



# The Role of Digital Tools in Supportive Supervision of Community Health Workers in Liberia

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This Doctoral Thesis, *The Role of Digital Tools in Supportive Supervision of Community Health Workers in Liberia*, presented by Anuoluwa Ishola, and Submitted to the Faculty of The Harvard T.H. Chan School of Public Health in Partial Fulfillment of the Requirements for the Degree of Doctor of Public Health, has been read and approved by:



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*Date:* January 7, 2022



**The Role of Digital Tools in Supportive Supervision of Community Health Workers in  
Liberia**

**Anuoluwa Ishola**

**A Doctoral Thesis Submitted to the Faculty of  
The Harvard T.H. Chan School of Public Health  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Public Health**

**Harvard University  
Boston, Massachusetts.**

**March 2022**

### **Abstract**

A joint report published by the WHO and the World Bank estimates that over half of the world's population lacks access to complete coverage of essential health services due to multiple factors within the health systems and external factors outside the health system (WHO & World Bank, 2017). One factor contributing to inadequate health services coverage is the shortage and inequitable distribution of skilled health workers (Liu et al., 2017a). CHWs are a cadre of the health workforce that can fill the health workforce deficit (WHO, 2008a).

The doctoral project explored the role of the digital tools that LMH has developed and how effective they are in enhancing supportive supervision of community health workers in remote areas in Liberia. It sought to understand and explain the relationship between CHWs and their supervisors and how the digital tools can support that relationship. Furthermore, it explored how digital tools have been leveraged for supervision, and their connection to the broader health system, using the system thinking framework (Arnold & Wade, 2015).

The project used a qualitative approach for data collection and analysis. The research began with a systematic literature review. Focus group discussions and semi-structured interviews followed this to elicit information from relevant stakeholders on the role of technology in supportive supervision, supervision structure for CHAs, community health, and engagement strategies/approaches to strengthen practices at the community level.

The findings showed the promise of using digital tools to monitor attendance via GPS, minimize treatment and reporting errors, and complement on-site coaching done by supervisors. While the benefits of mobile technology deployments continue to show promise, there is a need to be aware of everyday challenges faced with the introduction of the technology. Challenges such as digital literacy, malfunctioning of phones, damage to phones, and inadequate power supply to properly charge the phones all affect how effective the tool is during and after supervision. The findings also support those digital tools can complement in-person training and serve as a valuable resource for CHAs and their supervisors on and off the field when in an enabling environment.

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## Abbreviations

<b>AIDS</b>	Acquired Immunodeficiency Syndrome
<b>CBIS</b>	Community Based Information System
<b>CHA</b>	Community Health Assistant
<b>CHC</b>	Community Health Committee
<b>CHFP</b>	Community Health Focal Person
<b>CHW</b>	Community Health Workers
<b>CHSS</b>	Community Health Service Supervisors
<b>DCT</b>	Data Collection Tool
<b>GDP</b>	Gross Domestic Product
<b>HFDC</b>	Health Facility Development Committee
<b>HIV</b>	Human Immunodeficiency Virus
<b>HMIS</b>	Health Management Information System
<b>ICCM</b>	Integrated Community Case Management
<b>ICT</b>	Information and Communication Technology
<b>LMH</b>	Last Mile Health
<b>LMIC</b>	Low Middle-Income Country
<b>MOHSW</b>	Ministry of Health and Social Welfare
<b>NCHAP</b>	National Community Health Assistant Program
<b>ODK</b>	Open Data Kit
<b>OIC</b>	Officer in Charge
<b>PHC</b>	Primary Health Care
<b>PMTCT</b>	Prevention of Mother-to-Child Transmission
<b>SDG</b>	Sustainable Development Goals
<b>WHO</b>	World Health Organization
<b>UHC</b>	Universal Health Coverage
<b>UNICEF</b>	United Nations Children's Fund
<b>QAO</b>	Quality Assurance Officer

## **Section 1: Introduction**

Globally, the WHO estimates that about 18 million additional health workers are needed to meet the human resource requirements for Universal Health Coverage (UHC) (WHO, 2016). A joint report published by the WHO and the World Bank estimates that over half of the world's population lacks access to complete coverage of essential health services due to multiple factors within the health systems and external factors outside the health system (WHO & World Bank, 2017). One factor contributing to inadequate health services coverage is the shortage and inequitable distribution of skilled health workers (Liu et al., 2017a). Low- and middle-income (LMICs) countries in sub-Saharan Africa have the most significant human resource shortages globally (WHO, 2016). The basic threshold for healthcare workers is 2.28 skilled professionals per 1000 people, with Africa having a threshold of 1.33 health workers per 1,000 population. The health workforce's density varies within the continent, but most countries still fall below the recommended threshold (Soucat et al., 2013) & (WHO, 2016).

Several factors contribute to the shortage of health workers, including an aging healthcare workforce, investment shortfalls in pre-service training, career change, premature mortality, government budget constraints, and the limited capacity of educational programs (Liu et al., 2017b) & (Kinfu et al., 2009). The shortage of health workers affects all aspects of the health system, particularly the quality of care (Haseeb, 2018). One of the WHO's recommendations to address the shortage of health workers is task-shifting (WHO 2008) which allows for the redistribution of tasks among the health workforce (WHO, 2008a).

However, task shifting requires health worker cadres to take on the new tasks. Community Health Workers (CHWs) can be part of the task-shifting if they are adequately trained, supervised,

equipped with adequate resources, and a robust referral system is in place (WHO, 2008a). CHWs are a cadre of the health workforce that can fill the health workforce deficit (WHO, 2008a). The task-shifting recommendation was driven by evidence on the contribution of CHW to improve health outcomes in their communities and the opportunity they present when appropriately integrated into the health systems (Campbell & Scott, 2011) & (WHO, 2008a).

CHWs are "frontline public health workers who are trusted members of a particular community and are in good standing, meaning they are respected and trusted members of their community. They liaise between the health and social services, and the community to aid access to health services, quality improvement and delivery of culturally appropriate health services" (CDC, 2019). Furthermore, the WHO defines CHW as "health workers who are trained to an extent with no formal professional certification and may live and work within a particular community" (WHO, 2007). The roles and responsibilities differ from country to country and, in some cases, will differ from intervention to intervention within a country (Perry & Zulliger, 2012). This project will focus on examining the community health system intervention in Liberia.

Due to the civil war and Ebola epidemic, the health workforce suffered a significant setback, with health workers losing their lives or seeking other opportunities outside of Liberia (Dahn et al., 2021). To address this shortfall, the Liberia Ministry of Health in 2016 collaborated with implementing and funding partners (including Partners in Health, International Rescue Committee, Last Mile Health, Global Fund, and USAID) to launch the National Community Health Assistant (NCHA) Program (Last Mile Health, 2016). The Community Health Assistants serve as CHWs within their communities. The program aimed to improve access to care for the most vulnerable,

build a resilient health workforce, and strengthen its primary health system (Last Mile Health, 2016). The program's implementation occurs in 14 out of Liberia's 15 counties. A total of 3011 community health workers and 359 clinical supervisors were deployed to serve over 700,000 people in remote areas (Last Mile Health, 2018). The program aims to deploy over 4,000 health workers to serve the 1.2 million Liberians who live more than three miles from the closest health center. The program aims to strengthen the health system, build a resilient health labor force, and provide health services to the most vulnerable in remote areas (Last Mile Health, 2016). As part of this initiative, the Ministry of Health and Social Welfare (MOHSW) developed the Community Based Information System (CBIS) in partnership with Last Mile Health. This system monitors and evaluates adherence to the national community health program (Last Mile Health, 2018).

However, it is insufficient to introduce a national community health program without considering CHW programs' challenges. In other settings, CHW programs have failed or faced challenges that hinder the quality of service provided by CHWs. Challenges include lack of resources, inadequate supervision, transportation barriers, and referral issues (RHIhub, 2021). Therefore, there is a need to ensure that quality of care and engagement with health facilities are maintained and sustained within the health system. This is important because it aligns with the national priority of improving community health and the global agenda through the Sustainable Development Goals (SDG). The third SDG focuses on health, urging countries to ensure healthy lives and promote well-being for all ages (United Nations, 2021). In addition, improving access to clinical education for community health workers and strengthening health systems leaders' capacity is critical to building quality health systems (United Nations, 2015).

Furthermore, to support Liberia's government and address a critical upskill gap within the health workforce, Last Mile Health (LMH) established the Community Health Academy in 2017. The Academy was established to partner with Ministries of Health to strengthen health systems leaders' capacity and community health workers' clinical skills by using digital training tools to build health systems (Last Mile Health, 2019).

LMH is the host organization for this project. LMH was selected for the doctoral project based on its alignment with my professional interests in strengthening health systems. Furthermore, the organization provided an opportunity to apply skills acquired in my doctoral program and offered an opportunity to learn more about digital technology.

This doctoral project will explore the role of the digital tools that LMH has developed and how effective they are in enhancing supportive supervision of community health workers in remote areas in Liberia. It will seek to understand and explain the relationship between CHWs and their supervisors and how the digital tools can support that relationship. Furthermore, it will explore how digital tools have been leveraged for supervision, and their connection to the broader health system, using the system thinking framework (Arnold & Wade, 2015).

## **Section 2: Analytical Platform**

### **2.1 Primary Health Care**

Robust community health systems, including community health workers, are vital in primary health care. The journey of the community health system started with primary health care. The 1978 Alma-Ata Declaration defines primary health care as essential health care based on practical, scientifically sound, and socially acceptable methods and technology. It is universally accessible and affordable to individuals and families in the community. Despite the Alma-Ata Declaration and its focus on primary health care, it was widely neglected in many health systems which prioritized curative, hospital case care. In reaction to this, the Declaration elevated the importance of primary care to protect and promote all people's health (WHO, 1978). The Alma-Ata Declaration's objectives were to reinforce and elevate the importance of primary health care and prioritize the need for countries to strengthen their primary health care systems. (WHO, 1978a) & (Africa Working Group of the Joint Learning Initiative, 2006).

Since the Declaration over four decades ago, there have been improvements in primary health care (PHC) in many countries in sub-Saharan Africa. Furthermore, the WHO and UNICEF report showed that PHC is instrumental in reducing some of the leading causes of morbidity and mortality, with a significant reduction in death from malaria, tuberculosis, HIV/AIDS, and diseases prevented by a vaccine (WHO & UNICEF, 2018). Although there has been progress in strengthening PHC and evidence to support the impact of PHC, unintended consequences and factors and conditions continue to hinder primary healthcare growth in Low Middle-Income Countries (LMICs) (WHO, 2017a). Competing priorities often take away resources from primary

health care, and fragmentation results from vertical programs focused on specific diseases and conditions (WHO, 2017a).<sup>1</sup>

Primary health care has taken various forms globally, with some countries progressing and some lagging, with Ethiopia being an exemplar country. The Ethiopia Health Extension Program (HEP) has been shown to impact the health of women and children within the country. The program provides more frequent access to care for rural and low-income women than previously available (USAID, 2019). There have been varying degrees of progress in other African countries since the Alma Ata Declaration. The Ouagadougou Declaration produced by the International Conference on Primary Health Care and Health Systems (2008) in Africa in Ouagadougou, Burkina Faso, reaffirmed the Alma-Ata declaration's principles and put a renewed focus on primary health care in Africa. It was a call to action for the African governments to improve health and involve and empower communities to improve their well-being (WHO, 2008b). The Declaration on primary health care and health systems primarily focused on leadership and governance for health; health service delivery; human resources for health; health financing; health technologies; community ownership and participation; health information systems; research for health and partnership for health development (WHO, 2020).

Studies have shown that primary health care is one of the most cost-effective approaches to delivering essential health services and intervention (WHO, 2018). The functioning of a primary health care system is dependent on having a sufficient health workforce with a range of skills and

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<sup>1</sup> Vertical Programs is a part of the health system with a defined objective with a target population to address single condition. There is separate funding, human resources and other resources attached to the program to achieve the set objectives (Cairncross et al., 1997).

expertise. In low resource settings, significant work is needed to meet the demand for this workforce, including increasing the number of trained workers, their distribution, and their competencies (WHO & UNICEF, 2018). Willcox et al. pointed out the discrepancy in the ratio of health workers to population growth. The density of health workers is not increasing in low resource settings because population growth exceeds the number of health workers trained and recruited into the health system in many African countries (Willcox et al., 2015).

The Global Health Workforce Labor Market Projections for 2030 by Liu et al. stipulate that health development goals are challenged by the inequitable distributions and acute shortage of health workers that hinder the delivery of essential health services. The projections show that by 2030, there will be a requirement for 80 million health workers, but only 65 million will be available, leaving an estimated 18 percent shortage (health workforce shortage of 15 million). The basic threshold for healthcare workers is 2.28 skilled professionals per 1000 people; out of the 165 countries included in the study, an estimated 83 countries fall under this required standard, with the most significant health worker shortage occurring in sub-Saharan Africa and South Asia (Liu et al., 2017b).

The Joint Learning Initiative by the Africa Working Group highlighted the challenges and gaps within the health workforce system. The report underscored the disproportionate nature of population growth to human resources in many countries within the continent. The increase in population has not seen an increase in human resources for health; the health professionals' ratio has either declined or remained stagnant (Africa Working Group of the Joint Learning Initiative, 2006). There are 1.9 health workers per 1000 people in Africa compared to 7.78 in the American

region. Although South Africa, Seychelles, Mauritius, and the Gambia provide an exception and have 3.9 or more health workers per 1000 people, many other countries have less than one health worker per 1000 people (Soucat et al., 2013). The Africa region has 24 percent of the global disease burden but has only 3 percent of the health workforce (Kamineni, Shobana, 2019). Due to the factors highlighted, there has been a renewed interest in using community health workers to bridge the gap in the HRH shortage and improve access to health services at the primary health care level (Kane et al., 2021).

One of the WHO's recommendations to address the shortage of health workers is task-shifting (WHO 2008), which allows redistribution of tasks among the health workforces. Tasks can be delegated to health workers with less specialized skills to reduce service delivery bottlenecks (Kane et al., 2021).

Task-shifting can ensure more efficient use of the available workforce. Naburi et al., time and motion study on the potential of task-shifting in scaling up Prevention of Mother-to-Child Transmission (PMTCT) service in Tanzania, found that task shifting from nurses to CHWs would save time and significantly reduce the cost spent per PMTCT patient (Naburi et al., 2017). Another study conducted on the impact of task shifting when community health workers were introduced in Zambia found the addition of CHWs increased demand for health services at the referral health facilities. It lessened the burden for higher-skilled health professionals (Keller et al., 2017).

### **2.1.1 Health Workforce: Community Health Workers (CHW)**

The origin of community health workers (CHW) can be traced back to China in the 1920s (Mhlongo & Lutge, 2019). The first documented large-scale training for CHWs was in Ding Xian, China, and the CHWs were known as Farmers Scholars. The barefoot doctors' era followed this in the early 1950s and expanded this model into other LMICs in the 1960s (Mhlongo & Lutge, 2019) & (Perry, 2013). However, the 1980s saw a decline in the progress and movement National Community Health programs and PHC as envisioned by the Alma-Ata agreement. One of the reasons attributed to the decline in the movement was the global recession due to the oil crisis of the 1970s. Governments had to reprioritize and were encouraged by international donors to embrace the free-market reforms while reducing public sector funding (Perry, 2013). Another reason for the shift is the emergence of vertical programs and selective primary health care<sup>2</sup> supported by international partners and donors (Perry, 2013).

Within the last decade, CHW programs have seen a rebirth globally as CHWs can provide culturally sensitive and people-centered primary health care (Scott et al., 2018). There has been an extension of CHWs across the different continents and countries. There have also been varying definitions and work scope for CHWs (Perry, 2013). CHWs include health extension workers, village health workers, traditional birth attendants, community volunteers, and community health assistants (Perry, 2013).

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<sup>2</sup> Selective Primary Health Care (SPHC) is an alternative to comprehensive primary health care. It is cost effective approach and it focuses on treatment of a selected disease that contributes to the most morbidity and mortality (Unger & Killingsworth, 1986).

However, the deployment has taken various forms on the African continent depending on the country, as the density and quality of community health worker programs vary across the region (UNAIDS 2017). CHWs have been used to address specific needs related to HIV/AIDs, maternal and child health, and other stand-alone programs with various degrees of structure, support, supervision, and reporting (Tulenko et al., 2013). There have been attempts to integrate CHWs programs into the countries' health systems. For example, Ethiopia launched the health extension worker program (Tulenko et al., 2013). Nigeria has the community health extension worker (CHEW) integrated into the National Primary Health Care Development Agency under the basic health service scheme (Farnham Egan et al., 2017). Also, Zambia developed a national CHW strategy and launched the community health assistant program in 2012. These countries are examples of countries that integrated CHWs into the national health system (Tulenko et al., 2013).

Multiple challenges face the CHW programs, including a lack of certification, inadequate training, limited career pathways, and poor planning (Cometto et al., 2018). The challenges are further exacerbated by competing actors with minimal coordination contributing to fragmented, donor-driven management and disease-specific training, making it difficult to fully integrate into an existing health system (Cometto et al., 2018). These factors add to wasted resources and hinder the opportunity to provide integrated service delivery at the community level (Cometto et al., 2018). In many countries within the region, CHWs are poorly integrated into the health systems and work on vertical projects focused on a specific health intervention, often resulting in an underutilization of community health workers within Africa's context (UNAIDS, 2017). Cometto et al. point out the uneven nature of support and integration of CHWs into health systems within countries, with acceptable practices and evidence-based policy not evenly adopted (Cometto et al.,

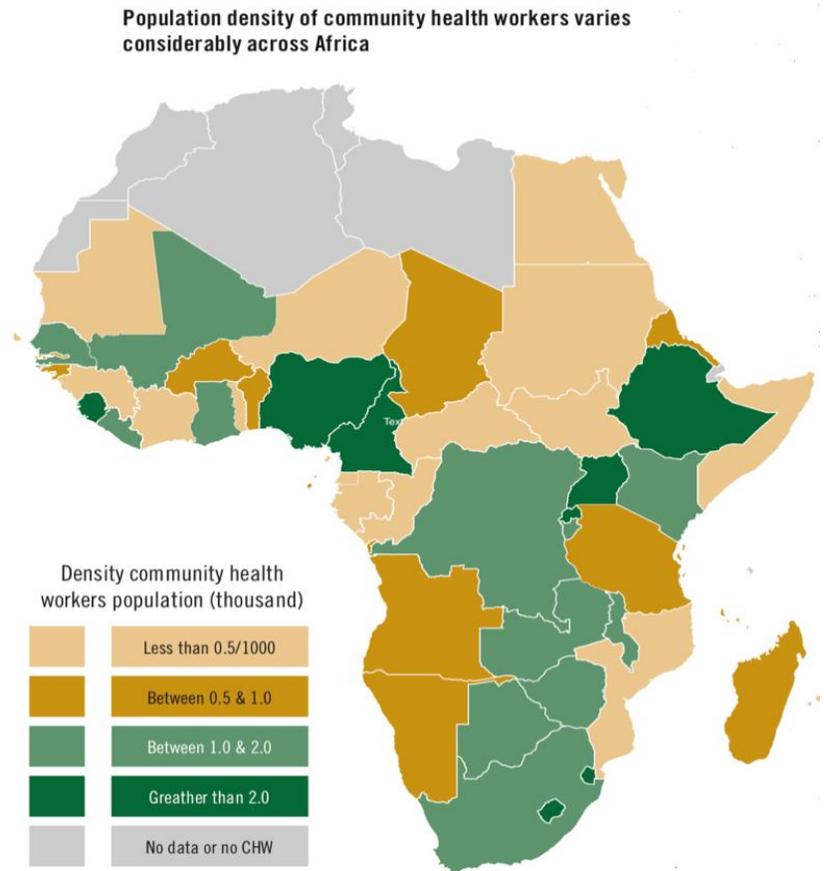
2018). Furthermore, the vertical approach of focusing on a specific disease has brought about short-term gains and contributed to fragmentation and challenges with sustainability and ownership (Tulenko et al., 2013).

Although fragmentation is common, there are examples of countries that have integrated their community health workers within the more extensive health system. These countries include Ethiopia, Rwanda, Kenya, Senegal, and Liberia. Ethiopia is one of the leading examples of integrated community health programs. Over 42,000 health extension workers provide health promotion, disease prevention, immunizations, and treatment of uncomplicated illnesses in their communities in rural and remote areas (UNAIDS 2017).

Also, Senegal has an integrated and exemplary community health worker program (UNAIDS, 2017). Additionally, published evidence demonstrates effectiveness through an integrated and comprehensive program that includes CHWs. One of such is the integrated community-based health service, community development, and hospital care provided by Hospital Albert Schweitzer (HAS) in Haiti. Perry et al., in the paper “reducing under-five mortality through the HAS integrated system,” highlighted the success of the integrated program in reducing under-five mortality (58 percent) and children between 12-59 months (76 percent) in target areas. The integrated program used community health workers to provide peer to peer health education, referral to health facilities, assist the mobile clinic, immunization and support nutritional counseling and growth monitoring within their community (Perry et al., 2006).

A preponderance of evidence shows the effectiveness of CHW programs in delivering health services ranging from preventive, promotive, and curative services within an enabling environment

(WHO, 2018). A CHW program is dependent on a system, and the CHW program plays a role within the system or intervention. Hence, a CHW program is only as effective as the intervention or system it supports (Perry & Zulliger, 2012). For example, Yeboah-Antwi et al., in a randomized controlled trial on case management of



**Figure 1: Density CHW per Country in Africa**

malaria and pneumonia for under five in Zambia, found that community health workers were able to manage pneumonia and malaria at the community level effectively. The study demonstrated that CHWs appropriately tested children with fever using the rapid diagnostic test for malaria and assessed and treated children with non-severe pneumonia cases with amoxicillin (Yeboah-Antwi et al., 2010). Also, a systematic review of RCTs on the effectiveness of a community-based intervention to improve exclusive breastfeeding in LMIC found a significant increase in the rate of exclusive breastfeeding in the four countries studied for the intervention (Hall, 2011). The

interventions in the study saw home visits and community health workers, midwives, and traditional birth attendants playing a role in the success of the interventions (Hall, 2011).

Several studies have demonstrated that CHW program success is contingent on multiple factors. For example, Scott et al., in their systematic review of CHW programs, showed that community ownership, continuous education of CHWs, supportive supervision, sufficient supplies, and logistical support are all critical factors in determining the success of CHW programs (Scott et al., 2018). The authors also found that the credibility and sustainability of CHW programs can be improved if integrated into the health systems (Scott et al., 2018). The review found gaps in training and supervision, social accountability, and governance (Scott et al., 2018). Other robust studies have shown the effectiveness of CHWs to perform necessary vital health activities. However, other studies have also highlighted gaps between implementation and service delivery quality—subsequently failing to generate the desired health impacts (Henry et al., 2016). Like other studies, factors such as incentives, enabling work environment, and supportive supervision have been considered determinants of effective CHW programs. In recent times, an emphasis has been placed on the role of supportive supervision compared to the hierarchical form of supervision (Henry et al., 2016) & (Jaskiewicz & Tulenko, 2012).

## **2.2 Health System in Liberia**

Liberia, a country with an estimated population of 4.9 million, is administratively divided into 15 counties, with six counties (Montserrado, Lofa, Bong, Nimba, Grand Bassa, and Margibi) accounting for 75 percent of the population (Ministry of Health and Social Welfare, 2011) & (World Bank, 2020). The counties are divided into health districts, and there are 93 health districts in the country (Sesay et al., 2018).

The health system is structured hierarchically with primary, secondary, and tertiary facilities. The community- health service delivery is managed and supervised across the national, county, district, and health facilities and community levels (Devlin et al., 2016). The central level is responsible for overseeing the departments, programs, divisions, and units. The central level supervises hospitals and lower-level health units, and the other levels of supervision include district-level and community-based health services. The county and community health services are responsible for providing direct support at the county level (Ministry of Health, 2015).

There are 727 health facilities in the country, 64 percent of which are public. About 71 percent of the population is within an hour's walking distance of a health facility, and about 29 percent of the population do not have physical access to health care because they are beyond 5 km (walking distance) from the closest health facility (Ministry of Health, 2015). The 2010 national census of health and social welfare workers recorded an estimated 9196 health and social welfare workers in the country. The table below shows the breakdown of health workers by cadre (MOHS, 2011) & (MOHS, 2010).

**Table 1: Breakdown of Health Workers in Liberia**

<b>Cadre</b>	<b>Number</b>
Physician	90
Nurse	1393
Certified Midwife	412
Nurse Aide	1589
Physician Assistant	286
Traditional Midwife	243
Dentist	23
Environmental Health Technician	173
Lab Technician/Assistant	376
X-Ray Technician	22
Pharmacist	46
Other Health Cadres	693
Non-Clinical Health Workers (Accountant, Cleaner, Field worker, non-clinical professional, registrar, security, and surveillance)	3207
<b>Total</b>	<b>8553*</b>

*\*Table less than actual number due to missing data*

Liberia, a country emerging from 14 years of civil war and working towards rebuilding, was hit by the Ebola virus between 2014-2015. The Ebola outbreak overwhelmed an already existing weak public health system. The chronic shortage of higher-level trained workers, poor roads, and weak infrastructure led to a dependency on Community Health Volunteers (CHV) for many essential health services. The use of CHV supported and managed by different partners was in alignment with the Community Health Service Strategic plan (2011-2015). Although the implementation of services varied by partner, the different interventions showed that community members could deliver health services with training and supervision. CHVs were instrumental in community-

based surveillance of infectious disease and provided significant support during the Ebola outbreak (Healey et al., 2021).

The Ebola outbreak left the health system fragile, particularly the primary health system. Additionally, the outbreak disproportionately affected health workers. Health workers were more at risk of contracting the virus (Devlin et al., 2016). The outbreak's effects were not only felt within the in-service health system, but the pre-service was also affected. Training institutions for health workers were closed during this period resulting in a ripple effect in the post-Ebola context with a small health workforce (Devlin et al., 2016).

The revision of the 2016 National Community Health Service Strategic plan brought about the opportunity to introduce a new cadre of compensated community health workers known as the Community Health Assistants (CHAs) (Rogers et al., 2020). The revised policy focused on developing a Community Health Assistants (CHAs) program with the mandate to deliver a package of preventive, curative, promotive, rehabilitative, and palliative services, and surveillance (MOHS 2016). The national community health assistant program was introduced into the health system in Liberia (MOHS, 2016). The community health worker program in Liberia is still in the early years and continues to show promise. Nonetheless, there are lessons from other integrated country programs and evidence that can improve Liberia's CHW program's effectiveness.

### **2.2.1 National Community Health Assistant Program**

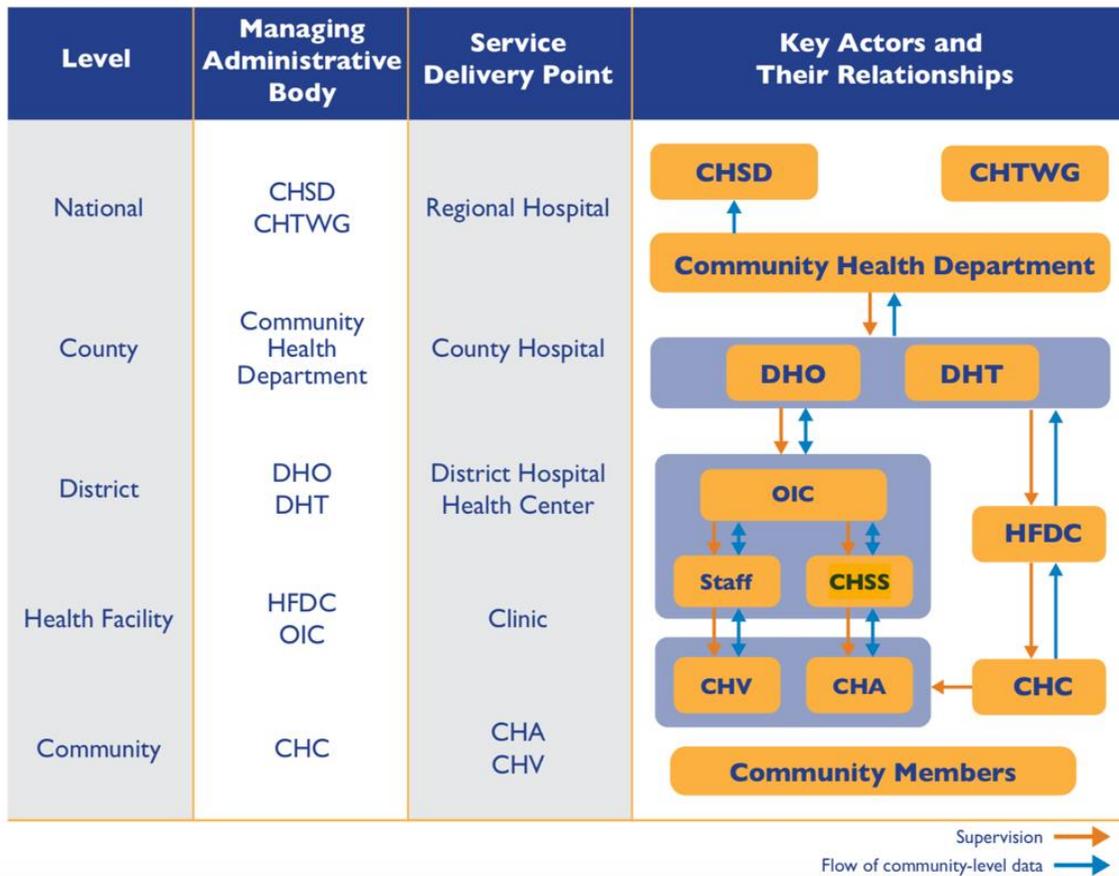
The establishment of the National Community Health Assistant Program saw the consolidation of the different community health volunteer programs managed by NGOs, civil society organizations and other partners at the community level. CHAs are literate men and women based in the

community. They are nominated by the community and trained to provide a standardized and integrated health package including surveillance, preventive, promotive, and curative services to households located beyond 5 Km for a health facility (Healey et al., 2021). The training is a total of two months, covering four modules. The training is separated by weeks, allowing CHA to practice in their community with support and assessment by Community Health Service Supervisor (CHSS) (Rogers et al., 2020).

The NCHA program's mandate is to deploy about 4000 CHAs across Liberia to serve 1.2 million Liberians who live in remote areas more than 5km (walking distance) from the closest health facility (Jallah et al., 2018). As of 2018, nearly 3000 CHAs and over 300 Community Health Service Supervisors, who supervises the CHAs, have been hired, trained, and deployed across 13 of the 15 counties (Jallah et al., 2018). Community Health Service Supervisor (CHSS) are trained health workers such as physician's assistants, registered nurses, community midwives, and environmental health technicians. In addition to their formal training, they receive additional four weeks of training, including mentorship and supportive supervision training. The four-week training is competency-based and aims to prepare the CHSS to execute the following roles and responsibilities: supportive supervision, facilitation; coordination and planning; quality assurance; supply chain coordination, and facility management (CHSS Facilitation Guide, 2017). Currently, the NCHAP has over 3448 CHAs with 2862 males (83 percent) and 586 females (17 percent). There are a total of 373 CHSSs (51 percent male (191) and 49 percent female (182)) (Healey et al., 2021).

Each CHSS is responsible for supervising 10 Community Health Assistants (CHAs). Supportive supervision focuses on performance, skills, and motivation using the SIFT-C (Study, Identify,

Focus, Teach, and Coach) approach. Supervision by the CHSSs occurs both on the field and monthly facility-based meetings (Devlin et al., 2016). In addition to supportive supervisory services, they provide technical support in planning and implementing community programs. (CHSS Facilitation Guide, 2017). Figure 2 shows the different levels of the national community health system and the supervisory relationship within the system.



**Figure 2: Community Health Structure and Supervisory Relationship**

### **2.3 Supportive Supervision**

The supervisory approach in the health sector has evolved with time. Insights from different disciplines have supported this evolution. Previously, a more traditional, more authoritarian approach was used in the health sector in most countries for supervision (Avortri et al., 2019). Traditional supervision emphasizes inspection, control, and fault-finding with minimal support or mentorship on performance improvement (Clements et al., 2007). Another form of supervision is clinical and professional supervision. It allows staff to reflect, review practice, change practice and identify continuing development needs. These types of supervision are different from supportive supervision (Avortri et al., 2019b). The World Health Organization defines supportive supervision as: *“A process for assisting staff to improve work performance continuously. The supervisory visit is carried out in a respectful way to improve the health staff’s skills and knowledge (WHO, 2008b).”*

This type of supervision contributes to health system strengthening by enabling health workers to improve service quality (Avortri et al., 2019b). It allows for open and bidirectional communication and helps to use a team approach to facilitate problem-solving. Additionally, it is dependent on consistent follow-up with the staff to monitor performance towards goals and data inform decision-making (WHO, 2008b). It consists of on-the-job training, using data to inform decision making, observation, and documenting feedback and observations (WHO, 2008).

Evidence shows that supportive supervision effectively improves the quality of services delivered at the community level. For example, a study in Ethiopia on the effectiveness of supportive supervision in ensuring consistent delivery of health found that supportive supervision effectively improved the integrated community case management skills of community health workers in

Ethiopia. In addition, the study found that after receiving a minimum of one supportive supervision visit, there was an increase in management consistency in diarrhea, malaria, and pneumonia (Ameha et al., 2014). In Liberia, supportive supervision is the selected approach for the supervision of CHAs by CHSSs by the Ministry of Health. A part of the CHSS training includes how to provide supportive supervision to CHAs on the field.

## **2.4 Digital Tools in Health**

The World Health Organization defines "*digital health as the use of information and communication technology to support health*" (WHO, 2019). The use of digital technology for routine and innovative approaches to address health challenges has seen a significant increase over time. Digital health tools have been used in various interventions for different target users ranging from health providers to patients (Kenny et al., 2020a). Some digital health tools and applications include health information technology, mobile health, telemedicine, and wearable devices (FDA, 2020).

Digital tools present a unique opportunity to respond to the shifting health needs and shortages within the health workforce. Some of the digital tools' noted advantages are the ease of use and access to the correct information at the right time. An added advantage of the digital tool is relief from time-consuming tasks such as allowing for more patient time (OECD, 2020). In addition, it allows for more accurate surveillance and analysis of a large amount of data to better treat and assess health system trends (OECD, 2020). Compared to paper-based tools, digital tools have also shown lower error rates in data collected and decreased cost over time (Kenny et al., 2020a).

The WHO has classified digital health interventions into four groups: interventions for clients, interventions for healthcare providers, interventions for a health system or resource managers, and interventions for data services (WHO, 2019a). These digital health interventions have contributed to addressing health challenges relating to managing inventory, data storage and synthesis, and access to proper health protocol and procedures. In addition, there are various digital health interventions for healthcare providers, including community health workers (WHO, 2019b).

Digital health tools include mobile digital applications<sup>3</sup>. There has been increasing use of mobile digital tools to aid various health objectives worldwide (Braun et al., 2013). Studies have shown evidence on mobile tools' success to aid CHWs in improving the efficiency of services, quality of care provided, and the program monitoring capacities. CHWs use the mobile phone to collect health data in their community, health promotion, and treatment guidelines (Braun et al., 2013). Additionally, CHWs play a pivotal role if equipped with the right tools in the wake of an outbreak. Digital tools are used for surveillance, communication, decision-making, and training. Digital tools can also be used for remote data collection, communication via short message service, monitoring, and digital contact tracing (Feroz et al., 2021).

#### **2.4.1 Digital Tools in Liberia**

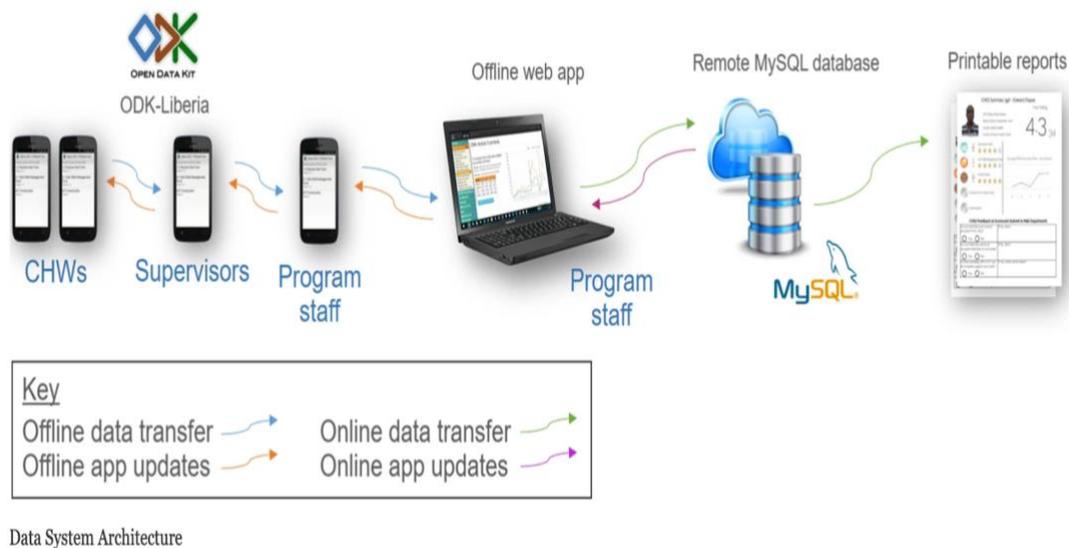
There has been a penetration of various digital interventions across Africa, and Liberia is no exception. Different digital health systems and interventions have been piloted and scaled. One of the universal management systems used in the Liberia is Health Information Management System (HMIS), which captures services and administrative and management outputs at the health facility level (HealthEnabled, 2017). Another management system tailored for community use is the Community Health Management Information System (C-HMIS). The system collects information on services provided at the community level (HealthEnabled, 2017).

Another tool introduced and piloted was an open data kit used to create the electronic data capture (EDC) through mobile phones (Kenny et al., 2020a). This is an Android based application powered by OppiaMobile Technology. The rationale for introducing the EDC technology was to

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<sup>3</sup> Digital application is a communication and ICT systems and communication channel that aids the delivery of health materials and digital interventions (WHO, 2019).

improve the data quality, usage, the efficiency of the NCHA program (Kenny et al., 2020b). One of the application's use is to deliver multimedia learning content and quizzes to frontline health workers (Bailey et al., 2019). One of the functionalities of the application is the Bluetooth-based data transfer system. The transfer system permits users to transmit data to another use without internet connectivity or a cell network. The diagram below illustrates the process, with Bluetooth capabilities allowing offline data transfer and updates (Kenny et al., 2020a).



**Figure 3: Offline Design and Implementation Mobile Data Capturing Platform**

For LMH, mobile phone use started with a pilot in 2015 during the Ebola Crisis. A version of the ODK was modified for data collection use. In 2019, after completing the pilot phase, the Ministry of Health, in collaboration with Last Mile Health, deployed an Android-based application to over 3000 mobile phones for community health workers and their supervisors (Bailey et al., 2019). Over time, LMH, in collaboration with the MOH, has customized and developed open-source software for multimedia education, data collection that can be used offline. In collaboration with

different partners, the Ministry of Health has customized and deployed different digital tools.

These tools include:

**Table 2: Type of Digital Health Tools and Applications in Use in Liberia**

Digital Tool and Application	Purpose
Community Event-Based Surveillance (CEBS)	CEBS helps facilitate timely data collection on events of the potential risk to public health. Community-based health workers are trained to provide surveillance services (MOHS, 2016).
Community-Based Information System (CBIS)	CBIS is used to collect, analyze, and manage health services offered at health facilities at the community level (Measure Evaluation, n.d.). In Liberia, it is the national information system for the NCHA program used for health service data.
Joint Integrated Supportive Supervision (JISS)	JISS is used for quality assurance checks. MoH, in partnership with LMH, has digitized the tool known as eJISS. The system is also used for implementation fidelity within the health system.
Liberia Open Data Kit	Data collection platform that has been modified with offline functionality. It allows for decision support. In Liberia, this is used along with paper-based tools.
Vaccine Tracking System (VTS)	VTS is an electronic platform to track vaccine implementation. In addition, it is used to track vaccination and vaccine defaulters (Last Mile Health, 2021). LMH supported in the development of the vaccine tracker
National Health Information System (HIS)	This is used for data collection, storage, and reporting. The platform used in Liberia is DHIS II.
Electronic Logistics Management Information System (eLMIS)	eLMIS is a health logistic management system used for recording and reporting data. It can be used for commodity management and tracking at the community level (Ntirenganya, 2017).
Academy	E-learning multimedia platform built on the OppiaMobile application <sup>4</sup> . The academy application contains parts of the NCHA curriculum that have been digitized. Currently, there are four courses on the application. It has multimedia video content with quizzes for knowledge assessment.

<sup>4</sup> OppiaMobile application is an open-source learning application designed to deliver multimedia learning content in a low broadband setting. The application can be used both online and offline (Bailey et al., 2019).

The mobile phones for the CHAs are equipped with training videos, routine monthly home visit forms, and an Integrated Community Case Management (ICCM) data capturing form. In addition, the supervisor's mobile phones are equipped with forms that captured supervisory activities such as supply chain information. The application included a timestamp and geo-tag to monitor the location and time in which the forms were completed. This was done to prevent falsifying information. Supervisors were responsible for transferring data collected by CHAs to their mobile phones and taking it to the central office for transfer to the database (Kenny et al., 2020a).

### **Section 3: Host Organization**

#### **Last Mile Health**

Last Mile Health (LMH) is a non-profit organization founded in 2007 in Liberia with a vision of a health worker for everyone every day. LMH currently works in five countries in Africa (Liberia, Sierra Leone, Uganda, Ethiopia, and Malawi) and two offices in the United States (Boston and New York). For the past 12 years, Last Mile Health has worked with the Liberian government to implement a national community health worker program and has expanded work to four other African countries. The organization works with countries to build and strengthen community-based primary health systems. One of the organization's primary objectives is to train and support frontline health workers to bring health services to remote, rural, and last-mile communities. In addition, the organization has worked with the Ministry of Health to deliver services to 1.4 million people served by community health workers in remote communities worldwide. One of the health workforce capacity-building initiatives of Last Mile Health is the Community Health Academy ("the Academy") (Last Mile Health, 2021).

The Community Health Academy's goal is to leverage digital technologies to train thousands of community health workers, supervisors, and the health systems leaders who support them. The Academy is working with governments and other partners to create Health Systems Leadership Development (HSLD) courses as well as developing and delivering a Clinical Education (CE) program for community health workers that will be delivered through mobile devices for use both online and offline (Last Mile Health, 2018). In Liberia, LMH provides technical and financial support at the national level. Additionally, under the “one county one partner” policy, LMH provides support in three counties (Grand Bassa, Grand Gedah, and Rivercess) in Liberia. The counties supported by LMH are known as the managed counties (Last Mile Health, 2021).

My role at Last Mile Health started as the Regional Engagement Director – West and Central Africa. The role was to establish and manage the regional hub for the Academy to serve West and Central Africa. The role helped build health workforce capacity within Liberia through a series of programs (on the HSLD and CE Platforms) developed by the Academy.

The position involved working with academic institutions, clinical experts, country governments, and community health workers to design tailored content for the platforms. In addition to working with external partners, the role receives support from the internal Academy team based in Liberia and the global team based out of Boston, Massachusetts. Also, the Regional Engagement Director contributed meaningfully to building momentum and usage of the two leading digital health education platforms. The role included working with an academic institution and clinical experts to develop context-specific content for the platforms.

#### **Section 4: Project Design, Goals, and Strategy**

This project looked in-depth into the role of digital tools in improving CHW supervision in a remote area. Specifically, this project sought to understand the supervisory relationship between the CHA and the CHSS in Liberia. It investigated the role of technology in supporting the supervision of CHAs in the field. Furthermore, it examined how digital tools have been leveraged for supervision and their connection to the entire health system using the systems thinking framework. The project proposed to answer the following research questions:

##### **What role can digital tools play in the supervision of CHA in Liberia?**

- What are the lessons learned from the introduction and deployment of mobile technology to CHAs and CHSSs in Liberia that can contribute to existing knowledge about the role of technology in supervision?
- What are the strengths and weaknesses of using digital tools during supervisory visits by CHSSs?

#### **4.1 Method**

This project used a qualitative approach for data collection and analysis. The research began with a systematic literature review of both published and grey literature on CHW programs, supportive supervision, and digital health. Focus group discussions and semi-structured interviews followed the literature review to elicit information from relevant stakeholders on the role of technology in supportive supervision, supervision structure for CHAs, community health, and engagement strategies/approaches to strengthen practices at the community level. The study investigated the integrated national community health program and mapped out the supervisory relationship

between community health assistants and the community health system. The analysis included a review of inputs, outputs, health services, and outcomes.

#### **4.1.1 Data Collection**

##### **4.1.1.1 Literature Review**

The systematic literature review included both published and grey literature. A systematic review was conducted of English published literature between 2000 and 2021. The search was conducted on Hollis, PubMed, and Google scholar redirected to public health peer-reviewed journals. The search started by reviewing abstracts about NCHW programs, CHW supportive supervision, and if relevant, the full articles were reviewed further. Additionally, citations within existing literature were searched for other relevant pieces of literature. The review included quantitative, qualitative, and mixed-method articles. The keyword search included community health workers, frontline health workers, mobile applications, clinical education, and supportive supervision.

The inclusion criteria included reports, studies, and articles with keywords such as digital health, clinical education, e-learning, community health, community health workers, community health education, and primary health care conducted in low- and middle-income countries (LMIC) available in the English language. Opinion pieces and letters to editors were excluded from the review. The search of NCHW program LMIC returned 14,000 articles from Google Scholar. However, the PubMed database resulted in 26 articles from 2009 and 2021. The search across the different databases resulted in 80 papers reviewed and 32 selected for this project.

The systematic literature review and the system thinking framework informed the development of questions for the focus group discussions and semi-structured interviews. The data collection tools

were developed to elicit information from relevant stakeholders on the NCHA program, supportive supervision of CHAs, the digital tools used, the status of community health, and engagement strategies/approaches to strengthen practices at the community level.

#### **4.1.1.2 Study Population**

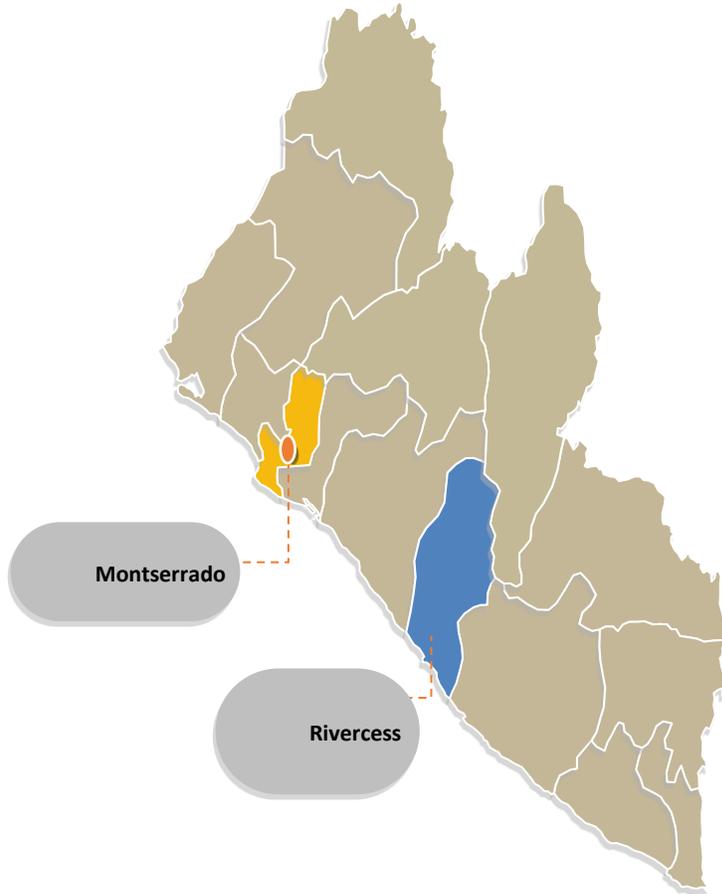
The study population had 35 participants, including health officials within the Community Health Services Division (CHSD) and the Digital Health department within Liberia's Ministry of Health. Additionally, digital health experts involved with the intervention were interviewed

#### **4.1.1.3 Sample and Sampling**

Convenience and snowball sampling was used to identify participants. As part of the recruitment, participants were asked to recommend other participants knowledgeable about the subject matter. The participants included CHSSs, CHAs, CHSD leadership, and mid-level managers within the Ministry of Health. Considering that CHAs and CHSSs are connected through supervision, they provided valuable insights into the digital tool's role and usage for supervision. Additionally, the project intended to learn from their experiences and insights on the strength and weaknesses of the tools.

Consultation with the Last Mile Health program and digital health team in Monrovia informed the selection of counties and districts. COVID-19 related restrictions confined the data collection to only two counties. Some of the criteria for selection included the availability of CHAs and CHSSs. Additionally, the counties with the academy application and routine forms on the mobile application also informed the selection. These criteria informed the selection of Rivercess and Montserrado county as the sites for data collection. Another condition for selection was knowledge about the NCHA program and the supervision process.

Montserrado county is in the northwestern part of the country with the national capital of Monrovia. It has four districts with a population of 1,144,806, making it the most populous county in Liberia. It is the first level of administrative division (Ministry of Internal Affairs, 2012).



Rivercess is in the southeast of Monrovia with ten districts and Cestos City as the county capital.

**Figure 4: Map of Data Collection Site in Liberia**

The county is one of the most isolated counties in Liberia (LISGIS, 2013). Rivercess is one of the counties managed by LMH. The organization provides financial and technical support for this county's community health worker program. Focus Group Discussions were conducted in Rivercess with CHAs and CHSSs.

**Table 3: List of Participants**

<b>Participant List</b>	<b>Number</b>
<b>Key Informant Interview</b>	
Director of Community Health	1
Assistant Director of Community Health	1
County Health Officer	1
Community Health Department Director	1
Digital Health Coordinator (MoH)	1
District Health Officer	2
Officer in Charge	1
M & E officer	1
Community Health Focal Person	1
ICCM Coordinator	1
Quality Assurance Officer	3
Digital Health Coordinator (LMH)	1
<b>Focus Group Discussions (FGDs)</b>	
Community Health Assistants (2 FGDs)	14
Community Health Service Supervisor (2 FGDs)	6
<b>Total</b>	<b>35</b>

#### **4.1.1.4 Semi-Structured Interview**

Semi-structured interviews were conducted between January and March 2021 in Montserrado and Rivercess. There were one-on-one interviews with relevant stakeholders with an interview guide that allowed for open-ended responses. The interviewees included Ministry of Health officials at the central and county levels. In addition, at the county level, community health assistants and community health service supervisors are responsible for implementing safety and quality at the district level. Also, other stakeholders supporting supervision within the community health systems were interviewed. The interviews took approximately an hour with each participant. All participants were fluent in English. Therefore, the interviews were audio-recorded and conducted in English.

Semi-structured interviews with key stakeholders with decision-making power happened at the central level in Montserrado's capital city, Monrovia. The capital city of Monrovia houses the headquarters of the Ministry of Health and Social Welfare. Interviews were conducted with participants at the central, county, district, and community levels to understand the supervisory relationship.

#### **4.1.1.5 Focus Group Discussion (FGDs)**

A Research Assistant (RA) moderated focus group discussions with CHA and CHSS in March 2021. Five Focus group discussions were conducted with CHAs and CHSSs in two districts (Timbo and Jo River) with 24 participants. The RA was selected based on experience with qualitative research and came highly recommended by the University of Liberia. The RA was trained in the data collection tools and observed interviews before moderating the discussions. I supervised the process. The discussions were audio-recorded and conducted in a mix of Liberian broken English and English for the CHAs. The research assistant translated the transcripts from broken English to English.

#### **4.1.2 Data Analysis**

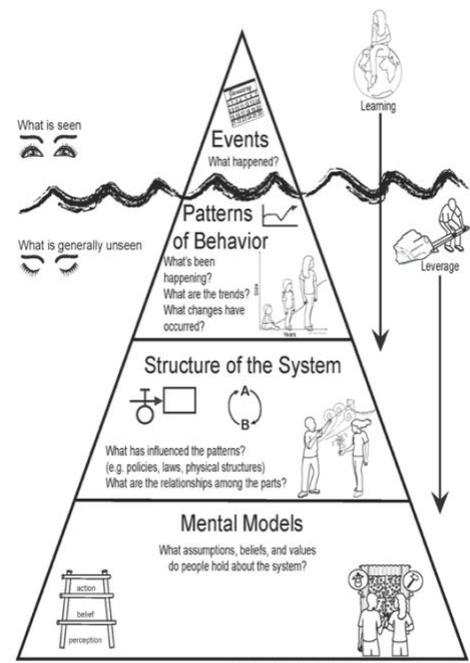
All interview recordings were transcribed verbatim by a research assistant. The transcripts were thoroughly checked against the recording to ensure the accuracy of the transcribed content. A systematic approach was used to describe and understand the data. The data collected was coded thematically using qualitative analysis techniques—the grounded theory was used for data analysis and open coding. NVivo software was used for analysis. Data collection and analysis occurred concurrently. The rationale behind this approach was to use emerging themes to inform subsequent data collection.

## Section 5: Framework for Change

For this project, the framework applied as a lens to answer the research question is the System Thinking approach. The system thinking approach frames how structure operates and interacts within a system (Kapp et al., 2017). It frames the understanding of the issue, the possible actions, and future actions (Rajagopalan & Midgley, 2015). It allows for exploring interdependent and interrelated parts of systems and how changes in one part of the system affect other parts of the system. This framework is appropriate because of the interdependency of the health system. Simple changes in the system can have unintended consequences (Aronson, 1996). The system consists of subsystems; in this case, community health is a part of the system that contributes to the whole (Aronson, 1996).

Within the system thinking framework, multiple models apply to this project. These include the iceberg model as well as the causal loop. The iceberg model (figure below) of system thinking is applied to understanding the problem and developing

recommendations that inform future actions. Systematic structure generates patterns and events, but most of the time, we only see the events, and based on that, decisions are made. Meanwhile, the event is just the tip of the iceberg resulting from deeper patterns and systemic structures. Thus, to fully understand the events, there is a need to understand what is seen and unseen (Kim, 1999). In the past and present times, the system thinking approach was used to address the



**Figure 5: Iceberg Model**

health system's challenges. An example is applying the framework by WHO and the Alliance for

Health Policy and System Research to Health Systems Strengthening. This is reflected in a landmark report titled System Thinking for Health Systems Strengthening (Savigny et al., 2009).

Part of the methodology included this approach to answer the research question and provide recommendations. The rationale behind this choice is that it takes a system-wide approach to comprehend the health system related to community health. For this project, the system thinking approach aided in framing and understanding the national CHW program as it fits into the whole health system within Liberia. Furthermore, it looks at the interconnection between the effective use of digital tools for supervision and the entire health system.

## **Section 6: Result Statement**

### **6.1 Events**

The system thinking iceberg model was used for the analysis. The event looks at what happened and what is visible within the system. The Ministry of Health introduced the use of digital tools to complement gaps in training, surveillance, data management and supervision. The Community Health Service Division (CHSD) with the Ministry of Health (MOH) digitized parts of the NCHA paper-based curriculum with the support of LMH. The digitization of the courses aims to serve as training refreshers and instructional videos for the CHAs and their supervisors. Currently, the academy app holds three courses: Digital health basics, CHA basics, and immunization.

### **6.2 Patterns**

The analysis looked at trends over time in implementing the digital tools. The analysis revealed several key themes. One emerging theme was that digital tools help fill a gap in health education among community health assistants through a mobile application called the Academy on the DCT. We found that CHAs and CHSSs watch the training videos to refresh their knowledge on the different subject matters covered during the course.

Additionally, the videos on the DCTs complimented the health education sessions conducted with community members. Participants reported sharing the videos with community members during site visits and health education sessions to teach community members about specific health topics and danger signs. The DCT is also shown to the patient/caregiver to reassure the knowledge, diagnosis, and treatment option they are prescribing.

*“One of the advantages is that if you have your material, a digital material on your tablet. And then you are performing a procedure. And you’re stranded maybe you missed the step,*

*for example, like during an RDT test if you just miss this step. But with your mobile phone, all you need to do is just to go to that Identical area. Okay, so all you need to do is just refer to your mobile phone. Open that area. And then, just watch the video in less than five minutes. You feel confident in doing your job so CHA will always tell you that with the mobile phone I feel respected in the community.”*

While discussing the academy application is helping with engagement in the community, one of the participants shared the following:

*“So, when the caregiver says my child is coughing, they expect the CHA to give them amoxicillin because they feel that it is pneumonia. But then the CHA will say no, just drink water and let’s monitor the child. So, with the video all you need to do show the video of a child with pneumonia. And then you will notice that the child struggling to breathe. And then you just need to show that video to the caregiver and say, compare your baby condition to this condition. Is it the same? And then you will say No, my baby is not breathing like this is. You say okay whenever you see the baby breathing like this, it means that the child has pneumonia, but because your baby is not breathing like this, it means that your child has common cold they will – okay..., you minimize the confusion between the caregiver, and the CHA because most often they feel that the CHA doesn’t even know what he or she is doing. She doesn’t want to give drugs.”*

Furthermore, the interviews revealed that the academy application on the DCT helps complement existing training of CHAs by CHSSs and supports reinforcing knowledge about key areas. With the CHAs having varying literacy rates, the videos and simplified text serve as reminders and

complement health education engagement at the community level. One of the participants reported on how the academy application can be used to reinforce knowledge.

*“If you go to the Academy in the DCT, you will understand what are the causes of diabetes, what are the causes of these different things and so it makes the work easy. And without the DCT the work was going to be challenging for us.”*

Another participant particularly emphasized how the academy application helped fill a gap in the critical knowledge for CHAs.

*“It is helpful because during the CHA training, they didn’t really go in depth with the signs and symptoms of all of those diseases that we are treating but the Academy is actually teaching them and they are knowing those various signs and symptoms of all of the diseases that they are treating in the community, even including malnutrition.”*

Additionally, the CHSSs reference the videos during supervision as a learning reminder and fill the knowledge gap among CHAs. One of the academy application features is tracking the learners' progress through quizzes and an engagement tracker embedded in the mobile application. Supervisors can access this information and observe CHA engagement on the app by checking the phones during supervisory visits. The CHSS reviews the academy app during the visit to monitor the CHA usage and review test scores. They also use the opportunity to teach if they notice any significant gaps in knowledge with the CHA as part of the supportive supervision.

Another emerging theme was the role of the DCT to minimize treatment and reporting errors. One of the applications available on the DCT is the Liberia ODK. The Liberia ODK supported by LMH contains different routine forms used by community-based health workers. One of the critical features of the Liberia ODK is the skip logic. It allows users to see the next question based on the answer to the current question. Based on the answer, a recommendation is provided if the patient needs referral to health facilities and how to proceed. In addition to treatment options, users cannot proceed if they do not complete vital questions. Participants reported that the skip logic helped minimize treatment and reporting errors. The skip logic function aids accuracy in dispensing medication for patients and treatment. It also provides prompts when the user needs to refer the patient. The ODK with the different features and functions is available on a CHA and CHSS phone (DCT). Participants shared the benefits of using the different features and functions on the DCT. One of the participants shared:

*“The DCT will also direct you to what you need to do; so, at times when you forget, and you don’t think you can go this far the DCT will tell you to do this. Like when we go, we supposed to do audit for one child out of five children that the CHA treated. The DCT will also ask you whether you did the audit. And if you did the audit was the child treated correctly? If you put yes, if you put No, it will also tell you another thing to do.”*

Another participant stated this about how the skip logic supported in keeping them on track while reporting and completing the forms.

*“One of the good things about using the DCT is it forces you to do the right thing. It compels you to do the right thing. Because if you do not say the right word, or what you*

*are supposed to put on that particular page it can never flip. So, if you want to flip the DCT will tell you have to say something. So, the DCT can compel us to do the right thing.”*

Additionally, the application is enabled with predictive text, contributing to the ease of using the DCT. One of the participants in the project reported the following based on the features of the application.

*“The digital makes the work more accessible than before when you are using only the papers. It can make you not be guessing; you know, sometimes we can forget, but as soon you try to put the wordings the specific word, you can see the word to be used there, and it can guide compared to just the paper form, digital makes the work easier.”*

Furthermore, the Liberia ODK is customized, and access to forms is based on the cadre. The paper-based data collection tools, such as supervisory and routine forms for various community-based health workers, were converted to electronic versions. These materials are available for use on the DCT. Access to the electronic forms is based on roles and responsibilities within the community health system. For example, the CHAs have access to the routine visit form and a sick child management form. The supervisors have access to the electronic restock form, vaccine tracker application, supervision visit log, and the supervision checklist on their DCT. The supervision checklist form contains questions on CHSS management of the supervisory visit, restock process, coaching and mentoring, and questions on observation of the use of the DCT by the CHA during the supervisory visit. Participants mentioned that access to the electronic versions of these forms facilitates data to be received and compiled at a faster pace.

One of the duties of the CHSS is data collection from the CHAs and completing the monthly summary form. The current data collection process includes retrieval from the phone via Bluetooth by the supervisor during site visits. All the collected data and completed forms are submitted to the health facility and then to the county office. At the county level, the data is uploaded into the central database. One participant at the central level described how data gets from the field into the central system.

*“The CHAs are using the mobile phones (DCT) daily. And then the supervisors collect those data from them at the end of the month. So, the same way the manual transfer goes the DCT transfer also goes in such manner. At the end of the month, using Bluetooth, the CHSS pairs with the CHA’s DCT and transfers the information on the ODK to their own DCT. Then they take it to the county health team, and they upload it into the system but that is only into the Last Mile data script. In counties where that is been piloted, we are doing both The DCT data collection, and the paper data collection is coming to the ministry of health.”*

The electronic process eliminates the time needed to get the data to the central level. Decision-makers have access to data faster. Furthermore, the forms available on the DCT aim to aid the quality of supervision and provide a means to collect accurate and timely data.

While participants found the DCT helpful and instrumental in improving the quality of service and supervision, some expressed concern about the time required to complete both the paper-based and electronic versions of the forms. The Liberia ODK is available only in counties managed by

LMH, and the scale-up of the application is yet to be nationwide. On the other hand, the academy application is available on all DCT nationwide. In addition to the piloting of the Liberia ODK for data entry and supervision and the academy application for continued education by LMH, there are other digital innovation pilots implemented in other counties by other partners. Under the one partner one county policy, other partners provide technical and financial support in other counties. One of the participants from the KII mentioned some of the digital applications used in different counties. The participants stated:

*“Currently there are several pilots around digital health in the country and Last Mile Health is doing some digital pilot using mobile phones, the DCT to collect data.... You also have the PASS digital health pilot. The PASS is a USAID project and using the digital platform to report alert and notifications from CHAs, making sure they appear to the facility as they occur. That system though it had its own challenges because it only operates with internet. So, it was only piloted in areas where there is internet; Bong, Nimba and Lofa. Another digital application is the Child Friendly Communities/Real Time Monitoring (CFC/RTM) by UNICEF. The aim of the application is to use real time data to inform communities about what is happening into their program and sends the data to central; provides feedback to the communities first and then it transfers that data to the national,*

Since the Liberia ODK containing the different electronic forms is only available in 3 out of 15 counties, users must complete both versions of the form, contributing to the overall time spent on completing forms and possibly taking time away from the actual work.

Another function on the application allows tracking the availability of the drugs received from the health facility by the CHSSs and distributed to the CHAs (drug stock-in and stock-out process). The stock tracker is used for tracking and restocking drug supply with the CHAs and CHSSs. Some participants reported on the discrepancy between the paper and electronic versions. When asked about the challenges faced with the DCT, one of the participants responded:

*“For me it is the restock area. Sometimes in the DCT it will tell you bottle and in the paper form it will have tablets so like that it confuses you in putting the amount in certain areas if you do not put a certain amount there it will not go. So that is one of the areas that I really have issue with.”*

Participants mentioned the need for the electronic version to correspond to the paper version. Participants also indicated that the electronic version is not frequently adapted to keep up with changes and realities of the drug available for distributions at the community level. In contrast, the paper-based version, the CHA, or the supervisor can handwrite the changes on the form.

The findings also support that the DCT contributes to enforcing supervision by tracking CHSS visits to the field. CHSSs and CHFPs have GIS trackers and timestamps enabled on their DCTs. This is to ensure that CHSSs are going for supervision and reporting on findings from the field. The tracker monitors supervisors’ visits to the CHA communities. Participants stated that there were reports of supervisors not going for supervision and completing forms from different sites other than the supervision site. The GIS tracker is a mitigating factor in ensuring that supervisory

visits are happening at the community level. In addition to tracker locations, it is also used for monitoring the inequitable distribution of supervision.

*“They are to use a GPS to enter that they are in an area, so it registers that CHSS is out in the field on this date and at this time, you know, in a particular location that is captured by the digital tool.”*

Participants found the GPS tracker and timestamp to be a useful accountability tool to monitor attendance of supervisory visits. Additionally, data collected from the GPS tracker and timestamps can help inform performance decisions at the health facility and central levels. Decision-makers at the county and central level have access to the data and can track supervision and time reported on the field. This information can inform areas lacking in supervision and areas with high supervision rates.

*“Yes, for the data collection tools is very much important because it helps us to safely save our information that we collect from the field, and it also makes our work very easy. It helps even our bosses to know our location when it comes to the work that we do. Because when you get somewhere you connect your GPS; I think it tells them that you the CHSS went to that place because if you are not within that community there is no way you are going to connect that GPS. Yes, it is within that community or any of the communities that you have CHA that you get to before you can connect the GPS. So, it helps us and it also help our bosses to know that we are actually going to those places we say we go and it also limits the amount of paperwork that we do.”*

However, participants also reported challenges using the GPS tracker and time stamp features on their DCT. One of the participants mentioned one of the challenges faced during the rainy season.

*“One of the disadvantages of this DCT when rain is falling you can never get the GPS. And once your GPS is not recorded, they do not consider that supervision. So, it can give us hard time during the rainy season. You will go in the community; you will do your supervision but once the GPS is not recorded due to bad weather that supervision is not considered.”*

Another emerging theme was the use of the DCT to track vaccine coverage. As part of the routine household visits, CHAs are expected to track vaccination status on their DCT. During the household visit, they check the vaccine card to see who has been vaccinated and who still needs to be vaccinated. The DCT is used to document and track sick children in the community. The CHSS also have access to the VTS on their DCT, and they work closely with the CHAs to track vaccination in the community.

*“VTS also helping us to collect data from the community especially with the children that suppose the take vaccine. It can help us to track the defaulter from the community. When we bring it to the facility then we know how to plan the outreach with the vaccinator to carry vaccine to those communities.”*

The participants reported that the VTS application contributed to the ease of data collection and allowed for tracking vaccine defaulters within the community. However, some participants also

reported challenges with the application malfunctioning during field visits, thereby hindering usage.

The most frequent technological challenges reported by the participants were the solar power bank provided to charge the phone was not properly charging the phones, targeted users not knowing how to use the phone, limited storage space on the phone, and malfunctioning of the applications on the phone. Notably, the participants give multiple examples of how the DCT was malfunctioning during use.

*“The only problem is when it begins to malfunction. Whether the CHA or the CHSS device begin to malfunction. That just paralyze everything; you can’t go farther until someone comes in to do some fixing before you can go ahead. That’s the only downside about it.”*

During the discussion about the challenges faced with the DCT malfunctioning and how it results in delays. One of the participants stated the following:

*“The DCT they brought to us; Every time it can be tripping. You go in the program you have gone halfway entering your information. It’s going to trip, it will come back, and you have to reboot, it will trip again. So as the result it delays you, certain information you are supposed to do in two to three minutes sometimes it takes you seven minutes.”*

Furthermore, participants in the rural areas reported on the challenges relating to electricity and charging the solar charger during raining season. One of the participants in Rivercess described below the challenge sometimes faced with charging the phones below:

*“So, another thing like she was saying when it comes to the solar charger that we use to charge the DCT is another disadvantage. You can’t find charging booths all over like Monrovia. So, at times we find it difficult. So like the other time I went in the field, and my DCT went off. I went all the way I met one CHA just how I left and went to meet with the other CHA, when turning on the GPS tracker my DCT went off. I even ask around that community, who has power bank, and I couldn’t find anything, so I had to bring my DCT back without entering any information.”*

Other challenges reported included the theft of the phones and fear of damaging the phone resulting in the users not using the phones as needed. Some participants reported that their phones were stolen while charging at a charging center in the community. During a KII, the participant reported the following:

*“I have seen in some areas, people break into CHAs homes and steal these materials because the power bank, the solar panel are very valuable.”*

Also, some participants reported that users would not take the DCT on the field in some instances out of fear of damaging the phone.

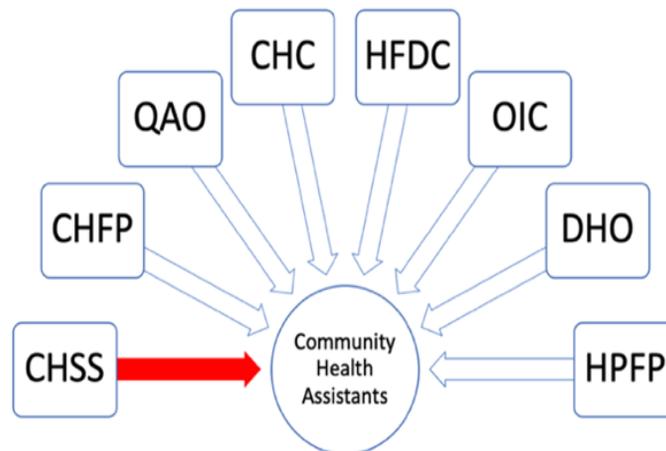
Another challenge that was echoed among participants on the field is the restrictions placed on the DCT. The sim card and camera features were disabled. Access to making or receiving phone calls is locked as well as access to the internet. The restrictions placed on the DCT are to prevent

personal use. However, participants mentioned that the restrictions hindered the work on the field. Examples provided by participants included:

*“One of the things I got problem with because it’s a phone and we supposed to be able to use it to call and for other things. They blocked the phones, and we can’t make any call. We are only restricted to use the forms in it we are not allowed to use it to make any calls. So, if we don’t have our personal phones, if we even go in the field and anything happens, we cannot call.”*

*“We are adults and then this DCT is fully restricted. It was one time certain group came to me and they wanted photos and I say I can’t provide photos because you give me DCT that is restricted even if you block the call area, let the camera area be open so when we see other cases in the field we can take a photograph; pictorial is one of the best evidence for programs but then we got the DCT in our hand and we can’t do anything because they block everything. Let the camera area be open so that when we are face with any emergency in the field, we can get some picture evidence but then it is block so it’s a serious problem.”*

## Supervisory Relationship



**Figure 6: Supervisory Relationship: Different Cadres providing Supervision**

Additionally, the findings revealed that multiple cadres provide supervisory support to the CHA on the field. As the diagram illustrates, supervision of CHAs is not only done by CHSSs, but other cadres also supervise them with varying frequency.

However, the CHSSs are the primary supervisors of the CHAs. They are responsible for training and provide direct supervision to the CHA. The expectation is to spend 80 percent of their effort on the field and 20 percent at the health facility. However, this might not be the reality due to demand at the health facility, unfavorable road conditions during the rainy season, inadequate resources, and shortage of health workers (Westgate et al., 2021). Also responsible for the supervision of CHAs on the field is the community health focal person (CHFP). In addition to the CHFP, the managed counties under Last Mile Health have Quality Assurance Officers (QAO), who also supervise the CHAs at the community level. LMH recruits the QAOs in the county to ensure quality in implementing the NCHA program in the three managed counties. The primary role of the QAO is to strengthen quality supervision of the CHA by the CHSS. In addition, they support the CHSSs in the supervision of the CHA. Occasionally, the CHSS and QAO perform

joint supervision, and in situations where the CHSS is not available, the QAO can supervise the CHA. There is evidence recommending that improvement in quality of supervision is more impactful than the frequency of supervision (Hill et al., 2014). The study by Hill et al., looking at the impact and implementation issues facing supervision of community health workers in LMIC, reviewed a time-use study from Ghana comparing supervised versus unsupervised health workers. The study found that supervised who did not feel supported did not perform better than unsupervised health workers.

On the other hand, health workers who felt supported performed better than other health workers (Hill et al., 2014). The quality of supervision and the support provided during supervision play a more significant role than the frequency of supervision. With multiple cadres involved in the supervision of the CHA at different times can hinder productivity instead of contributing to the quality of service provided by the CHA as intended (Hill et al., 2014).

### **6.3 System Structure**

The system structure looks at the system that enabled the patterns. One of such structure is the strategic plan developed to enable the implementation of the NCHA program and the use of digital tools. Additionally, Liberia implements the “one county one partner” policy. To minimize duplication and inequitable distribution of coverage, partners are assigned to different counties. The partner assigned to a county provides technical and financial support to the county health team to manage the CHA program. Last Mile Health is one of the technical partners supporting the National Community Worker Program. LMH provides technical support and financial assistance for CHAs and CHSSs in 3 out of the 15 counties. The three counties under LMH are Rivercess, Grand Gedah, and Grand Bassa.

LMH investment in the county includes transportation for supervision (including motorbikes for supervisors), mobile phones, solar-powered chargers, lifesaving commodities, and timely payment of salaries for community health workers. With the commitment of Last Mile Health to support implementation in the Rivercess, it provides an enabling environment for supervision and the use of the digital tools.

#### **6.4 Mental Modes**

The mental modes are instrumental in determining the values and expectations that guide the system structure and the patterns observed during this project. One of the critical mental modes identified during this project by participants is the pride in the NCHA program. When asked what brings the most pride about the program, one of the participants mentioned:

*“When the program initially started, most of us felt that it was not important for community health assistant to treat at the community level. We just felt It was not important, it was unsafe, it would have been a threat to the facility and other things, but to our outmost surprise, it beats our imagination, we see that health facilities have been relieved, the burden of the health facility have been reduced at a maximum level. That’s one of my prides.”*

There was a sense of commitment to the program's success by participants. One can assume that plays a role in how the program implementation is approached.

Overall, the findings captured the strengths and weaknesses of deploying mobile technology to CHAs and their supervisors in Liberia. There is much to benefit from digital tools, especially in remote and rural areas with limited access to health services. The findings showed the promise of

how digital tools can be used to monitor attendance via GPS, minimize treatment and reporting errors, and complement on-site coaching done by supervisors. While the benefits of mobile technology deployments continue to show promise, there is a need to be aware of everyday challenges faced with the introduction of the technology. Challenges such as digital literacy, malfunctioning of phones, damage to phones, and inadequate power supply to properly charge the phones all affect how effective the tool is during and after supervision. The findings also support that digital tools can complement in-person training and serve as a valuable resource for CHAs and their supervisors on and off the field.

The key informant interviews at the central level provided insights into the aims and expectations set for introducing the digital tools into the community health systems. Additionally, it provided additional understanding into the rationale behind introducing the various tools to the different cadres within the community health system. However, the FGDs provided an insight into the realities of using the DCT in the fields. It provided an opportunity for participants to share the advantages and disadvantages of using the tools on the field. Furthermore, the discussions provided information on the relationship between supervision and the DCT.

## **Section 7: Discussion**

The successful implementation of any digital tool depends on the features and implementation design and other external factors such as an enabling digital health environment (WHO, 2019a). The findings from this project have shown that DCT can play a role in improving service provision and supervision of CHAs. The CHAs have access to educational materials that serve as reference materials, digital forms, and features on the DCT that help minimize the errors, among other functionalities mentioned in the results. In addition to improved access to training materials, the GIS trackers and timestamps assist in monitoring attendance of supervisory visits by CHSS. It serves as one of the accountability tools to ensure attendance.

The introduction and use of the DCT also come with its challenges. The findings show that in piloting some of the applications in only the managed counties and with the “one partner one county” policy, there might be standardization and uniformity challenges with implementation among the different counties. With different partners implementing and introducing innovations at the county level, the quality of care might vary depending on the county partner’s technical and financial capabilities.

The findings also revealed challenges faced with using the DCT by health workers on the field. One of the challenges mentioned was the malfunctioning of the phones – some of the phones were not correctly charging and suddenly shutting off during use—another challenge faced with the technology, the electronic forms sometimes would not allow submitting inputted data. The participants also reported that occasionally the DCTs froze during use, hence hindering the use.

Without the opportunity to fully utilize the DCT, the benefits and gains are inconsequential to improving the quality of supervision for CHA.

Furthermore, the process of supervision and the use of digital tools cannot be viewed through a monolithic lens. The system thinking framework for change used for this project understands the interconnective nature of the health system (see figure below).



**Figure 7: Interconnectedness of the health system building blocks**

It is with this lens of interconnectedness that the role of digital health and within the health system was explored. The paper explored and sought to understand the role of various people responsible for supervision and the support provided at the central level. Also, the resources available to ensure

supervision and the use of the digital tools. It sought to see how digital tools supported supervision within the existing ecosystem (Savigny et al., 2009).

Finally, the use of digital tools for supportive supervision is only as effective as the system in which they operate; without the proper technical support to address challenges, clinical expertise to create, and update medical content on the applications as well as support from leadership, the benefits of the tools will be lost. Additionally, the digital tools should complement supportive supervision; it is not a replacement or substitution from time on the field with the CHAs and for adequate training of CHAs and their supervisors.

## **Section 8: Recommendations**

This section highlights recommendations to the Liberia Ministry of Health and partners based on the findings from this project.

To scale up and sustain the digital health program and quality supervision of community health worker, there is a need to continuously factor the interconnectedness of the health system with the people at the center.

**Scale-up of digital innovations with a track record of improving quality:** In collaboration with partners, the government has implemented a significant number of digital innovations at the county level, and some of these digital innovations have shown to be effective in improving the quality of service, such as the Liberia ODK. Invest and scale up the use of digital tools across the different counties while slowly phasing out the paper-based versions of the forms. The ongoing revision to the National Community Health Services Strategic Plan (2016–2021) provides an opportunity to revisit and develop an integrated strategy with the different partners to scale appropriate innovations at the county level. In collaboration with partners, the MOHS can develop a standard framework that can be implemented and customized based on the county's available resources and digital maturity.

**Technology support at the county level:** The use of technology comes with its challenges and difficulties, and it appears that there is a need to move the solution closer to the problem. Providing technology support by having at least one IT specialist at the county level will go a long way in reducing wait time and the need to send damaged phones to the central level to be fixed or replaced. Existing health workers at the district level can be leveraged as the first point of contact with

addressing minor technical issues. The complex issues can be resolved with support from the ICT team at the central level. This will help minimize the cost of recruiting new staff at the district level. Additionally, it will also cut down on the wait time for repairs of DCTs.

**Continuous use of the blended learning approach for training and supervision:** Expanding and scaling up the use of digital tools will be instrumental for the ease of work. However, it cannot replace traditional in-person approach of delivering training for continuous education and in-person supervision (WHO, 2019b). The use of digital tools needs to be accompanied by adequately equipped and trained frontline health workers. Additionally, ensuring continuous support through multiple channels through refresher training, peer-to-peer support, and remote support is essential for success (Frehywot et al., 2013).

**Assessment of the county readiness in human resources and digital maturity:** The readiness of each county to implement the tools effectively should inform the scale-up of the digital tools across the country. There is an association between the effectiveness of the digital tools and having equipped and trained health workers to use the tools. Thereby there is a need to ensure that human resource needed for deployment and technical support is also available (WHO, 2019b). Furthermore, assessment of the digital maturity by counties will also be instrumental in mapping a clear pathway for integrating digital tools into continuous education and supervision for each county (Frehywot et al., 2013).

**Establishing mechanism for monitoring engagement with the digital tools:** In addition to anecdotal reports on the benefits and use of the digital tools, there is a need for routine data retrieval

from the academy application to monitor user engagement with course modules on the application. A comprehensive plan for retrieving and monitoring course engagement at the county level is recommended alongside the scale-up strategy. The MOH can work with the different partners and donors to develop and implement a feasible plan to monitor and manage data at the county level.

### **Section 9: Limitations**

Participants were selected based on convenience sampling, so the findings may not reflect all the users with access to the DCT at the community level. Another limitation of this project is that data collection was in a county managed and financed by Last Mile Health. The findings might not be reflective of the role of digital health in other counties across the country. An additional limitation to this study is the potential bias associated with self-reporting data and my dual role as the researcher and a representative of Last Mile Health. One approach used to minimize discomfort associated with providing honest feedback about the DCT was recruiting an independent research assistant to conduct the FGDs. The findings and recommendations apply to Liberia and may not translate to other African countries.

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## Appendix: Instruments

### Key Informant Interview Guide

Name of Interviewer:	
Name of Interviewee:	
Place of Interview:	
Date of Interview:	

#### *Introduction*

##### **Welcome (Explain purpose of the interview)**

Thank you for agreeing to do this interview. My name is [NAME], and I'll be talking with you today. This project is to fulfil my doctoral academic requirement as set by my graduate school (Harvard Chan School of Public Health). The purpose of this interview today is to learn more about your experiences with and recommendations related to community health assistant program. The interview will last about 1 hour.

Did you read the consent form that was sent to you? Do you have any questions?

#### *Ground rules*

- Everything you tell us will be confidential. To protect your privacy, we won't connect your name with anything that you say.
- At any time during our conversation, please feel free to let me know if you have any questions or if you would rather not answer any specific question. You can also stop the interview at any time for any reason.
- Please remember that we want to know what you think and feel and that there are no right or wrong answers.
- Is it OK if I audiotape this interview today?

#### *[Turn on recording equipment]*

#### *Background (5 minutes)*

*I would like to start by asking you some question about your current job*

1. What is your position within your organization/Ministry of Health?
  - a. Can you talk about your major responsibilities and activities within your department?

- b. How long have you been in this position?
- c. Can you tell me about your work and how it is related to the National Community Health Assistant Program?

### *Supervision of CHAs*

*A key part of my project is to understand the role of the CHSS in relations to the National Community Health Assistant Program.*

- 2. Can you describe in as many details the process for supervision by CHSSs on the field?
- 3. In your opinion, what factor or activities make supervision effective for CHAs? And what factors hinder effective supervision by CHSSs for CHAs?
- 4. What role do you believe supervision play in the experience of the community health workers?
- 5. What part of the NCHAP program brings you pride?

### *Digital tool usage by CHSSs and CHAs*

- 6. Can you talk about how the mobile application has been used to support supervision in the field?
- 7. In your opinion, what other ways can mobile application be used to support supervision of CHAs?
- 8. In your opinion, what are the advantages of the digital tools (mobile application) that have been deployed to CHSSs and CHAs?
- 9. What are some of the challenges reported or have you seen of using the digital tools (mobile application) that have been deployed to CHSSs and CHAs?
- 10. How is the directorate using the information collected by the application?
- 11. What are some of your recommendations to overcome these challenges of using digital tools by CHSSs and CHAs?
- 12. Do you have any recommendations or suggestions on how the (programs on the phone) mobile application can be used to make supervision better and the CHA program?

Thank you for your time. We have come to the end of the interview. Thank you again for sharing your experience and ideas with me today, I really appreciate your inputs and they will be used to inform my research and also contribute to knowledge about community health in Liberia on a

global platform. If you have any follow-up questions, or if there was anything else that you wanted to share with me, please feel free to follow up with me.

## **Focus Group Discussion (CHSSs and CHAs)**

### ***Introduction***

Welcome, I hope you are doing well. Thank you for volunteering to participate in this focus group discussion. You have been asked to participate in this discussion because your views are important. I appreciate your time.

This focus group discussion is designed to understand your thoughts about the use of the (programs on the phone) mobile application as it relates to supervision. The discussion will take no more than 2 hours. If it okay, I would like to tape the discussion so help with recollection.

Do I have your permission? (switch on the recorder)

### ***Ground rules***

- It is important that one person speaks at a time. Also, there is no right or wrong answers.
- Please respect the person speaking's view, even if you don't agree with what the person is saying.
- No meeting in meeting
- You do not have to speak in a particular order.
- When you have something to say, please do so. It is important to hear everyone views.
- Does anyone have any questions?

### ***Background***

1. I will like to get to know everyone. Can you tell me your names?
2. Can you share in detail, your daily activities and responsibilities as a CHSS or CHAs within the community?

### ***Understanding supervision (National Community Health Assistant Program)***

3. Can you share in detail, what a supervisory visit looks like?
4. What are the different ways of monitoring CHA's work?
5. Can you talk about the different tools/documents you use for supervision of CHAs?

6. What are some of the tools/documents reviewed during supervision visit by the CHSSs (for CHAs)?
7. Tell me everything you and your supervisor (CHSS) can do during supervision (For CHAs)?

*Digital tool usage by CHSSs and CHAs.*

8. Please tell us ways the program on the phone can help your patients (For CHAs)?
  - a. Please tell me how the program on your phone can help with your work (for CHSSs)?
  - b. Please tell me how you can use all the programs that are on the phone they gave you?
  - c. Please tell me how you can use the programs on your phone to work with the CHSS or report to the CHSS (for CHAs)?
9. What do you think about the programs on the phone?
10. Can you tell me in detail, how you use the mobile application during your supervisory visit?
  - a. What do you like about using the mobile application during your supervisory visit?
  - b. What do you not like about using the mobile application during your supervisory visit?
11. Do you have any recommendations or suggestions on how the mobile application can be used to make supervision better and the CHA program?

We have come to the end of the discussion.

**Conclusion**

Thank you for the participating. Your opinion is valuable to this study, and I hope you found the discussion interesting. I would like to remind you that any comments highlighted in the report will be anonymous.