps prevent stock outs.

Improved referral systems, meanwhile, require a multifaceted approach. An effective referral system not only includes referral actors (i.e., CHWs who issue referrals and health facility staff who see the referred patients), but also materials such as referral slips and available and affordable transportation.

Data management interventions allow CHWs and health facility staff to access the same information on their patients via digital platforms. The data collected should include patient information (confidentially), CHW performance data, and supervisor feedback to CHWs.

Finally, since CHWs' supervisors are often health facility staff, strengthening linkages between CHWs and the health system can further improve the relationship between CHWs and their supervisors to reach a supportive environment where CHWs are better integrated into the larger health system.

## Considerations for future interventions

In addition to the main takeaways for developing interventions to enhance the relationship between CHWs and the health system, this literature review also identified studies that documented challenges, along with recommendations to address them. Stock management challenges included the struggle for commodity availability, leading to stock outs and interruptions in the supply chain; recommendations included strengthened stock management systems with national support, review systems to keep track of stock availability, and timely stock requests. Referral challenges included costly transportation, delays in referral completion, CHWs' limited understanding of the referral procedure, and inadequate referral compliance; recommendations included transportation vouchers, clear guidelines, training on referral procedures, and incentives for referral compliance. Supervision challenges included administrative burdens, irregular supervision, weak linkages between CHWs and health facilities, and poor supervision capacity; recommendations included constructive feedback, scheduled supervision and supervisory visits to CHWs, improved communication between CHWs and the health system, and training for supervisors. A recurring theme among the interventions recommended by the reviewed literature is the promise of approaches that draw on principles of behavioral economics. Many of the recommendations listed above aim to make systems more intuitive and easier (less hassle) to use by health system actors. Changes in how information flows between the health system actors—be it for supervision, stock management, referrals, or data management—can positively modify the systems and structures in which health systems actors operate. While principles of behavioral economics featured more heavily in the reviewed literature than human-centered design (HCD) approaches, the potential of HCD should also be explored.

## Limitations of the literature review

Many articles focused on the challenges CHWs faced regarding behavioral factors in their relationship with the health system, usually accompanied by recommendations to overcome those challenges. Others involved recommendations alone. Although such articles have the power to guide considerations for future research and raise awareness of the barriers that may prevent building linkages between CHWs and the health system, this literature review would have benefited from examining more articles focused on interventions specific to improving interactions between CHWs and the larger health system. Particularly regarding research question 2, many articles focused on interventions that improved some other component related to CHWs' work happened to include interactions with the larger health system

such as tools to help with stock management. Furthermore, even though this literature review presented a variety of CHW programs in different geographic areas, the small-scale qualitative studies likely provided weak evidence because results were limited to specific contexts.

Another limitation of this literature review was response bias, such as social desirability; in other words, health facility staff and CHWs may have given survey responses based on what they felt was socially acceptable to their local contexts or to what they thought researchers wanted to hear. Assessing this and future content should involve contextual considerations and finding ways to identify reliably informative responses.

## Recommendations for future research

Possible future research that would further allow tailoring interventions includes exploring the environment in which CHWs work and support communities, how to create supportive environments for CHWs' emotional well-being, what may help CHWs improve skills improvement, among other factors that may help CHWs sustain adequate motivation and performance and strengthen their relationships with supervisors and community members. Research that focuses on changing the behaviors of actors at higher levels of the health system would also help strengthen linkages between CHWs and the health system. Combining health system elements with the community dynamics and actors (community members and CHWs), as well as cultural norms and practices, will help improve health outcomes. Professional relationship networks are also key area to be considered for future research and for strengthening the health system (LeBan, 2011).

## Conclusion

CHWs are essential in malaria control interventions and have long been part of the health system, whether formally or informally. Multiple levels of influence of CHW behaviors within the health system affect CHW performance, and CHWs rely on the health system for motivation, mentorship, supplies, and more. Strengthening of all touchpoints between CHWs and the health system—including stock management, referrals, data management, and supervision— will build these linkages and overall improve CHWs' impact on malaria control, prevention, and treatment.

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# Annex 1: Literature Review Search Terms

Breakthrough ACTION identified search terms in consultation with an informationist from the Johns Hopkins University Welch Library and PMI. The project used PubMed to extensively test and refine search terms and identify MeSH operators and text words (tw). Authors used an asterisk (\*) as needed at the root of search terms to allow for multiple endings. Concepts were searched together.

TABLE 1. LITERATURE REVIEW SEARCH TERMS	
CONCEPTS	SEARCH TERMS
1. Health Areas	"malaria"[Mesh] OR "malaria*"[tw] OR "child health"[Mesh] OR "child health"[tw] OR "maternal health"[Mesh] OR "maternal health"[tw] OR "Diet, Food, and Nutrition"[Mesh] OR "nutrition"[tw]
2. Community Health Workers	"community health workers"[mesh] OR "community health worker*"[tw] OR "community health volunteer*"[tw] OR "health volunteer*"[tw] OR "health promoter*"[tw] OR "village health worker*"[tw] OR "primary health worker*"[tw] OR "rural health worker*"[tw] OR "community health officer*"[tw] OR "health extension worker*"[tw] OR "voluntary health worker*"[tw] OR "volunteer health worker*"[tw] OR "lay health worker*" [tw] OR "community health assistant*"[tw] OR "community health aide"[tw] OR "community health aides"[tw] OR "community volunteer*"[tw] OR "village health volunteer*" [tw] OR "accredited social health activist*"[tw] OR "ASHA worker*"[tw] OR "auxiliary health worker*"[tw] OR "barefoot doctor*"[tw] OR "community health practitioner*"[tw] OR "community health practitioner*"[tw] OR "medical auxiliar*"[tw] OR "women development army"[tw] OR "development army"[tw] OR "women development armies"[tw] OR



	<p>"development armies"[tw] OR  "village volunteer*"[tw] OR  "health outreach worker*"[tw]</p>		
3. Health System	<p>"Public Health Systems Research"[mesh] OR  "Delivery of Health Care, Integrated"[mesh] OR  "Delivery of Health Care"[mesh] OR  "Delivery of Healthcare"[tw] OR  "Healthcare Deliver*"[tw] OR  "service deliver*"[tw] OR  "Health Care System*"[tw] OR  "Healthcare System*"[tw] OR  "Community Based Distribution*"[tw] OR  "Integrated Health Care System*"[tw] OR  "Integrated Delivery System*"[tw] OR  "Public Health Systems Research"[tw] OR  "Integrated Community Case Management"[tw] OR  "supervision"[mesh] OR  training*[tw] OR  "supply chain*"[tw] OR  "data management"[mesh] OR  "data management"[tw] OR  "Inservice Training"[Mesh] OR  "Inservice training"[tw] OR  institutional*[tw] OR  "community health system"[tw] OR  "mentors"[Mesh] OR  "data collection"[MeSH] OR  "data collection"[tw] OR  "Health Information Systems"[Mesh] OR  "Health Information System*"[tw]</p>		
4. Countries	<p><b>Sub-Saharan Africa</b></p> <ul style="list-style-type: none"> <li>● Angola</li> <li>● Benin</li> <li>● Botswana</li> <li>● Burkina Faso</li> <li>● Burundi</li> <li>● Cabo Verde</li> <li>● Cameroon</li> <li>● Central African Republic</li> <li>● Chad</li> <li>● Congo</li> <li>● Cote d'Ivoire</li> <li>● Ivory Coast</li> </ul>	<p><b>Asia/Oceania</b></p> <ul style="list-style-type: none"> <li>● Bangladesh</li> <li>● Cambodia</li> <li>● China</li> <li>● India</li> <li>● Indonesia</li> <li>● Korea</li> <li>● Lao</li> <li>● Malaysia</li> <li>● Myanmar</li> <li>● Nepal</li> <li>● Pakistan</li> </ul>	<p><b>Latin America and the Caribbean</b></p> <ul style="list-style-type: none"> <li>● Argentina</li> <li>● Belize</li> <li>● Bolivia</li> <li>● Brazil</li> <li>● Colombia</li> <li>● Costa Rica</li> <li>● Dominican</li> </ul>

	<ul style="list-style-type: none"> <li>● Democratic Republic of the Congo</li> <li>● Djibouti</li> <li>● Equatorial Guinea</li> <li>● Eritrea</li> <li>● Eswatini</li> <li>● Ethiopia</li> <li>● Gabon</li> <li>● Gambia</li> <li>● Ghana</li> <li>● Guinea</li> <li>● Guinea-Bissau</li> <li>● Kenya</li> <li>● Lesotho</li> <li>● Liberia</li> <li>● Malawi</li> <li>● Mali</li> <li>● Mauritania</li> <li>● Mozambique</li> <li>● Namibia</li> <li>● Niger</li> <li>● Nigeria</li> <li>● Rwanda</li> <li>● Sao Tome and Principe</li> <li>● Senegal</li> <li>● Sierra Leone</li> <li>● Somalia</li> <li>● South Africa</li> <li>● South Sudan</li> <li>● Sudan</li> <li>● Tanzania</li> <li>● Togo</li> <li>● Uganda</li> <li>● Zambia</li> <li>● Zimbabwe</li> </ul>	<ul style="list-style-type: none"> <li>● Papua New Guinea</li> <li>● Philippines</li> </ul>	<ul style="list-style-type: none"> <li>● Republic</li> <li>● Ecuador</li> <li>● El Salvador</li> <li>● French Guiana</li> <li>● Guatemala</li> <li>● Guyana</li> <li>● Haiti</li> <li>● Honduras</li> <li>● Mexico</li> <li>● Nicaragua</li> <li>● Panama</li> <li>● Paraguay</li> <li>● Peru</li> <li>● Suriname</li> <li>● Venezuela</li> </ul>
Filters:	English; Full Text Available; 2010 to Present; Human		

## Annex 2: Additional Articles Reviewed

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## Annex 3: Article Characteristics

TABLE 2. NUMBER OF ARTICLES BY LOCATION	
LOCATION	NUMBER OF ARTICLES
Afghanistan	1
Bangladesh	5
Bangladesh and Kenya	1
Benin	1
Burkina Faso	4
Burundi	1
Cambodia	2
Cameroon	1
Côte D'Ivoire	1
Democratic Republic of the Congo	3
Democratic Republic of the Congo, Malawi, Mozambique, Niger, and Nigeria	1
Democratic Republic of Congo; Madagascar; Mozambique; Nigeria	1
Ethiopia	19
Ethiopia, Malawi, Niger, Ghana, Mali and Mozambique	1
Ethiopia; Tanzania	1
Ghana	5
Ghana, Guinea-Bissau, Tanzania, Uganda	1
Guatemala	1
Honduras and Lao People's Democratic Republic (PDR)	1
India	24
Indonesia	1
Iraq	1
Kenya	10
Kenya and Malawi	1
Lao PDR	1
Liberia	1
Madagascar	2
Malawi	7
Mali	3

Mozambique	5
Myanmar	5
Nepal	3
Nicaragua	2
Niger	2
Nigeria	13
Pakistan	1
Pakistan and Afghanistan	1
Peru	3
Rwanda	8
Rwanda and Malawi	1
Senegal	5
Sierra Leone	1
South Africa	5
South Sudan	1
Sub-Saharan Africa	1
Tanzania	9
The Gambia	1
Uganda	22
Zambia	10
Zimbabwe	1

TABLE 3. NUMBER OF ARTICLES BY PROGRAM FOCUS	
PROGRAM FOCUS	NUMBER OF ARTICLES
CHW program	14
iCCM	31
Malaria	54
MNCH	89
Nutrition	14