



# The Impact of Mobile Health Tools on Social Connectedness Between Community Health Workers and Pregnant Women in Malawi

2023 Social Connectedness Fellowship Program  
in Partnership with Partners in Health (PIH)

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SAMUEL CENTRE  
FOR SOCIAL  
CONNECTEDNESS

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## EXECUTIVE SUMMARY

Mobile health (m-Health) is defined as “the use of mobile phones and other wireless technology in medical care.”<sup>1</sup> “For nearly two decades, mobile health (or m-Health) has been hailed as the most innovative and enabling area for the digital transformation of healthcare globally.”<sup>2</sup> Mobile penetration is now higher than ever and has been regarded as a promising solution for maximizing healthcare worker efficiency, especially in low-health resource areas. “Social connectedness means working towards a society where everyone is valued, seen, and heard.”<sup>3</sup> Social connectedness in health is important because it has been shown to be linked to longer life, and enhanced health, and plays a crucial role in preventing serious illnesses. Partners In Health (PIH) has been actively collaborating with the Malawi Ministry of Health to provide an integrated healthcare model that encompasses two hospitals, twelve health centers, and a network of over 1200 community health workers.<sup>4</sup> Community health workers (CHWs) are “health care providers who live in the community they serve,” and since 2019, PIH CHWs have used an m-Health tool called "YendaNafe" to facilitate community-based health services.<sup>5</sup>

This study gained insights into the perceptions of pregnant women, regarding a mobile health tool and how it impacts the social connectedness with their community health workers. A qualitative study was employed and data was collected via in-depth interviews with 12 pregnant women. The study found that participants had varying opinions and levels of awareness about the YendaNafe tool, with some recognizing its value in providing personalized pregnancy support and others having a limited understanding of its purpose. Furthermore, the research identified that the presence of m-Health tool during CHW visits was associated with enhanced health and well-being, as CHWs provided vital health education aided by the tool thus fostering support, trust and social connection. The mobile health tool also facilitated communication while preserving privacy. Lastly, most participants expressed trust in Community Health Workers (CHWs), viewing them as 'deputy doctors.' This perception was reinforced by the participants' positive experiences with CHWs, who were seen as knowledgeable, approachable.

Overall, the women appreciated the personalized messaging facilitated by these tools, strengthening their bond with CHWs. The m-Health tool enhanced information exchange

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<sup>1</sup> Tayla Holman, “What Is mHealth (Mobile Health)?: Definition from TechTarget,” Health IT, accessed September 11, 2023, <https://www.techtarget.com/searchhealthit/definition/mHealth>.

<sup>2</sup> Robert S. Istepanian, “Mobile Health (M-Health) in Retrospect: The Known Unknowns,” *International Journal of Environmental Research and Public Health* 19, no. 7 (March 22, 2022): 3747, <https://doi.org/10.3390/ijerph19073747>.

<sup>3</sup> Samuel Centre for Social Connectedness (SCSC), “About Social Connectedness,” Accessed August 28, 2023, <https://www.socialconnectedness.org/about-us/about-social-connectedness/>.

<sup>4</sup> “Malawi | Partners In Health.” Partners in Health. Accessed June 12, 2023. <https://www.pih.org/country/malawi>.

<sup>5</sup> World Health Organization, “What Do We Know about Community Health Workers? A Systematic Review of Existing Reviews,” *Human Resources for Health Observer Series* 19 (Geneva: World Health Organization, 2020), <https://www.who.int/publications/i/item/what-do-we-know-about-community-health-workers-a-systematic-review-of-existing-reviews>.

and engagement between the woman and the CHW. On the aspects of trust and confidentiality concerns regarding the m-Health tool, the study found that participants generally expressed low levels of apprehension. The majority of participants demonstrated confidence in the security measures and privacy features of the m-Health tool. Recommendations include tailoring mobile health content to individual patient needs to enhance social connectedness, and providing additional training for CHWs in areas like mental health and marriage counseling to improve community health programs.

## KEYWORDS

- **m-Health** - “The use of mobile phones and other wireless technology in medical care.”<sup>6</sup>
- **Social connectedness** - “Social connectedness means working towards a society where everyone is valued, seen, and heard; where everyone can exercise their agency and basic human rights; and where solidarity, trust, and cooperation pave the way for the community.”<sup>7</sup>
- **Community Health Workers** - “Community health workers (CHWs) are health care providers who live in the community they serve and receive lower levels of formal education and training than professional health care workers such as nurses and doctors.”<sup>8</sup>
- **Antenatal Care** - “The care you get from health professionals during your pregnancy.”<sup>9</sup>
- **Postnatal Care** - “A care given to the mother and her newborn baby immediately after the birth of the placenta and for the first” 42 days of life.<sup>10</sup>

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<sup>6</sup> Tayla Holman, “What Is m-Health (Mobile Health)?: Definition from TechTarget,” Health IT, accessed September 11, 2023, <https://www.techtarget.com/searchhealthit/definition/m-Health>.

<sup>7</sup> Samuel Centre for Social Connectedness (SCSC), “About Social Connectedness,” Accessed August 28, 2023, <https://www.socialconnectedness.org/about-us/about-social-connectedness/>.

<sup>8</sup> World Health Organization, “What Do We Know about Community Health Workers? A Systematic Review of Existing Reviews,” Human Resources for Health Observer Series 19 (Geneva: World Health Organization, 2020).

<sup>9</sup> “Your Antenatal Care,” NHS, accessed September 11, 2023, <https://www.nhs.uk/pregnancy/your-pregnancy-care/your-antenatal-care/>.

<sup>10</sup> Kihinetu Gelaye Wudineh et al., “Postnatal Care Service Utilization and Associated Factors among Women Who Gave Birth in Debretabour Town, North West Ethiopia: A Community- Based Cross-Sectional Study,” BMC Pregnancy and Childbirth 18, no. 508 (December 27, 2018), <https://doi.org/10.1186/s12884-018-2138-x>.

- **Maternal health services** - “Maternal health refers to the health of women during pregnancy, childbirth and the postnatal period.”<sup>11</sup>

## ACRONYMS AND ABBREVIATIONS

- **SCSC:** Samuel Centre for Social Connectedness
- **m-Health:** Mobile Health
- **PNC:** Postnatal Care
- **ANC:** Antenatal Care
- **APAS-ANC/PMTCT:** Adherence System
- **MVP:** Millennium Villages Project
- **MCH:** Maternal and Child Health Care

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<sup>11</sup> WHO, “Maternal Health,” World Health Organization, accessed September 11, 2023, [https://www.who.int/health-topics/maternal-health#tab=tab\\_1](https://www.who.int/health-topics/maternal-health#tab=tab_1).

## 1. INTRODUCTION

This research investigates the impact of mobile health (m-Health) on the level of social connectedness between community health workers (CHWs) and women attending Antenatal Care (ANC) in the district of Neno, located in the Southern Region of Malawi. Neno, with a population of approximately 158,000 as of 2016, serves as the focal point for this study.<sup>12</sup>

In Malawi, the Community Health Strategy (2017–2022) was implemented by The Ministry of Health to strengthen the delivery of primary healthcare services.<sup>13</sup> This strategy focuses on the utilization of health surveillance assistants (HSAs), who are government-supported community health workers (CHWs) stationed at community clinics in Malawi.

WHO defines community health workers (CHWs) as “health care providers who live in the community they serve and receive lower levels of formal education and training than professional health care workers such as nurses and doctors.”<sup>14</sup> “Community health workers (CHWs) are health-care workers who most commonly provide care delivery at the community or household level.”<sup>15</sup>

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<sup>12</sup> Myness Kasanda Ndambo et al., “The Role of Community Health Workers in Influencing Social Connectedness Using the Household Model: A Qualitative Case Study from Malawi,” *Global Health Action* 15, Article no. 2090123 (August 12, 2022), <https://doi.org/10.1080/16549716.2022.2090123>.

<sup>13</sup> Ministry of Health, Government of the Republic of Malawi, “National Community Health Strategy 2017 - 2022: Integrating health services and engaging communities for the next generation” (July 2017), [https://www.healthynewbornnetwork.org/hnn-content/uploads/National\\_Community\\_Health\\_Strategy\\_2017-2022-FINAL.pdf](https://www.healthynewbornnetwork.org/hnn-content/uploads/National_Community_Health_Strategy_2017-2022-FINAL.pdf).

<sup>14</sup> World Health Organization, “What Do We Know about Community Health Workers? A Systematic Review of Existing Reviews,” Human Resources for Health Observer Series 19 (Geneva: World Health Organization, 2020).

<sup>15</sup> Myness Kasanda Ndambo et al., “The Role of Community Health Workers in Influencing Social Connectedness Using the Household Model: A Qualitative Case Study from Malawi,” *Global Health Action* 15, Article no. 2090123 (August 12, 2022).

## 1.1 PIH Malawi

Partners in Health (PIH), is “a global health and social justice organization that aims to provide high-quality health care globally to those who need it most.”<sup>16</sup> Starting in 2006, PIH Malawi, now operating as Abwenzi Pa Za Umoyo (APZU), began its work in Malawi. Unlike running its own health facilities, PIH integrated with the public health operations of the Ministry of Health (MoH). This collaboration began in 2007 and aimed to provide healthcare in partnership with the MoH to the residents of Neno District. Neno District, located in the rural southwest of Malawi, has an estimated population of 165,000, comprising mainly subsistence farmers.<sup>17</sup> The district is quite remote with no paved roads and minimal access to electricity, available to only 3.7% of the population.<sup>18</sup>

To achieve its mission, PIH established an integrated care model in Neno. This model includes two hospitals, twelve health centers, and a network of over 1200 community health workers.<sup>19</sup> Therefore, in partnership with the local Ministry of Health (MoH), a community health worker (CHW) cadre was introduced to extend health-care support to the household level. The goal is to bring healthcare services to even the farthest reaches of the district, ensuring comprehensive coverage. Through this approach, Abwenzi Pa Za Umoyo (APZU) aims to contribute significantly to the healthcare landscape of Neno District.

Through home visits, dedicated PIH community health workers screen, follow-up and refer patients for the treatment of various health conditions. The CHWs focus on

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<sup>16</sup> “What Drives Us,” Partners In Health, accessed September 11, 2023, <https://www.pih.org/>.

<sup>17</sup> Emily B Wroe et al., “A Household-Based Community Health Worker Programme for Non-Communicable Disease, Malnutrition, Tuberculosis, HIV and Maternal Health: A Stepped-Wedge Cluster Randomised Controlled Trial in Neno District, Malawi,” *BMJ Global Health* 6, no. 9 (September 15, 2021): e006535, <https://doi.org/10.1136/bmjgh-2021-006535>.

<sup>18</sup> Partners In Health, “Malawi,” Partners In Health, accessed August 31, 2023, <https://www.pih.org/country/malawi>.

<sup>19</sup> *Ibid.*



eight major areas: diseases such as 1) TB; 2) HIV; 3) STIs; 4) non-communicable diseases (NCDs); socio-cultural impacts on health such as 5) family planning; 6) maternal and neonatal health; 7) child health, and 8) malnutrition screening in children under 5 years old.<sup>20</sup> This study intends to focus on major area number 6 which is maternal and neonatal health.

According to Rachel L. Deitz, “the presence of functioning health clinics with community health worker programs may indirectly improve health outcomes by increasing the social connectedness of the community in addition to providing direct patient care.”<sup>21</sup>

In August 2018, PIH developed and introduced a mobile health technology tool (m-Health tool) called “YendaNafe”, which was then launched in July 2019 to provide community-based health services and coordination. YendaNafe “links PIH’s network of CHWs to primary and secondary clinical teams in the Neno District to more effectively screen, provide ongoing care, and refer patients in communities to care in health facilities.”<sup>22</sup> In CHW programs, m-Health has been used to support the activities of CHWs. For example, CHWs have used m-Health to send messages or share videos with their clients to provide education, encourage behavioral change and encourage clients to adhere to clinic visits.<sup>23</sup>

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<sup>20</sup> Emily B Wroe et al., “A Household-Based Community Health Worker Programme for Non-Communicable Disease, Malnutrition, Tuberculosis, HIV and Maternal Health: A Stepped-Wedge Cluster Randomised Controlled Trial in Neno District, Malawi,” *BMJ Global Health* 6, no. 9 (September 15, 2021): e006535

<sup>21</sup> Rachel L. Deitz et al., “A Qualitative Study of Social Connectedness and Its Relationship to Community Health Programs in Rural Chiapas, Mexico,” *BMC Public Health* 20, Article no. 852 (June 3, 2020), <https://doi.org/10.1186/s12889-020-09008-6>.

<sup>22</sup> Wendy Achieng and Philip Ngari, “Partners In Health to Open Source Their Full CHT-Based Community Health App – YendaNafe,” *Medic*, October 18, 2022, <https://medic.org/stories/partners-in-health-to-open-source-their-full-cht-based-community-health-app-YendaNafe/>.

<sup>23</sup> Karin Källander et al., “Mobile Health (m-Health) Approaches and Lessons for Increased Performance and Retention of Community Health Workers in Low- and Middle-Income Countries: A Review,” *Journal of Medical Internet Research* 15, no. 1 (January 2013): e17, <https://doi.org/10.2196/jmir.2130>.

While the impact of m-Health on various aspects of healthcare has been extensively studied, research on m-Health apps integration in the clinical practice is still at an early stage, with a variety of knowledge gaps to be filled. Despite the varied potential benefits outlined by studies, the contextual factors of deploying m-Health determine successes of the m-Health programs.<sup>24</sup> Where m-Health systems are introduced in new contexts, there is need to pay attention to the needs of local users. In this context, this research aims to fill one of these gaps by examining the influence of m-Health (mobile health) on social connectedness between community health workers (CHWs) and women attending ANC (these being the local users) in Neno, Malawi.

### **1.3 Social Connectedness in Healthcare: A Research Lens**

Social connectedness “means working towards a society where everyone is valued, seen and heard; where everyone can exercise their agency and basic human rights; and where solidarity, trust and cooperation pave the way for the community. Social connectedness is grounded in three values: respect, recognition, and reciprocity.”<sup>25</sup>

Measuring social connectedness requires considering multiple factors: “(1) connections to others via the existence of relationships and their roles, (2) a sense of connection that results from actual or perceived support or inclusion; and (3) the sense of connection to others that is based on positive and negative qualities.”<sup>26</sup> By examining

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<sup>24</sup> Ibid.

<sup>25</sup> Samuel Centre for Social Connectedness, “About Social Connectedness,” Accessed August 28, 2023, <https://www.socialconnectedness.org/about-us/about-social-connectedness/>.

<sup>26</sup> Julianne Holt-Lunstad, Theodore F. Robles, and David A. Sbarra, “Advancing Social Connection as a Public Health Priority in the United States.,” *American Psychologist* 72, no. 6 (September 2017): 517–30, <https://doi.org/10.1037/amp0000103>.

these factors, we gain a more comprehensive understanding of social connectedness and its impact.

Furthermore, social connectedness plays a crucial role in preventing serious illnesses and outcomes, such as heart disease, stroke, dementia, depression, and anxiety.<sup>27</sup> “Lack of social connectedness can increase stress levels and lead to behavior that increases health risks, such as increased tobacco and alcohol use, or reduce healthy behaviors, such as eating well, exercising, and getting adequate sleep. Isolation can also mask symptoms and increase the delay in seeking care.”<sup>28</sup>

Healthcare can be defined as the “efforts made to maintain or restore physical, mental, or emotional well-being especially by trained and licensed professionals.”<sup>29</sup> Healthcare aims to provide respectful and responsive care that aligns with “individual patient preferences, needs, and values.”<sup>30</sup> A commonly-used tool in healthcare, “m-Health (mobile health) is a general term for the use of mobile phones and other wireless technology in medical care.”<sup>31</sup> Mobile health (m-Health), as a transformative facet of healthcare, leverages the use of mobile devices to revolutionize health service delivery. Through m-Health, individuals can access medical information, resources, and even consultation remotely, breaking down geographical barriers and enabling healthcare to reach underserved areas.

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<sup>27</sup> Ibid.

<sup>28</sup> Institute of Medicine (US) Committee on Health and Behavior: Research, Practice, and Policy, *Health and Behavior: The Interplay of Biological, Behavioral, and Societal Influences* (Washington, DC: National Academies Press, 2001).

<sup>29</sup> “Healthcare Definition & Meaning,” Merriam-Webster, accessed May 16, 2023, <https://www.merriam-webster.com/dictionary/healthcare>.

<sup>30</sup> ARHQ, “Six Domains of Healthcare Quality,” Agency for Healthcare Research and Quality, accessed August 12, 2023, <https://www.ahrq.gov/talkingquality/measures/six-domains.html>.

<sup>31</sup> Tayla Holman, “What Is mHealth (Mobile Health)?: Definition from TechTarget,” Health IT, accessed September 11, 2023, <https://www.techtarget.com/searchhealthit/definition/mHealth>.

Lastly, m-Health applications extend beyond individual care, influencing public health initiatives and disease surveillance. These technologies empower users with health education, awareness, and self-monitoring tools, fostering a proactive approach to well-being.

#### **1.4 Understanding the Problem & Purpose of this Study**

There is a growing global concern regarding social connectivity, loneliness, and social isolation.<sup>32</sup> M-Health has the potential to address these issues and engage the population in their well-being.<sup>33</sup> While the use of mobile health technology has gained traction in healthcare systems, the integration of m-Health apps in clinical practice is still in its early stages.<sup>34</sup>

A study that was conducted in Malawi investigating the “The role of community health workers in influencing social connectedness using the household model” demonstrated the impact of m-Health on maternal health services, such as fostering positive attitudes towards work delivery and building strong relationships between CHWs, community members, and health facility staff.<sup>35</sup> It primarily focused on the perspective of CHWs and not the end users of healthcare services, which were the patients.<sup>36</sup>

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<sup>32</sup> Julianne Holt-Lunstad, “Loneliness and Social Isolation as Risk Factors: The Power of Social Connection in Prevention,” *American Journal of Lifestyle Medicine* 15, no. 5 (May 6, 2021): 567–73, <https://doi.org/10.1177/15598276211009454>.

<sup>33</sup> Jacqueline Louise Mair et al., “Exploring the Potential of Mobile Health Interventions to Address Behavioural Risk Factors for the Prevention of Non-Communicable Diseases in Asian Populations: A Qualitative Study,” *BMC Public Health* 23, no. 753 (April 24, 2023), <https://doi.org/10.1186/s12889-023-15598-8>.

<sup>34</sup> Somayyeh Zakerabasali et al., “Mobile Health Technology and Healthcare Providers: Systemic Barriers to Adoption,” *Healthcare Informatics Research* 27, no. 4 (October 31, 2021): 267–78, <https://doi.org/10.4258/hir.2021.27.4.267>.

<sup>35</sup> Myness Kasanda Ndambo et al., “The Role of Community Health Workers in Influencing Social Connectedness Using the Household Model: A Qualitative Case Study from Malawi,” *Global Health Action* 15, Article no. 2090123 (August 12, 2022).

<sup>36</sup> Ibid.

Furthermore, there is a lack of research on the use of m-Health apps in fostering social connectedness in low-resource areas.<sup>37</sup> This study aims to address these research gaps and gain insights into the perceptions and opinions of the beneficiaries, specifically women, regarding perceptions of YendaNafe and sense of connection with the CHWs who use the tool.

Understanding the effects of YendaNafe on social connectedness in the specific context of maternal care in Neno can provide valuable insights into their potential to enhance communication and relationships among healthcare workers and patients. This, in turn, can improve the delivery and utilization of maternal health services within the CHW Program at PIH in Neno.

Moreover, this study addresses an existing gap—since the inception of YendaNafe, a comprehensive evaluation from the beneficiaries' perspective has been lacking, an evaluation crucial to shaping the evolution of the CHW program, guiding necessary enhancements and adaptations. The findings of this study will not only contribute to filling these research gaps, but also provide valuable insights for policymakers, healthcare providers, and researchers in improving social connectedness and healthcare delivery within the CHW program.

PIH consistently conducts routine data analysis supervised by Dr. Chembe, who serves as the Chief Medical Officer for PIH in Malawi. Dr. Chembe provides oversight and supervision for data analysis related to the Neno District Health Office (DHO) facility. During one routine data analysis as I was collecting data at the headquarters it was discovered that pregnant women tend to delay disclosing information about their

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<sup>37</sup> Gail Webber, Bwire Chirangi, and Nyamusi Magatti, “Experiences of a Multiple Intervention Trial to Increase Maternity Care Access in Rural Tanzania: Focus Group Findings with Women, Nurses and Community Health Workers,” *Women’s Health* 16 (2020): 1–8, <https://doi.org/10.1177/1745506520969617>.

pregnancies until late. This disclosure delay has a detrimental impact on CHWs ability to provide timely support for early initiation and completion of all necessary ANC visits. With over 50% of the women attending ANC visits at this facility were attending their first visit at 12 weeks of gestation or later and this is considered significantly overdue<sup>38</sup>

There are myriad reasons why women may be hesitant to disclose pregnancy information earlier, such as concerns about privacy, the fear of others knowing about their pregnancy, or even discomfort with male CHWs. From studies conducted by Kok, it was found that CHWs can play an essential preventative, connective, and supportive role in the works of early pregnancy detection through enrich connections between the CHW, the community, and pregnant women.<sup>39</sup>

By exploring these factors, this study aims to *establish recommendations on how we can better use the m-Health tool and CHW programs to minimize pregnancy, disclosure hesitancy and gain the beneficiaries perspectives in relation to social connectedness and m-Health use.*

In conclusion, this study aims to bridge the existing research gaps by investigating the influence of YendaNafe on social connectedness from the perspective of pregnant women (i.e beneficiaries of the m-Health tool).

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<sup>38</sup> Dr Chiyembekedzo and Partners In Health -Monitoring, Evaluation, Informatics and Research Department. Assessment of routine unpublished data, July, 2023

<sup>39</sup> Maryse C. Kok et al., "A Qualitative Assessment of Health Extension Workers' Relationships with the Community and Health Sector in Ethiopia: Opportunities for Enhancing Maternal Health Performance," *Human Resources for Health* 13, no. 80 (September 30, 2015), <https://doi.org/10.1186/s12960-015-0077-4>.

## **1.5 The Guiding Questions and Objectives**

### **1.5.1 The Specific Objectives**

The Specific Objectives of this study include :

1. To explore the perceptions of pregnant women regarding the use of YendaNafe (m-Health tool);
2. To understand the role of YendaNafe in facilitating social connectedness between pregnant women and community health workers (CHWs); and,
3. To identify barriers to social connectedness resulting from the use of YendaNafe between pregnant women and community health workers.

### **1.5.2 The Guiding Questions**

These were the questions that were used as a guide to answer the main objective: “If mobile health influences social connectedness between community health workers and women attending antenatal care in Neno.”

1. What are the perceptions of pregnant women regarding the use of YendaNafe (m-Health tool)?
2. What are the barriers to social connectedness experienced by pregnant women when using YendaNafe?
3. How does YendaNafe facilitate social connectedness between pregnant women and community health workers?

## 2. LITERATURE REVIEW

### 2.1 Introduction

Mobile health, or m-Health, is described as “the use of mobile and wireless communication technologies to improve healthcare delivery, outcomes, and research.”<sup>40</sup> “For nearly two decades, mobile health was hailed as the most innovative and enabling area for the digital transformation of healthcare globally.”<sup>41</sup>

Mobile usage is now higher than ever and has been regarded as a promising solution for maximizing healthcare worker efficiency especially in low health resource areas.<sup>42</sup> There are more than 318,000 health apps available worldwide, according to a 2017 report by science and health data company, IQVIA.<sup>43</sup> The mobile health applications range from general wellness tips to telemedicine for booking and payments.

A systematic review of 21 articles discovered that mobile technology has the potential to greatly impact healthcare in Sub-Saharan Africa and “has leapfrogged land-based telecommunication infrastructure” even in “low-income and remote areas.”<sup>44</sup> “In rural areas, where population densities are lowest and access to healthcare

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<sup>40</sup> Karandeep Singh and Adam B Landman, “Chapter 13 - Mobile Health,” Chapter, in *Key Advances in Clinical Informatics: Transforming Health Care Through Health Information Technology*, ed. Kathrin Cresswell et al. (Cambridge, MA: Academic Press, 2017), 183–96, <https://doi.org/10.1016/B978-0-12-809523-2.00013-3>.

<sup>41</sup> Robert S. Istepanian, “Mobile Health (M-Health) in Retrospect: The Known Unknowns,” *International Journal of Environmental Research and Public Health* 19, no. 7 (March 22, 2022): 3747, <https://doi.org/10.3390/ijerph19073747>.

<sup>42</sup> Andrew Bastawrous and Matthew J Armstrong, “Mobile Health Use in Low- and High-Income Countries: An Overview of the Peer-Reviewed Literature,” *Journal of the Royal Society of Medicine* 106, no. 4 (April 2013): 130–42, <https://doi.org/10.1177/0141076812472620>.

<sup>43</sup> IQVIA Institute for Human Data Science, report, *The Growing Value of Digital Health* (IQVIA Institute for Human Data Science, November 2017), <https://www.iqvia.com/insights/the-iqvia-institute/reports/the-growing-value-of-digital-health>.

<sup>44</sup> Thomas J. Betjeman, Samara E. Soghoian, and Mark P. Foran, “mHealth in Sub-Saharan Africa,” *International Journal of Telemedicine and Applications* 2013 (December 4, 2013): 1–7, <https://doi.org/10.1155/2013/482324>.



personnel often limited, m-Health offers potential solutions for maximizing healthcare worker impact and efficiency.”<sup>45</sup>

In Kenya, a mobile health tool called “MPep” is used to remind patients when to go for checkups and also reminds health workers who to follow up with regarding missed appointments, or upcoming tests.<sup>46</sup> This m-Health solution in Kenya has been particularly very helpful when tracking patients with HIV and AIDS, especially children born with the virus. M-Health was also particularly helpful globally during the COVID-19 pandemic through contact tracing, and providing geolocation and exposure notification.<sup>47</sup>

Current evidence suggests that m-Health is particularly effective in improving medication adherence and facilitating healthcare-worker communication.<sup>48</sup> However, the use of m-Health for anonymous health education dissemination has been less successful due to limited access among vulnerable populations, such as pregnant women.<sup>49</sup>

### **2.3 M-Health in Malawi (YendaNafe)**

The majority of m-health technologies are still being developed and implemented at the pilot level in Malawi, where the notion of “m-health” is still extremely new. The introduction of m-Health in Malawi specifically PIH aimed to utilize the community health

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<sup>45</sup> Ibid.

<sup>46</sup> Ivy Mushamiri et al., “Evaluation of the Impact of a Mobile Health System on Adherence to Antenatal and Postnatal Care and Prevention of Mother-to-Child Transmission of HIV Programs in Kenya,” *BMC Public Health* 15, Article no. 102 (February 7, 2015), <https://doi.org/10.1186/s12889-015-1358-5>.

<sup>47</sup> Henry Bair, Jenny D. Wanger, and Nirav R. Shah, “A Brief History of Exposure Notification During the COVID-19 Pandemic in the United States, 2020-2021,” *Public Health Reports* 137, no. 2\_suppl (June 8, 2022): 23S-28S, <https://doi.org/10.1177/00333549221099533>.

<sup>48</sup> Muhammad Arshed et al., “Effectiveness of mHealth Interventions in Medication Adherence among Patients with Cardiovascular Diseases: A Systematic Review,” *Diseases* 11, no. 1 (March 1, 2023): 41, <https://doi.org/10.3390/diseases11010041>.

<sup>49</sup> Thomas J. Betjeman, Samara E. Soghoian, and Mark P. Foran, “mHealth in Sub-Saharan Africa,” *International Journal of Telemedicine and Applications* 2013 (December 4, 2013): 1–7.

toolkit because it was developed in a low-income country. Yendanafe is an m-health tool created in August 2018 by PIH Malawi and Medic collaborated to make “An offline-first tool with real time capability, YendaNafe, locally interpreted as “walk with us”, enables faster, better, and more equitable care, in addition to real time data collection and aggregation.”<sup>50</sup> The app's implementation began in July 2019 with 228 CHWs from two of the 14 catchment sites in the Neno district executing the CHW program household model.

“The app links PIH’s network of CHWs to primary and secondary clinical teams in Neno District to effectively screen, provide ongoing care, and refer patients in communities to care in health facilities.”<sup>51</sup> As a researcher, I had the opportunity to observe firsthand in Neno Malawi how the app functions in five crucial areas: in-app messaging, longitudinal patient profiles, task and schedule management, evidence-based care guides for decision support, and dashboards for performance management and encouraging supervision. This opportunity was thought-provoking, in that technologies, even in those kinds of rural settings, may be utilized and deployed to jointly increase the standard of care through protocol-driven door-to-door home visits.

#### ***2.4 Maternity Services Delivered Through m-Health Technologies in Sub-Saharan Africa Through CHW Programs***

In a study conducted in Burkina Faso,<sup>52</sup> participants (experienced the innovative integration of m-Health services within the context of maternal healthcare. The study

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<sup>50</sup> Wendy Achieng and Philip Ngari, “Partners In Health to Open Source Their Full CHT-Based Community Health App – YendaNafe,” Medic, October 18, 2022.

<sup>51</sup> Ibid.

<sup>52</sup> Antonia Arnaert et al., “Experiences of Women Receiving Mhealth-Supported Antenatal Care in the Village from Community Health Workers in Rural Burkina Faso, Africa,” DIGITAL HEALTH 5 (2019): 205520761989275, <https://doi.org/10.1177/2055207619892756>.

discovered three levels to the intervention which are “1) it allowed for early detection of pregnancy-related complications, 2) it was perceived as promoting collaboration between CHWs and midwives, and 3) it was a source of reassurance during a time when they are concerned about their health.”<sup>53</sup> The study also delved into asking the women what they believed or preferred to be put in place when it came to m-health in their maternal journey. They mentioned that the women preferred brief, clear, actionable messages that directed, supported, and motivated them to be vigilant and seek expert help when asked what they believed or preferred to be adopted in the usage of m-health technology.<sup>54</sup>

Additionally a study was done in Ntcheu district, Malawi aimed to understand “barriers preventing pregnant women from starting antenatal clinic in the first trimester of pregnancy in Ntcheu District-Malawi.”<sup>55</sup> The study discovered that the majority of pregnant women desired to begin their antenatal care as soon as possible. These findings are in line with the findings of this current study.<sup>56</sup> Despite this, a number of obstacles were noted when it came to women going to start their ANC journey early, including cultural, social, and service-related difficulties. Cultural barriers included waiting for marriage counselors to intervene from the husband's side, a procedure known as "Kuthimba." Furthermore, numerous women concealed their pregnancies throughout the first several months out of fear of witchcraft-related negative outcomes.

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<sup>53</sup> Antonia Arnaert et al., “Experiences of Women Receiving Mhealth-Supported Antenatal Care in the Village from Community Health Workers in Rural Burkina Faso, Africa,” *DIGITAL HEALTH* 5 (2019): 205520761989275, <https://doi.org/10.1177/2055207619892756>.

<sup>54</sup> Esther Cathyln Atukunda et al., “mHealth-Based Health Promotion Intervention to Improve Use of Maternity Care Services among Women in Rural Southwestern Uganda: Iterative Development Study,” *JMIR Formative Research* 5, no. 11 (2021): e29214, <https://doi.org/10.2196/29214>.

<sup>55</sup> Chancy S. Chimatiro et al., “Understanding Barriers Preventing Pregnant Women from Starting Antenatal Clinic in the First Trimester of Pregnancy in Ntcheu District-Malawi,” *Reproductive Health* 15, no. 158 (September 21, 2018), <https://doi.org/10.1186/s12978-018-0605-5>.

<sup>56</sup> Kisha German, "The Impact of Mobile Health (m-Health) on Social Connectedness Between Community Health Workers and Pregnant Women in Malawi" (2023).

On the socioeconomic front, some women put off starting ANC because they were waiting for a pregnancy start up package which includes new clothes and other resources from their husbands to look presentable during ANC appointments.<sup>57</sup> During this study a question was asked about the socioeconomic front when it comes to ANC care and support. Some women stated that they would delay ANC because they were waiting for a pregnancy start up package which includes new clothes and other resources from their husbands to look presentable during ANC appointments.

Furthermore, poor attitude of health staff has an impact on ANC attendants. The majority of women stated that they began ANC late because some health staff were impolite and did not respect confidentiality. Men's refusal to accompany their spouses to maternity clinics out of fear of having HIV tested worked as a barrier for some women, who did not want to appear to have the pregnancy outside of marriage. The study also emphasizes the desire of women for their husbands' presence, as some village customs necessitate obtaining an authorization letter from Traditional Leaders for unmarried pregnant women to initiate ANC at healthcare facilities.

## ***2.5 Challenges and Opportunities Presented by m-Health Technologies***

A systematic review of 32 articles on m-Health technologies identified 9 challenges of mobile health technologies.<sup>58</sup> The identified “challenges include (1) lack of security guidelines and regulations for developing secure mHealth apps, (2) developers’

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<sup>57</sup> Chancy S. Chimatiro et al., “Understanding Barriers Preventing Pregnant Women from Starting Antenatal Clinic in the First Trimester of Pregnancy in Ntcheu District-Malawi,” *Reproductive Health* 15, no. 158 (September 21, 2018), <https://doi.org/10.1186/s12978-018-0605-5>.

<sup>58</sup> Bakheet Aljedaani and M Ali Babar, “Challenges with Developing Secure Mobile Health Applications: Systematic Review,” *JMIR m-Health uHealth* 9, no. 6 (June 21, 2021): e15654, <https://doi.org/10.2196/15654>.

lack of knowledge and expertise with secure m-Health app development, (3) lack of stakeholders' involvement during mHealth app development, (4) no or little attention by developers towards the security of mHealth apps, (5) lack of resources for developing secure mHealth apps, (6) project constraints during the mHealth app development process, (7) lack of security testing during mHealth app development, (8) developers' lack of motivation and ethical considerations when developing the mobile health technologies and (9) lack of security experts' engagement during mHealth app development."<sup>59</sup>

It has been noted "from the literature that there is an emphasis on resolving the security issues presented by mHealth apps [...] (e.g. presenting security framework, providing secure mHealth app development recommendations, and evaluating the security for existing mHealth apps). However, little attention has been given to how to resolve the human factors during the development process of mHealth apps (i.e. nontechnical solutions)."<sup>60</sup>

Despite the challenges posed by m-health, this study<sup>61</sup> uncovered significant opportunities it presents, particularly its potential to enhance health outcomes in various ways. One notable aspect is its ability to efficiently store information over extended periods, including an existing database of pregnant women. At PIH Malawi, m-health stands out for its data efficiency, low maintenance requirements, and cost-effectiveness, further emphasizing how the initial cost, text messaging, and flexible data plans make mobile phones highly appealing for integration into healthcare interventions

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<sup>59</sup> Ibid.

<sup>60</sup> Ibid.

<sup>61</sup> Kisha German, "Exploring the Influence of Screens on Social Bonds" Examining the Impact of Mobile Health(m-Health) on Social Connectedness Between Community Health Workers and Pregnant Women Attending Antenatal Care (ANC) in Neno, Malawi," (2023).

## 2.6 Social Connectedness & m-Health

“Social connection is an umbrella term that refers to the ways in which one can connect to others physically, behaviorally, cognitively, and emotionally. It can be broadly characterized as encompassing 3 major components” as seen in Figure 1.<sup>62</sup>

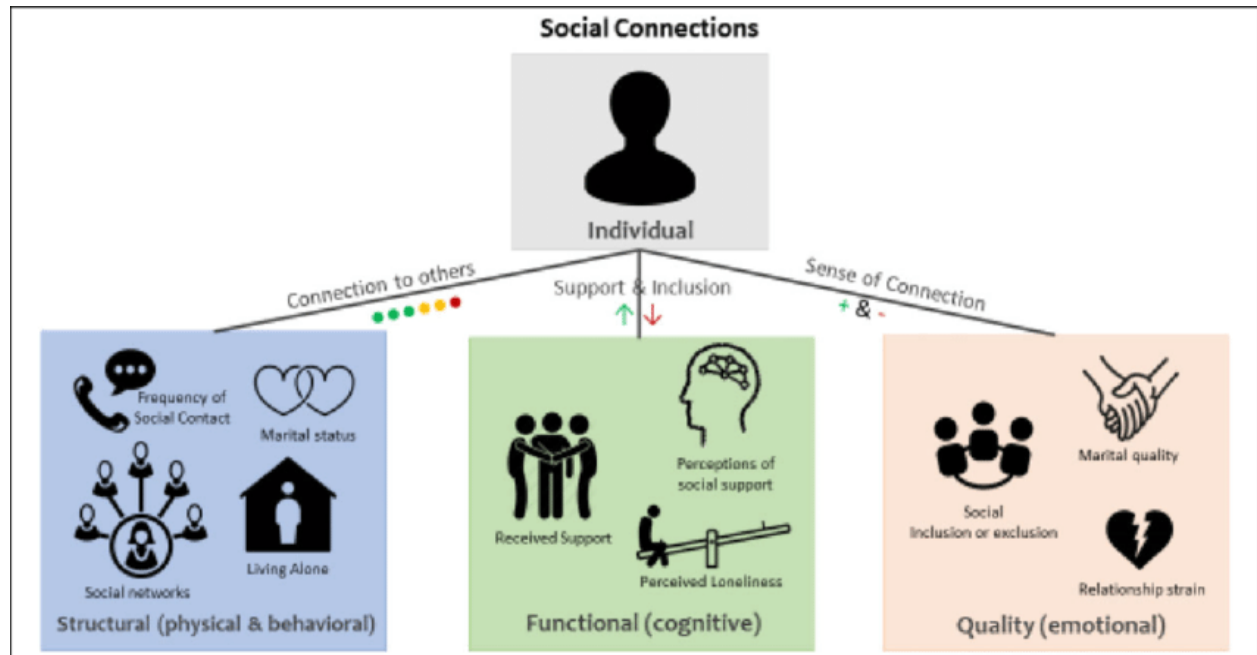


Figure 1: Social Connectedness Components<sup>63</sup>

1. “Social connection as a source of *structural* support via the physical or behavioral presence of relationships in our lives (e.g. size of the social network, marital status, living alone, frequency of social contact);
2. Social connection as a source of *functional* support via the resources or functions our relationships provide or are cognitively perceived to be available (e.g. perceived or received support, loneliness);

<sup>62</sup> Julianne Holt-Lunstad, “Fostering Social Connection in the Workplace,” *American Journal of Health Promotion* 32, no. 5 (July 4, 2018): 1307–12, <https://doi.org/10.1177/0890117118776735a>.

<sup>63</sup> *Ibid.*

3. Social connection as a source of *quality* support via the positive and negative emotional nature of our relationships (e.g. relationship satisfaction, conflict, strain).<sup>64</sup>

End-user perceptions was an emerging theme in a study that evaluated the “impact of a mobile health system on adherence to antenatal and postnatal care and prevention of mother-to-child transmission of HIV programs in Kenya.”<sup>65</sup> The primary aim of this study was to “assess the APAS’s effectiveness in enhancing MCH services within the The Millennium Villages Project (MVP) cluster.”<sup>66</sup> The fundamental purpose of this social connection study is to elevate the views and perspectives of the women who attend ANC at Neno. It seeks to give people a place to express their opinions and perceptions about the services developed for them. This goal is consistent with a similar study conducted in Kenya where the researchers emphasized the significance of engaging in sensitive and respectful conversation with women.<sup>67</sup> The study concluded that “communication with women should include sensitive and respectful exploration of their understanding and perception of risk and safety, as well as acknowledgement of any anxieties during their pregnancy journey.”<sup>68</sup>

The barriers to accessing health facilities for pregnant women, demonstrated in the study, align with documented findings. A qualitative review identified recurring challenges: cost, birthing decision influencers, lack of childbirth planning, HIV testing apprehension, transportation issues, complex healthcare policies, risk perception, care

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<sup>64</sup> Ibid.

<sup>65</sup> Ivy Mushamiri et al., “Evaluation of the Impact of a Mobile Health System on Adherence to Antenatal and Postnatal Care and Prevention of Mother-to-Child Transmission of HIV Programs in Kenya,” *BMC Public Health* 15, Article no. 102 (February 7, 2015).

<sup>66</sup> Ibid.

<sup>67</sup> Ivy Mushamiri et al., “Evaluation of the Impact of a Mobile Health System on Adherence to Antenatal and Postnatal Care and Prevention of Mother-to-Child Transmission of HIV Programs in Kenya,” *BMC Public Health* 15, Article no. 102 (February 7, 2015).

<sup>68</sup> Ibid.

quality, and medicalized childbirth. These factors highlight complex socio-economic, cultural, and systemic challenges that hinder timely maternal health access. Addressing these barriers is crucial for equitable and effective maternal healthcare.<sup>69</sup>

In conclusion, the literature review elucidates the evolving landscape of m-Health technologies within Sub-Saharan Africa, particularly their potential to address healthcare challenges in resource-constrained environments. The rapid adoption of mobile technology presents promising opportunities for enhancing maternal health outcomes and community-based care. However, the field grapples with security concerns, limited stakeholder involvement, and a scarcity of attention to non-technical factors during app development. This case study of the YendaNafe app showcases a tangible example of m-Health's impact, empowering community health workers and improving data-driven care coordination. Social connectedness and end-user perceptions emerge as pivotal aspects, emphasizing the need for culturally attuned and user-centric interventions. As barriers to healthcare access for pregnant women are underscored in the literature, recognizing and addressing these challenges collectively is imperative for advancing equitable maternal healthcare services.

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<sup>69</sup> Rana Dahab and Dikaios Sakellariou, "Barriers to Accessing Maternal Care in Low Income Countries in Africa: A Systematic Review," *International Journal of Environmental Research and Public Health* 17, no. 12 (June 2020): 4292, <https://doi.org/10.3390/ijerph17124292>.



### **3. RESEARCH METHODOLOGY**

#### **3.1 Research Design**

This study adopted a phenomenological qualitative research design. Phenomenological research aims to provide a description of “the lived experiences of individuals.”<sup>70</sup> It explores various aspects of experience, including “perception, thought, memory, imagination, and emotion.”<sup>71</sup> The purpose of phenomenology is to understand how human beings experience a particular phenomenon.<sup>72</sup>

#### **3.2 Study Setting**

The physical location for this study was Neno District, Malawi at the main PIH offices. “Neno’s geographic challenges and cultural context have fostered PIH’s model of integrated care, in which all 14 clinics offer decentralized treatment for many chronic conditions.”<sup>73</sup> The PIH-supported facilities offer the full spectrum of maternal health care, from prenatal checkups to safe deliveries, to postnatal monitoring and follow-up.

#### **3.3 Data Collection**

A purposive sampling strategy was employed to select participants from the various YendaNafe catchment areas. The YendaNafe initiative is operational across seven sites: Dambe, Neno DHO, Magaletta, Ligowe, Chifunga, Matope, and Luwani.

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<sup>70</sup> Deakin University, “Libguides: Qualitative Study Design: Phenomenology,” Phenomenology - Qualitative study design, Deankin University Library , accessed August 12, 2023, <https://deakin.libguides.com/qualitative-study-designs/phenomenology>.

<sup>71</sup> Ibid.

<sup>72</sup> Ibid.

<sup>73</sup> Partners In Health, “Malawi,” Partners In Health, accessed August 31, 2023, <https://www.pih.org/country/malawi>.

The inclusion criteria consisted of pregnant women who have been living within the YendaNafe catchment for the past three years, expecting pregnancies of three months or more, and having interacted with the YendaNafe m-Health system.

Data was collected from 12 women using in-depth interviews, administered by the research fellow, and the help of 7 CHW's. The team traveled to the various YendaNafe catchment areas. In-depth interviews were chosen as the data collection instrument due to their ability to capture intricate thoughts and behaviors, which are particularly valuable when exploring new subjects.<sup>74</sup> The 12 participants were chosen, guided by the principle of saturation. Saturation denotes the point at which novel insights or themes cease to emerge from the data, indicating a sufficient depth of information.<sup>75</sup>

On July 13th, a meeting was convened for site supervisors. A significant topic on the agenda was the ongoing Samuel Centre for Social Connectedness Fellowship study and the data collection procedures. During the meeting, the site supervisors were provided with a list of the selected women to be sampled. The inclusion criteria consisted of pregnant women who have been living within the YendaNafe catchment for the past three years, expecting pregnancies of three months or more, and having interacted with the YendaNafe m-Health system.

Notably, the extraction of this list was facilitated by the M&E informatics team. They then collaborated with the respective community health workers (CHWs) assigned to each site, each aligned with a specific site. These CHWs had the job of finding the

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<sup>74</sup> Carolyn Boyce and Palena Neale, *CONDUCTING IN-DEPTH INTERVIEWS: A Guide for Designing and Conducting In-Depth Interviews for Evaluation Input* (Watertown, MA: Pathfinder International, 2006).

<sup>75</sup> Greg Guest, Arwen Bunce, and Laura Johnson, "How Many Interviews Are Enough? An Experiment with Data Saturation and Variability," *Field Methods* 18, no. 1 (February 2006): 59–82, <https://doi.org/10.1177/1525822x05279903>.

women on the list and letting them know about the upcoming interviews before we started collecting data.

Through the in-depth interviews, administered by the research fellow, who with the help of a local team traveled to the various catchment areas. In-depth interviews were conducted for approximately 10 minutes.

### ***3.4 Research Team Collaboration and Analytical Approach***

To ensure reliability and validity, a collaborative systematic analysis process was done by three qualitative researchers. Five transcripts were distributed among the researchers, and each researcher independently developed a comprehensive codebook. Subsequently, a structured consensus-building session was conducted to create a single codebook, during which the researchers convened to discuss, compare and combine the codebooks.<sup>76</sup> A theoretical framework was then created out of the codes, effectively encapsulating the codes emerging from the data, thus enhancing the credibility and rigor of the analysis. Themes were then created from the theoretical framework using deodose.

## **4. ISSUE, EVIDENCE, AND KEY FINDINGS**

### ***4.1 Impact***

To achieve the objectives of the study, interviews were carried out through a community engagement initiative. To identify and sample our population, an inclusion and exclusion criteria were put in place. This was accomplished by extracting from the database a list of women who were 3-6 months pregnant and had previously interacted with YendaNafe. Community health workers (CHWs) used the list to personally find and

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<sup>76</sup> Appendix.

inform the women of their upcoming interviews. This method was adopted due to the absence of communication means accessible to these women. Consequently, the interviews took place at the residences of the women, with their consent being obtained beforehand.

A total of 12 interviews were carried out across 7 regions within Neno (Malawi), where the YendaNafe tool has been implemented. The women's perceptions and experiences concerning YendaNafe during their ANC visits were recorded. Additionally, the women shared their recommendations concerning the CHW program and offered insights on how these recommendations could be effectively implemented within a resource-limited environment.

## 5. KEY FINDINGS

The findings and themes of this study were inductively identified from the responses that were given by the 12 participants. At the time of the study period, all the participants were registered under a PIH health facility, and under the YendaNafe (m-Health) database.

### 5.1 Demographic Table

*Table 1: Demographic Table*

<b>Age</b>	<b>n</b>	<b>%</b>
15-20	3	25
21-25	3	25
26-35	4	33
36-40	2	16
<b>Marital Status</b>		

Single	2	17
Separated	1	8
Married	9	75

After thematic analysis, the study found 210 excerpts, 17 codes, and three key themes and their subthemes.

The first theme is **i) Women’s Opinions/Knowledge on YendaNafe** which includes women’s opinions on the perceptions regarding the use of YendaNafe. The second theme is **ii) Social Connectedness and Support** which includes sub-themes; i) *enhanced health and well-being*, ii) *social connection between women and CHW*, and iii) *social connectedness facilitated by m-Health*. In this theme, the participants discuss the role of YendaNafe in facilitating social connectedness, through interaction, social support, and gratitude. The participants also explain the health education, nutrition, and sex education support they receive through the CHW program.

The last theme is **iii) Trust and Confidentiality** where participants explained their views and opinions regarding the issues of trust and confidentiality of the use of the YendaNafe between them and the CHW.

### **5.2 Theme 1: Women’s Opinions/Knowledge on YendaNafe**

Participants had various perspectives and opinions regarding the utilization of the YendaNafe by CHWs. They understood that YendaNafe served as a resource for CHWs to deliver lessons throughout their pregnancy journey and was employed to document their responses concerning their present physical health characteristics.

*“Right now I believe using the phone is far better because the CHW is not struggling as well as I am not struggling. When we find that we have made*

*a mistake with something the phone will correct us immediately. With the books, we will just continue whether we have made a mistake or not. The lessons delivered through the phone are specifically tailored to my stage of pregnancy, which makes them more relevant and helpful. Previously, the CHW might have taught lessons that were easier for them to deliver, but now with the phone, the information is better suited to my individual needs.”<sup>77</sup>*

From the excerpt, the participant demonstrates her understanding of the tool's purpose, despite not directly using it, and contrasts it with the old system where the book registers were being used to record, screen, and keep information. The woman praises the tool's accuracy and how it corrects them when they make a mistake. There is also an acknowledgment of how the lessons delivered through this m-Health tool are tailored and effective. This is hailed as important by the woman because it supports the women throughout their pregnancy journey, offering valuable insights into their evolving health needs and ensuring comprehensive care.

Furthermore, 16% of the participants exhibited limited awareness regarding the specific purpose of the phone during their pregnancy journey. One woman's statement encapsulates this sentiment: “I don't know the importance of this phone, I just see them coming with a phone asking us questions. I don't know the importance.”<sup>78</sup>

This sentiment highlights a prevailing lack of understanding among certain participants about the phone's significance and intended role. These individuals perceive the presence of the phone merely as a platform for posing questions, without grasping the broader context and purpose behind its use.

The contrasting viewpoints within the participant group emphasize the need for improved communication and education to bridge this knowledge gap, ensuring that all

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<sup>77</sup> Pregnant woman from Matope, in discussion with the author, Matope, Malawi, July 24, 2023.

<sup>78</sup> Pregnant woman from Neno DHO, in discussion with the author, Neno, Malawi, July 20, 2023.

women comprehend how the m-Health tool, YendaNafe, plays a crucial role in enhancing their pregnancy experience and overall maternal health.

From studies on maternal health like that of Kok that highlight a hesitancy to early detection of pregnancy because of various reasons that have been stated.<sup>79</sup> The findings of this current study suggested that m-Health-supported visits of the CHWs had the potential to increase mothers' knowledge about their pregnancy, and as such motivated them to attend more ANC visits. A woman from Matope stated:

*“This program is great. Before, many of us used to delay seeking ANC until we were 5 months pregnant or even later, unaware of the potential dangers and risks involved in not receiving timely care. However, with this program, these health workers come to educate through their phones and encourage us to go for ANC visits early.”<sup>80</sup>*

The excerpt above further adds to the women's perceptions that the phone is important and crucial to both the CHW and them.

### **5.3 Theme 2: Social Connection and Support**

From the findings of the study, It was found that 70% of the women felt very supported when the CHW brought the monthly phone YendaNafe with them. The rest of the women felt slightly supported when the CHW brought the phone with the YendaNafe app in it. Furthermore, 91% of the women interviewed found that CHWs were present and attentive during their interactions. Interestingly, although most women agreed that the phone facilitated their interaction, they didn't elaborate on the specific ways it streamlined communication between themselves and the CHWs. Similarly, participants didn't voice any complications arising from the phone's presence during the visits. “The

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<sup>79</sup> Maryse C. Kok et al., “A Qualitative Assessment of Health Extension Workers' Relationships with the Community and Health Sector in Ethiopia: Opportunities for Enhancing Maternal Health Performance,” *Human Resources for Health* 13, no. 80 (September 30, 2015), <https://doi.org/10.1186/s12960-015-0077-4>.

<sup>80</sup> Pregnant woman from Matope, in discussion with the author, Matope, Malawi, July 24, 2023.

phone has simplified, when conversing it doesn't take much time to record my responses unlike when writing on paper."<sup>81</sup>

*"Many of us in the village tend to neglect our health, but community health workers (CHWs) ensure that we don't fall behind and actively help us maintain our well-being. Their presence and dedication help us overcome these challenges and prioritize our health."<sup>82</sup>*

The above participant's viewpoint captured their perceived knowledge as she elaborated to speak on behalf of her community starting with "Many of us in the village". She further explains the perceived approach to healthcare that they have and proceeds to acknowledge the presence and impact that the CHWs have had in helping them overcome their approach to healthcare and thus prioritize their health and overall well being.

### **5.3.1 Sub-Theme 1: Enhanced Health and Well-Being**

This theme provides a glimpse into how participants perceive the health education support provided by CHWs through the utilization of m-Health tools during pregnancy. The theme shows the conversations covering topics like safe motherhood, potential pregnancy risks, disease awareness, hygiene practices, and appropriate healthcare guidelines. These discussions resonate with the overarching objective of leveraging technology to narrow information disparities, empower women, and foster better health outcomes throughout the course of pregnancy.

*"Yes, to me it's helpful because they teach about things I don't know and I end up knowing. They also happen to teach me about diabetes. Even when the signs of diabetes appear, I won't be surprised because they came and taught me."<sup>83</sup>*

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<sup>81</sup> Pregnant woman from Neno DHO, in discussion with the author, Neno, Malawi, July 20, 2023.

<sup>82</sup> 'Pregnant woman 4,' in discussion with the author, Chifunga, Malawi, July 20, 2023.

<sup>83</sup> 'Pregnant woman 12', in discussion with the author, Luwani, Malawi, July 25, 2023.



This theme underlines how CHWs use the tool to convey crucial information related to safe pregnancy practices, identify potential risks in pregnancy, raise awareness about diseases like diabetes, promote proper hygiene, especially during pregnancy, and impart essential healthcare knowledge.

The participant's statement exemplifies the positive impact of m-Health tools in enhancing health education during pregnancy. The participant highlights that she gains knowledge about previously unknown topics, allowing her to be better prepared and informed. The reference to diabetes education and early recognition of its signs showcases the empowerment that comes from this education, enabling women to be proactive about their health.

CHWs serve as a crucial bridge between local communities and formal healthcare systems. Through regular interactions, CHWs not only provide information but also foster a sense of agency among pregnant women, enabling them to actively engage in their healthcare decisions. This empowerment extends to various aspects of health, from understanding the importance of antenatal care to making informed choices about nutrition and preventive measures. The final quote below highlights another aspect of health and well being which is nutrition as some participants highlighted the food scarcity in their locations, the CHW encourages them to eat a well balanced diet.

*“Also they taught me about eating a balanced diet, yes we eat but we don’t really reach the recommended stage, so their coming has enabled me to look for some food that can help me.”<sup>84</sup>*

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<sup>84</sup> Pregnant woman from Chifunga, in discussion with the author, Chifunga, Malawi, July 20, 2023.

### 5.3.2 Social Connection Between Women and CHWs

Before the introduction of the community health workers program, healthcare delivery in the Neno District of Malawi faced significant challenges. The absence of a comprehensive community-based healthcare system meant that many residents, especially those in remote areas, had limited access to medical services. The lack of infrastructure, such as paved roads and electricity, further hindered the timely and effective provision of healthcare.

Healthcare accessibility was a major issue pre-CHWs. Residents had to travel long distances to reach the nearest health facilities, which often led to delays in seeking medical attention. This situation adversely affected healthcare outcomes, as conditions could worsen during the time it took for individuals to reach a healthcare facility. Additionally, the lack of accessible healthcare likely contributed to preventable illnesses and fatalities.

In terms of maternal health, Malawi has one of the highest maternal mortality ratios globally, currently estimated at 5.7 maternal deaths per 1,000 live births.<sup>85</sup> Adolescent pregnancies comprise 25 percent of all births and 20 percent of maternal deaths.<sup>86</sup> This alarming statistic indicated that a significant number of women were at risk of losing their lives during pregnancy, childbirth, or the postpartum period. PIH, through its CHW programs, has one goal to achieve under the one major area of maternal and neonatal health, is to end preventable child and maternal deaths.

The relationship between CHWs and participants was characterized by a sense of social connectedness and positive interactions. 10/12 participants expressed

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<sup>85</sup> Tamara Chaura, Donnie Mategula, and Luis Aaron Gadama, "Adolescent Pregnancy Outcomes at Queen Elizabeth Central Hospital, Malawi: A Cross-Sectional Study," *Malawi Medical Journal* 33, no. 4 (December 2021): 261–68, <https://doi.org/10.4314/mmj.v33i4.6>.

<sup>86</sup> *Ibid.*

happiness and appreciation for the companionship and guidance provided by CHWs through the ANC visits in their pregnancy journey at the end of each interview. One woman expressed her gratitude by appreciating and highlighting the importance of the CHW being present saying;

*“I just want to express my sincere thanks to the hospital for sending these health workers, especially to us located in the village, that we should know what happens in our body, how to prevent these diseases, and the importance of rushing to the hospital. I am grateful because I can notice some signs even when I haven’t seen the doctor. And sometimes, I reach out to them when they haven’t come to see me. I just want them to know how much we appreciate them.”<sup>87</sup>*

With the presence of CHWs, women are getting better healthcare and they feel a real connection to CHWs who are able to provide better care, providing essential health education, monitored pregnancies, encouraged antenatal care visits, and facilitated access to healthcare facilities when needed. Additionally, they act as advocates for family planning and safe childbirth practices, helping to reduce the incidence of adolescent pregnancies. Notably, some women highlighted that the knowledge acquired from the lessons extended beyond their personal well-being to encompass the well-being of their families. Like this woman from Neno DHO who explained:

*“My health worker helps me even with my kids, for instance, in how I can take care of my children. Even when they are sick, my CHW encourages me to take them to the hospital and lessons on how to best take care of my children.”<sup>88</sup>*

This shows that the lessons delivered by CHWs through m-Health tools have a ripple effect, influencing the participants' understanding and ability to care for their own families and extend to their communities thereby enhancing the social connection instead of isolation they have.

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<sup>87</sup> Pregnant woman from Luwani, in discussion with the author, Luwani, Malawi, July 25, 2023.

<sup>88</sup> Pregnant woman from Neno DHO, in discussion with the author, Neno, Malawi, July 20, 2023.

The above statement shows the broader societal impact of the m-Health tool's educational content. It showcases how health education being provided by the CHW extends beyond the individual, enhancing participants' capacities to provide effective care for their children. The reference to guidance on seeking medical attention for sick children and imparting knowledge about childcare further exemplifies the pivotal role of CHWs in promoting holistic family well-being.

### **5.3.3 Social Connectedness Facilitated by the m-Health**

Participants explain their experiences with YendaNafe (m-Health tool) and the role it has played in facilitating connectedness and belonging during their ANC journey with the CHW.

*“It helps because the phone doesn’t speak, the conversation is basically between me and my health worker. The phone just records the responses and the reports get sent straight to the right people on what we have discussed with my health worker. Their bosses who receive the reports most likely do not even know who we are, they just know this is household number 1 or 2 and that they have taught these lessons and this program. You coming here today is probably also because of the phone that you have identified with my name but my health history is anonymous because of the phone.”<sup>89</sup>*

The above statement demonstrates the discreet yet impactful role the m-Health tool plays in bridging communication gaps, thereby enhancing social connectedness while preserving individual privacy. The m-Health YendaNafe tool serves as an intermediary, enabling private conversations between pregnant women and their assigned health workers. Rather than the tool itself initiating conversations, it records interactions, forwarding reports to relevant authorities. The sense of anonymity it affords

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<sup>89</sup> Pregnant woman from Luwani, in discussion with the author, Luwani, Malawi, July 24, 2023.

is noteworthy, as reports are assigned to household numbers rather than individual identities. This can be observed from a participant's statement.

Notably, when asked how they believe the CHW follows or tracks their pregnancy journey and ANC visits, 95% of the women could not explain how this is done. Many of the women commented that they “follow it well,” but didn’t note how the Yendafe tool helps CHWs actively follow their pregnancies.

#### **5.4 Trust and Confidentiality**

Participants express varying levels of trust and confidence in the confidentiality of their health information when interacting with community health workers (CHWs) through YendaNafe. A proportion of 98% of the participants trusted the CHW with their health information as some women expressed the health worker as being a companion through their pregnancy journey as they go to ANC visits. The majority trusts their health information on the m-Health tool because of the **relationship they had with the CHW**. For instance, one participant from Ligowe voiced her perspective, stating: “I trust the phone as they use it themselves, but then the book registers can be found somewhere and then they can read the registers.”<sup>90</sup>

Similarly, another participant from Matope expressed her sense of privacy and security in her interactions with CHWs, saying, “OK, considering that they have approached me to my home, they can keep my privacy, that’s why I’m comfortable to explain to them.”<sup>91</sup>

Notably, this participant not only emphasizes her sense of privacy but her acknowledgment of the effort undertaken by the CHWs, particularly considering the

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<sup>90</sup> Pregnant woman from Ligowe, in discussion with the author, Ligowe, Malawi, July 25, 2023.

<sup>91</sup> Pregnant woman from Matope, in discussion with the author, Matope, Malawi, July 24, 2023.

geographical distances, highlights the depth of connection she perceives in this relationship and thus building a deeper social connection.

Research conducted by Ndambo and Kok are synonymous with these findings by highlighting the centrality of trust in fortifying the relationship between community health workers and patients.<sup>92 93</sup> Kok's study underscores that trust, effective communication, open dialogue, and the alignment of expectations are pivotal aspects that shape the strength and dynamics of these relationships.

An intriguing aspect that emerged during interviews was that 5 out of the 12 women interviewed referred to the CHWs as "deputy doctors." A pregnant woman from Neno DHO explained this as, "Because we take them as deputy doctors. People sent by the doctors."<sup>94</sup> This indicates a profound level of trust and a willingness to openly communicate their health issues with the CHWs. This title signifies the deep sense of confidence these women have in the CHWs' medical expertise.

## 6. DISCUSSIONS

This study explored and discussed the influence of m-Health technologies in facilitating social connectedness between CHWs and women attending ANC in maternal health services in a low-resource setting. The findings highlight that m-Health technologies utilized in CHW programs play some role in facilitating an easy path toward social connectedness.

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<sup>92</sup> Myness Kasanda Ndambo et al., "The Role of Community Health Workers in Influencing Social Connectedness Using the Household Model: A Qualitative Case Study from Malawi," *Global Health Action* 15, Article no. 2090123 (August 12, 2022).

<sup>93</sup> Maryse C. Kok et al., "A Qualitative Assessment of Health Extension Workers' Relationships with the Community and Health Sector in Ethiopia: Opportunities for Enhancing Maternal Health Performance," *Human Resources for Health* 13, no. 80 (September 30, 2015).

<sup>94</sup> Pregnant woman from Neno DHO, in discussion with the author, Neno, Malawi, July 20, 2023.

This study observed that the women have a **fair understanding of what YendaNafe** does and its importance. They recognize its purpose in assisting CHWs during lesson delivery, aiding in household management for CHWs, and facilitating the tracking of pregnancy-related information. While the majority of participants failed to explicitly elucidate the specific mechanisms through which the tool fosters social connectedness, they consistently acknowledged its supportiveness. Furthermore, participants highlighted that CHWs were consistently present, regardless of the presence of the tool.

From the findings, it can be seen that some women are grateful that the CHWs are now even more helpful with YendaNafe around. Furthermore, women elaborated on the **usefulness of the YendaNafe**, noting that it enables CHWs to deliver personalized messages pertinent to the specific stages of their pregnancies.

Based on these findings, the YendaNafe app has played a role in fostering social connectedness. The tool allows CHWs to effortlessly monitor and stay updated on pregnancy-related information. As a result, women perceive a sense of value, knowing that CHWs possess a deeper understanding of their pregnancies compared to their own awareness. **The concept of social connectedness, as previously described, revolves around a society in which every individual holds value.<sup>95</sup> This sense of value that women experience through the attentive/present care provided by CHWs contributes to the enhancement of their social bond.**

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<sup>95</sup> Samuel Centre for Social Connectedness, "About Social Connectedness," Accessed August 28, 2023, <https://www.socialconnectedness.org/about-us/about-social-connectedness/>.

This observation finds resonance in a study conducted in Burkina Faso.<sup>96</sup> This study similarly underscored that the CHWs' informed knowledge about a woman's prevailing health condition, facilitated by the m-Health tool, fostered collaboration between the woman and the CHW. The tool's ability to enhance the exchange of information and engagement serves to deepen the connection between the two parties.

Based on the findings of this study, a strong and confident conclusion can be drawn that the CHW Program at PIH is effectively functioning. This aligns with the Ndambo study which also examined the CHW Program, albeit from the perspective of the CHWs themselves.<sup>97</sup> Notably, one shared observation between this study and the Ndambo study is the significance of establishing interpersonal relationships as a foundation for enhancing social connectedness. Both studies underscore the emergence of social connectedness between the participants and CHWs as a notable theme. Of particular note is how these lessons transcended individual health concerns.

The majority of women emphasized that the knowledge acquired from the lessons extended beyond their personal well-being to encompass the well-being of their families. This reflects a broader intention to care for not only their own health but also that of their loved ones. This dimension of prioritizing family health emerges as a pivotal aspect of social connectedness that emerged from the interviews.

The relationships and sense of social connectedness that exist between the CHWs provide guidance on motherhood and help expand their knowledge base.

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<sup>96</sup> Antonia Arnaert et al., "Experiences of Women Receiving Mhealth-Supported Antenatal Care in the Village from Community Health Workers in Rural Burkina Faso, Africa," *DIGITAL HEALTH* 5 (2019): 205520761989275.

<sup>97</sup> Myness Kasanda Ndambo et al., "The Role of Community Health Workers in Influencing Social Connectedness Using the Household Model: A Qualitative Case Study from Malawi," *Global Health Action* 15, Article no. 2090123 (August 12, 2022).



These lessons taught by CHWs encompassed various topics including safe motherhood, STIs, and nutrition. By receiving this encouragement and guidance, despite their geographical distance from hospitals, the women gained a profound sense of empowerment. Consequently, they began to view their health and overall well-being as a priority, as the quote below emphasizes; a vital source of interaction, hope, and health-oriented encouragement.

*“I feel loved with a health worker because sometimes when I’m sick and then I ignore, my health worker comes and takes me to the hospital looking at how I am okay and not neglecting my health. That’s overall the love I receive compared to then when I didn’t have a health worker.”<sup>98</sup>*

This relationship underscores the importance of human connection in fostering positive health outcomes.

The findings suggested that m-Health-supported visits of the CHWs have the potential to increase mothers’ knowledge about their pregnancy, and as such, motivate them to attend more ANC visits. This aligns with the existing body of literature, which underscores the pivotal synergy between m-Health technologies and CHW interactions in empowering maternal health knowledge and engagement.<sup>99 100</sup> By effectively deepening social connectedness and facilitating knowledge dissemination, these initiatives play a role in enhancing the efficacy and comprehensiveness of maternal healthcare practices.

This is in line with a study by Arnaert that found that even though “m-Health was a novel service for all participants, they expressed appreciation for these interventions,

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<sup>98</sup> Pregnant woman from Luwani, in discussion with the author, Luwani, Malawi, July 24, 2023.

<sup>99</sup> Araya Medhanyie et al., “The Role of Health Extension Workers in Improving Utilization of Maternal Health Services in Rural Areas in Ethiopia: A Cross Sectional Study,” *BMC Health Services Research* 12, Article no. 352 (October 8, 2012), <https://doi.org/10.1186/1472-6963-12-352>.

<sup>100</sup> Maryse C. Kok et al., “A Qualitative Assessment of Health Extension Workers’ Relationships with the Community and Health Sector in Ethiopia: Opportunities for Enhancing Maternal Health Performance,” *Human Resources for Health* 13, no. 80 (September 30, 2015).

which they found beneficial on three levels: 1) it allowed for early detection of pregnancy-related complications 2) it was perceived as promoting collaboration between CHWs and midwives, and 3) it was a source of reassurance during a time when they are concerned about their health.”<sup>101</sup>

In the context of discussing **barriers to social connectedness** resulting from the implementation of YendaNafe between pregnant women and community health workers, an interesting observation emerges. Out of the 12 women interviewed, 2 of them demonstrated an unwillingness to embrace YendaNafe facilitated by the CHWs, indicating a general sense of hesitation. However, all the women expressed a higher level of trust and confidence in the CHWs themselves rather than placing their trust solely in the technological YendaNafe tool.

This study found that concerns related to confidentiality and trust did not appear as prominent obstacles. This observation resonates with findings from the Arnaert study that reported a similar absence of voiced concerns about the confidentiality of collected data.<sup>102</sup> This convergence of perceptions further underscores the growing confidence in the security and privacy aspects of m-Health interventions within such contexts.<sup>103</sup>

Nonetheless, while our study revealed a high level of trust that women placed in the CHWs, the Ndambo study uncovered a contrasting perspective.<sup>104</sup> It identified instances where certain patients lacked trust in CHWs due to a specific incident involving a CHW who was found drunk and disclosing confidential information.<sup>105</sup> This

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<sup>101</sup> Antonia Arnaert et al., “Experiences of Women Receiving Mhealth-Supported Antenatal Care in the Village from Community Health Workers in Rural Burkina Faso, Africa,” *DIGITAL HEALTH* 5 (2019): 205520761989275.

<sup>102</sup> Ibid.

<sup>103</sup> Ibid.

<sup>104</sup> Myness Kasanda Ndambo et al., “The Role of Community Health Workers in Influencing Social Connectedness Using the Household Model: A Qualitative Case Study from Malawi,” *Global Health Action* 15, Article no. 2090123 (August 12, 2022).

<sup>105</sup> Ibid.

incident highlighted the imperative of preserving CHW confidentiality. Additionally, the Ndambo study indicated a need for novel approaches in addressing culturally sensitive health matters.<sup>106</sup> These different findings emphasize the necessity for continuous efforts in maintaining trust, confidentiality, and culturally appropriate strategies within the CHW Program to ensure its success and effectiveness. Likewise, prior CHW studies have demonstrated that when CHWs are chosen and capacitated within their communities, it builds trust in their services and abilities with individuals in their community.

Notably the connection between this study's findings and the studies outlined above is the importance of trust, confidentiality, and cultural sensitivity within the community health worker (CHW) Program. This study highlights the trust that women place in CHWs, a trust often fostered when CHWs are chosen from within their communities.

## **7. RECOMMENDATIONS**

The first part of this section, recommends a way mobile health tool developers can use the tools to influence social connectedness between health care workers and patients. The second recommendation describes how community health programs can be improved. The section ends with a note to the researcher on what they could consider before deeming their research feasible or not.

### ***7.1 Building Social Connectedness with the m-Health tool***

This recommendation sheds some light on how mobile health tools can be used to strengthen social connectedness between health care workers and patients.

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<sup>106</sup> Ibid.

Mobile health tools developers should ensure that the information delivered to the patients remains relevant to each patient's unique situation. Tailored content delivery is important because the patients feel valued when the content addresses their direct situations. The community health workers knew more about the unique pregnancy of every woman than the women themselves because of the mobile health tool. This made the women feel loved and cared for because someone else also cared for their pregnancy.

### ***7.2 Additional Program Desires***

This recommendation is directly tied to the community health program and not directly tied to the results of the study concerning mobile health and social connectedness.

It suggests providing additional training to community health workers (CHWs) in other relevant fields like mental health and marriage counseling. During interviews, women were asked about their preferences on how they think the program could improve. 10 out of the 12 women suggested that the community health workers should be knowledgeable in subjects like marriage counseling and mental health, as these are challenges frequently faced within the community

Another recommendation to the community health program would involve catering allowing the women to choose the preferred gender for their community health workers. This is because the study encountered a situation where a woman felt constrained from fully involving her male CHW in her ANC journey due to cultural and marital factors.

### **7.3 A Note to Researchers**

Finally, this recommendation goes out to people involved in the field of research. Before the research, there was a prevalent assumption that the outcomes would lack significance due to the belief that the women would be unfamiliar with the m-Health tool. Some even held the notion that the women might not possess the necessary understanding or insight to comprehend the tool's functioning, given their limited usage. Nevertheless, the study unveiled a contrasting reality: the women demonstrated a working knowledge of the app's operations.

This study strongly advocates for the demystification of knowledge towards vulnerable groups in rural settings. As health researchers, we should focus on rectifying perceptions and attitudes towards vulnerable groups situated in remote and low-resource regions. It is important not to make assumptions about their perceived literacy levels and language barriers before research.

This may enable PIH, Ministry of Health, and Health Researchers to conduct studies that were previously considered infeasible due to challenges posed by the literacy levels and language barriers among the research subjects.

## **8. CONCLUSION**

In an attempt to examine the influence of mobile health on social connectedness between community health workers and pregnant women. A phenomenology qualitative study was employed in Neno Malawi at PIH where a mobile health tool called "YendaNafe" is used by Partners in Hope community health workers. 12 pregnant women attending antenatal care in Neno were interviewed for the research. The results were analyzed using thematic analysis with the help of Partners in Hope qualitative

research experts. The result that stood out the most was that the mobile health tool was slightly an aid in influencing social connectedness between community health workers and pregnant women. The mobile health tool was an aid because it allowed the community health workers to know more about the pregnancy of the woman than the woman themselves. This made the women feel valued and cared for as someone else also cared for their pregnancy like them. The results of this study were similar with a study done in Burkina Faso that the mobile health tool facilitated collaboration between the community health workers and the patients.<sup>107</sup> The results of the study suggest that mobile health developers should make sure that the mobile health tool provides tailored content delivery.

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<sup>107</sup> Thomas J. Betjeman, Samara E. Soghoian, and Mark P. Foran, "M-Health in Sub-Saharan Africa," *International Journal of Telemedicine and Applications* 2013, no. 482324 (December 4, 2013), <https://doi.org/10.1155/2013/482324>.

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## APPENDIX

### APPENDIX A: INTERVIEW GUIDE - ENGLISH

#### **Examining the Influence of Mobile Health (m-Health) on Social Connectedness Between Community Health Workers (CHWs) and Women Attending Antenatal Care (ANC) in Neno**

##### **Informed Consent (ENGLISH) Pregnant Women**

Thank you for speaking with us. I'd like to start off by introducing our team. I'm [interviewer name] and this is [assistant name, if applicable]. I'll be leading the conversation [and, with your permission, will be recording our conversation.] [IF APPLICABLE] Also, [assistant name] will be assisting with taking notes so that we can remember everything that you say. The purpose of speaking with you today is to get your feedback about both challenges and successes with the CHW during your antenatal visits, specifically [name of specific program of interest]. In addition, a report will be produced on the outcomes, challenges and future opportunities that can help drive interventions on maternity health care and social connectedness.

Everything that you say is confidential and will only be shared anonymously, without your name mentioned. We do not expect that there will be any risks or discomforts to you if you decide to participate in this interview. There is no compensation offered for participating, but your responses will help inform our work to improve the services CHW program. You may stop participating in the conversation at any time. Your decision to participate or not participate will not have any effect on your relationship with the CHW Program or the services you receive [*for service recipients*].

Do you have any questions or concerns?

Do you agree to participate in this interview/focus group discussion?

Yes [PROCEED]      No [STOP]

Do you agree that we will record this interview?

Yes [PROCEED]      No [STOP RECORDING]

I acknowledge that I have explained this research study to the participant.

*Signature of person obtaining consent*

*Date*

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*Printed name of person obtaining consent*

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*Printed name of the participant*

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*Participant signature, "X" mark or thumbprint to indicate consent*

*Date*

## **Interview Questions for Pregnant Women Attending ANC**

**Social connectedness** means working towards a society where everyone is valued, seen and heard, where everyone can exercise their agency and basic human rights; and, where solidarity, trust and cooperation pave the way for the community. According to the Samuel Centre for Social Connectedness (SCSC), social connectedness is grounded in three values: respect, recognition, and reciprocity.

*Table 2: Interview Questions in English*

<b>Questions</b>	<b>Questions (&amp; probes)</b>	<b>What the Question Measures</b>
<b>Demographics</b>		
Age	How old are you ?	

Marital Status	Are you married, single, engaged or divorced?	
Number of pregnancies	Total number of children you have had ?	
Objective 1; <b>To explore the perceptions of pregnant women regarding the use of the m-Health tool and CHW Program</b>	<p>1.How have community health workers affected/impacted your pregnancy?</p> <p>2. How have CHWs supported or helped you during your pregnancy?</p> <p>2.Do you find the monthly visits helpful? Why or why not?</p> <p>3.How do you think the CHW's keep track of your pregnancy? For example, your ANC visits.</p> <p>4.Do you think that the phone helps CHW in his/her work?</p> <p>5 CHW's often bring a phone when visiting you. What is your experience with them like when they have a phone?</p> <p>6. How present do you find CHWs?</p> <p>A. Very present</p> <p>B. Somewhat present</p> <p>C. Neutral</p> <p>D. Not very present</p> <p>E. Not present</p> <p>Probing; Do you think they are equally, more or less present when they bring the phone?</p> <p>6.What do you think is the use of the phones that CHW's come with?</p> <p>IF YES</p> <p>Probing; Can you describe an instance where the YendaNafe tool (m-Health too/phone) has been helpful during your pregnancy?</p>	Knowledge and beliefs about what CHWs and CHW Program
Objective 2 <b>To understand the role of YendaNafe in facilitating social connectedness between pregnant women and Community Health Workers (CHWs)</b>	<p>1. Does the phone interfere with your interaction with CHW?</p> <p>2. Do you feel more supported with the YendaNafe tool when you compare the old system with the new system?</p>	

	<ol style="list-style-type: none"> <li>3. What difference do you see in the relationship? When your CHW visits you with this tool rather than the register?</li> <li>4. How do you feel loved by the CHW program as they use the tool?</li> <li>5. How supported do you feel when CHW bring the monthly phone tool? <ol style="list-style-type: none"> <li>a. Very supported</li> <li>b. Slightly more supported</li> <li>c. `Neutral</li> <li>d. Slightly less supported</li> <li>e. Less supported</li> <li>f. None - I feel supported seeing the CHW and if the tool helps them that's fine.</li> </ol> </li> <li>6. Has the phone simplified your interaction with the CHW during your visits? If yes, how? If not, why not?</li> </ol>	
<p>OBJECTIVE 3</p> <p><b><i>To identify barriers to social connectedness resulting from the use of YendaNafe between pregnant women and community health workers</i></b></p>	<ol style="list-style-type: none"> <li>1. Do you trust the YendaNafe tool (phone) when the CHW uses it? Why or why not?</li> <li>2. What do you like about the tool in comparison to the old system of using the register?</li> <li>3. Do you have any concerns or fears with the tool? <ol style="list-style-type: none"> <li>a. If Yes - what are your fears/concerns?</li> <li>b. If No - what helped build trust/confidence in the tool?</li> </ol> </li> <li>4. What would help build trust in the tool for you?</li> </ol>	<p>Perceptions of Trust</p>



	<p>5. Would you be comfortable sharing personal health issues with a CHW? Why? Why not?</p>	
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## APPENDIX B: INTERVIEW GUIDE - CHICHEWA

**Research Topic: Kuwunika zotsatira za kagwiritisdwe ntchito ka YendaNafe (m-Health tool) pa kugwirizana pakati pa community health workers (CHWs) ndi Amayi Opita Kuchipatala (ANC) ku Neno**

Kalata lopepha chilolezo:

Zikomo kwambiri chifukwa cholankhulana nafe. Poyamba ndifuna kuti tidziwane. Ine ndi (*dzina la wofunsa mafunso*) ndipo anzagawa ndi (*wothandizila ngati alipo*). Ine ndidzatsogolera zokambilanazi ndi chilolezo chanu ndipo (*dzina la wothandizila*) adzakhala akundithandiza polemba zomwe tidzakambilana ndi cholinga choti tidzakumbukile bwino lomwe zonse zomwe takambirana. Cholinga chocheza nanu lero ndichakuti timve kuchokera kwa inu mikwingwilima imene mwakumana nayo komanso zabwino pa ntchito zija za azanthu oyendera anthu kumudzi amachulidwa CHW (*tchulani pulogalamu yake*) mene zikuyendera. Zonse zomwe titakambilane pano ndi za chinsinsi, ndipo dzina lanu silidzatchulidwa.

Tikuyembekezela kuti sipadzakhala chiopsyezo, kapena kukhumudwa kamba kakutenga nawo mbali kwanu pa kucheza kwathu. Palibe cholowa chilichonse pakutenga nawo mbali kwanu, koma mayankho anu atithandiza kupititsa patsogolo ntchito zomwe a CHW amagwila. Mukhoza kusiya kutenga nawo mbali nthawi yakufuna kwanu. Kukana kutenga nawo mbali sikukhudza ubale womwe ulipo pakati pa inu ndi APZU (*kwa masitafu/ndi kwa ogwila ntchito ku chipatala*). Izi sizidzakhudzanso zolowa zomwe inu mumalandila kuchokera ku CHW Program.

Muli ndi Funso kapena chidandaulo chilichonse?

Mwavomera kutenga nawo mbali pa zokambilanazi ndi kukhala nawo mukafukufuku ameneyu?

Eya (pitilizani) ayi(imani)

Sayini ya wopempha chilolezo

Tsiku

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*Ndafotokozera za kafukufukuyu kwa wofunsidwa*

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*Sayini ya wotenga nawo mbali  
(chongani kapena dindani chala osonyeza kuvomaleza)*

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### **Kufunsa Mafunso kwa Amayi Oyembekezera Opita ku ANC**

**Kugwirizana kwa anthu;** Kugwirizana pakati pa anthu kumatanthauza kugwira ntchito kudera lomwe aliyense amalemekezedwa, kuwonedwa ndi kumveka, komwe aliyense angagwiritse ntchito udindo wake ndi ufulu wachibadwidwe; ndipo, kumene mgwirizano, kukhulupirirana ndi mgwirizano zimatsegulira njira anthu amudzi. Malinga ndi bungwe la Samuel Center for Social Connectedness (SCSC), kulumikizana kwa anthu kumakhazikika pazikhalidwe zitatu: ulemu, kuzindikira, ndi kuyanjana.

*Table 3: Interview Questions in Chichewa*

<b>Questions</b>	<b>Questions (&amp; probes)</b>	<b>What the Question Measures</b>
<b>Demographics</b>		
Zaka	Muli ndi zaka zingati ?	
Banja	Kodi ndinu wokwatiwa kapena wosakwatiwa?	
Masabata Oyembekezera amasiku anu	Kodi ndinu oyembekezera masabata angati?	
Chiwerengero cha mimba	Munakhalapo oyembekezera kangati?	
Cholinga 1; <b>Kufufuza momwe amayi oyembekezera amaonera pakugwiritsa ntchito chida cha m-Health ndi program ya CHW</b>	1. Kodi a CHW amakuthandizirani bwanji mukakhala ndi pakati?  2. Mumapeza kuyenderedwa mwezi uliwonse ndi ma CHW kothandiza Kapena	Chidziwitso ndi zikhulupiliro pa zomwe ma CHWs ndi CHWR

<p><b>Kodi ndi njira ziti zomwe a CHW adakuthandizirani pa nthawi yomwe muli ndi pakati?</b></p>	<p>ayii?</p> <p>3. Kodi mukuganiza kuti a CHW amatsatira bwanji za sikelo yanu?</p> <p>4. Mukuganiza kuti foni imamuthandiza CHW pa ntchito yake?</p> <p>5. Kodi mumamva bwanji CHW akabwera kuzakuyenderani ndi foni? Amaonetsa chidwi ndi inuyo?</p> <p>6. Kodi mukuganiza kuti mafoni omwe a CHW amabwera nawo ndi a chiyani?</p> <p>Funso Losatira ; Kodi mungapeleke chisanzo cha mene CHW anagwilitsa ntchitho phone kuku thandizani muli oyembekezelai?</p>	<p>Program</p>
<p><b>Cholinga 2 Kumvetsetsa udindo wa YendaNafe pothandizira kulumikizana pakati pa amayi oyembekezera ndi Community Health Workers (CHWs)</b></p>	<p>1. Kodi phone imasokoneza kucheza kwanu ndi CHW?</p> <p>2 Pali kusiyana kwanji pa chisamaliro chomwe mumalandira kuchokera kwa CHW potengera zipangizo zomwe akugwiritsa ntchito pa kuyendera kwake kwa pa mwezi? Mwachitsanzo kugwiritsa ntchito Foni kapena ayi</p> <p>3. Kodi mukuona kusiyana kwanji kwa ubale wanu ndi CHW akamakuyenderani ndi phone ndi m'mene ankakuyenderani ndi register?</p> <p>4. Kodi foni yaphweketsa/yavutitsa kuyanjana kwanu ndi a CHW panthawi yoyendera?</p>	
<p><b>CHOLINGA 3</b></p>		<p>Malingaliro a Trust</p>

<p><b>Kuzindikira zolepheretsa kulumikizana ndi anthu chifukwa chogwiritsa ntchito YendaNafe pakati pa amayi apakati ndi community health workers</b></p>	<ol style="list-style-type: none"> <li>1. Kodi mumakhulupirira kuti kugwiritsa ntchito phone kumathandizira kusunga chinsisi chanu?</li> <li>2. Kodi mumakhala omasuka kugawana nkhani za chinsisi zaumoyo wanu ndi CHW? Chifukwa chiyani?</li> </ol>	
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## APPENDIX C: CODEBOOK

### Codebook: Examining the Influence of Mobile Health (m-Health) on Social Connectedness Between Community Health Workers (CHWs) and Women Attending Antenatal Care (ANC) in Neno

No	CODE	DESCRIPTION
1	<b>Health Education</b>	Participants explain concepts of health education in their pregnancy journey
A	Dangers of contracting STI's	Participants explain the dangers of contracting STI's as a lesson through the CHW program
B	Nutrition	Participants explain the importance of having a balanced diet
C	Hygiene Practices during	

	pregnancy Medication Adherence	
<b>2</b>	<b>CHW Support during Pregnancy</b>	Explains how CHW supports pregnant women
A	Mental well being	Participants explain how mental health plays a role in sustaining their pregnancy
B	Relevance of timely Prenatal Care	
<b>3</b>	<b>Pregnant Women's knowledge on how CHW's track their pregnancy</b>	
<b>4</b>	<b>Opinions on how they think the phone is important to the CHW</b>	
<b>5</b>	<b>Social Connectedness between CHW's and participants</b>	
<b>6</b>	<b>Trust</b>	Participant's level of trust in CHWs in handling their personal health information and maintaining confidentiality mentioned in the response
A	<b>Confidentiality</b>	Reason for trusting the m-Health tool
<b>7</b>	<b>Quick Access to HealthCare</b>	
<b>8</b>	<b>YendaNafe taking time to load</b>	Participants explain how the were kept waiting by the CHW
<b>9</b>	<b>Digital Literacy and technology use</b>	N

<b>10</b>	<b>Recommendations on the m-Health tool</b>	
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*Table 4: Codebook*