UNDERSTANDING RESILIENCE AND WELL-BEING AMONG COMMUNITY HEALTH WORKERS IN GHANA: MEANINGS, CONTEXTUAL PROCESSES, AND SEASONAL DYNAMICS

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List of Abbreviations

Abbreviation	Full term
AIC	Akaike Information Criterion
AICC	Corrected Akaike Information Criterion
AR(1)	Autoregressive covariance structure of order 1
ARH(1)	Heterogeneous autoregressive covariance structure of order 1
BIC	Bayesian Information Criterion
BND	Builsa North District
BP	Between-person
CHMC	Community Health Management Committee
CHO	Community Health Officer
CHPS	Community-based Health Planning and Services
CHW	Community health worker
CI	Confidence interval
COREQ	Consolidated Criteria for Reporting Qualitative Research
COVID-19	Coronavirus disease 2019
DHA	District Health Administration
DHMT	District Health Management Team
GHC	Ghanaian cedi
GHS	Ghana Health Service
HIV/AIDS	Human immunodeficiency virus/acquired immunodeficiency syndrome
IDI	In-depth interview
IPA	Interpretative phenomenological analysis
IQR	Interquartile range
KNM	Kassena-Nankana Municipality

Abbreviation	Full term
KNWD	Kassena-Nankana West District
LMIC	Low- and middle-income country
LS-mean	Least-squares mean
MCH	Maternal and child health
MDA	Mass drug administration
NGO	Non-governmental organization
NHRC	Navrongo Health Research Centre
NHRCIRB	Navrongo Health Research Centre Institutional Review Board
NTD	Neglected tropical disease
P25	25th percentile
P50	50th percentile
P75	75th percentile
PhD	Doctor of Philosophy
REML	Restricted maximum likelihood
RRC-ARM	Resilience Research Centre–Adult Resilience Measure
SAS	Statistical Analysis System
SD	Standard deviation
SDG	Sustainable Development Goal
SE	Standard error
SMC	Seasonal malaria chemoprevention
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
UER	Upper East Region
UHC	Universal health coverage
WHO	World Health Organization
WHO-5	World Health Organization Five-Item Well-Being Index

Abbreviation	Full term
WP	Within-person

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Abstract

Community health workers (CHWs) are central to the delivery of primary health care interventions in many low- and middle-income countries. In Ghana, CHWs play an important role within the Community-based Health Planning and Services programme, supporting household follow-up, health promotion, referrals, community mobilization, disease prevention, and public health campaigns. Despite their importance to community-based primary health care, CHWs often work under difficult social, material, programmatic, and environmental conditions. Many also combine their health-related responsibilities with household, livelihood, and community obligations. These realities raise important questions about how CHWs experience resilience and well-being, what conditions shape these experiences, and whether they change across seasonal contexts.

This article-based thesis examines resilience and well-being among CHWs in Ghana through three connected studies conducted in the Upper East Region. The first study explored how CHWs understand and describe resilience and well-being in their own terms. The second examined the contextual processes and factors that shape these experiences across individual, relational, community, structural, and seasonal domains. The third used a prospective longitudinal cohort design to examine seasonal variation in resilience and well-being across dry, rainy, and transition/harvest seasons, and to assess the relationship between resilience and well-being over time. The qualitative studies used phenomenological inquiry and interpretative phenomenological analysis, while the longitudinal study used repeated seasonal surveys and linear mixed-effects models.

The findings show that CHWs understood resilience not as a single personal trait, but as a dynamic process involving cognitive and adaptive strategies, emotional regulation, communal support, and spiritual coping. Well-being was similarly described as broad and interconnected, encompassing environmental, financial, mental and emotional, physical, social, and spiritual dimensions. Across the studies, resilience and well-being were shaped by personal motivation, family support, peer relationships, community recognition, supervision, incentives, gendered expectations, resource constraints, and seasonal pressures. The longitudinal findings showed clear seasonal patterns in both outcomes, with important differences by district and incentive frequency. Higher resilience was consistently associated with higher well-being, although this relationship varied across seasons and was strongest during the rainy season.

Overall, the findings show that CHW resilience and well-being are dynamic, social-ecological, and seasonally shaped experiences. Supporting CHWs therefore requires more than expecting them to remain committed and resilient. It requires attention to the relationships, resources, recognition, supervision, incentives, and seasonal realities that make resilience and well-being possible. This thesis contributes to a context-sensitive and programme-relevant understanding of how CHWs sustain themselves while supporting primary health care in Ghana.

CHAPTER 1

Introduction

1.1 Introduction

Community health workers (CHWs) are central to the delivery of primary health care in many low- and middle-income countries (1–4). In this thesis, CHWs are defined as "individuals with an in-depth understanding of the community culture and language, have received standardized job-related training which is of shorter duration than health professionals, and their primary goal is to provide culturally appropriate health services to the community" (p.8) (5). The term "community health worker" will be used throughout this thesis as an all-encompassing term representing community health volunteers, community drug distributors, community health navigators, and all other formal or informal health workers who conform to the aforementioned definition.

Because CHWs work at the interface of communities and formal health systems, their role is especially important in contexts where access to health care is constrained. In these settings, CHWs often serve as the link between households, communities, and the formal health system (4,6). Their knowledge of local language, culture, and community life positions them to support health education, prevention, referrals, community mobilization, and public health campaigns in ways that are both practical and culturally relevant (3,5,7,8).

In Ghana, CHWs play an important role within the Community-based Health Planning and Services (CHPS) initiative, a national strategy designed to deliver primary healthcare by reorienting health services from sub-district facilities to convenient community locations (9,10). Through this initiative, CHWs work alongside Community Health Officers (CHOs) and other health system actors to extend primary health care to rural and underserved populations (9,10). Their work includes household visits, health promotion, referrals, support for malaria activities, vaccine-preventable disease programmes, Neglected Tropical Disease (NTD) interventions, Tuberculosis (TB), HIV/AIDS and other community-based health activities (5,9–11). In this regard, CHWs are not only an extension of the health system; they are also embedded community actors whose work depends on trust, recognition, and relationships.

Because CHWs live in the communities they serve, their close connection to community life is central to their effectiveness, but it can also expose them to multiple and competing demands. Despite their importance to healthcare delivery, CHWs often work under difficult social,

material, and environmental conditions. Many combine their health-related responsibilities with their personal or household responsibilities, such as farming, trading, family care, and other livelihood activities (9,12–14). They are expected to remain available to their communities and responsive to health system needs, while also managing their own household and economic pressures. Existing studies have shown that CHW motivation, performance, and retention are shaped by factors such as supervision, incentives, training, workload, community trust, and access to resources (14–16). However, less is known about how their role and these working conditions shape their resilience and well-being as lived experiences.

Resilience is often described as the process of adapting positively in the face of adversity or significant stress (17). For CHWs, adversity is rarely a single event. It may be cumulative and embedded in everyday work-life realities, including irregular professional or supervisory support, limited resources, competing responsibilities, and community expectations (12). This makes it important to understand resilience not only as an individual capacity, but as a dynamic process shaped by relationships, systems, and context (18–20).

Similarly, well-being among CHWs cannot be reduced to morale, job satisfaction, or the absence of distress. It is a multidimensional experience that includes physical, emotional, social, financial, spiritual, and relational dimensions. These dimensions are shaped by the conditions under which CHWs live and work, including household responsibilities, community expectations, access to resources, supervision, recognition, and seasonal pressures (21–24). Broader literature also shows that well-being is produced through social, cultural, relational, and environmental conditions, rather than being located only within the individual (25–27). This is why it is important to examine how CHWs themselves understand well-being within their specific lived realities and sociocultural contexts.

Given this layered nature of CHW experience, this thesis uses the social-ecological framework to understand the layered influences affecting CHW resilience and well-being. This perspective is useful for examining CHW resilience and well-being because both are shaped through interactions across multiple levels including the individual, personal, structural and social perspectives. Individual coping, family support, peer relationships, community recognition, supervision, incentives, and broader programme structures all shape how CHWs experience and

respond to stress (12,22). The framework is relevant in Ghana, where CHWs are embedded within the same communities they serve and where their work is influenced by both formal health system expectations and informal social obligations (11,12).

In addition to these social and programme-level influences, CHW experiences also occur over time and across seasons. Seasonality adds an important temporal dimension to understanding the working and living realities of CHWs. In northern Ghana, three distinct seasons (dry, rainy, and transition) shape livelihoods, mobility, disease patterns, agricultural labour, household resources, and health service delivery. These seasonal changes can intensify or ease the pressures that CHWs experience (12,14,28). The rainy season may increase disease burden, travel difficulties, and farming demands, while the dry season may bring heat and environmental stress. The transition or harvest period may offer some relief through improved household resources and community support (6,12,29–32). Despite the known impacts of seasons on community life, there remains limited longitudinal evidence on whether CHW resilience and well-being vary across these seasonal conditions.

This thesis responds to these gaps by examining resilience and well-being among CHWs in Ghana through three connected studies. The first study explores what resilience and well-being mean to CHWs in the Upper East Region of Ghana. The second study examines the contextual processes and factors that shape these experiences across individual, relational, community, structural, and seasonal domains. The third study investigates seasonal variation in resilience and well-being and examines the relationship between resilience and well-being over time.

The overall purpose of this thesis is to deepen understanding of CHW resilience and well-being in ways that are context-sensitive, programme-relevant, and useful for strengthening primary health care systems. The thesis argues that supporting CHWs requires more than expecting them to be resilient. It requires attention to the relationships, resources, structures, and seasonal realities that make resilience and well-being possible. By linking meanings, contextual processes, and seasonal dynamics, it contributes to a more complete understanding of how CHWs sustain themselves while supporting community-based primary health care in Ghana.

1.2 Research Aim, Objectives and Questions

The overall aim of this thesis is to deepen understanding of resilience and well-being among community health workers (CHWs) in Ghana by examining how these concepts are understood and experienced, the contextual processes that shape them, and how they vary across seasonal conditions. The thesis is organized around three interrelated objectives, each addressed in a separate empirical chapter (Chapters 4–6). Together, the objectives move from understanding the meanings of resilience and well-being, to examining the social-ecological conditions that shape these experiences, and finally to assessing their seasonal dynamics longitudinally

1.2.1 Objective 1: Meaning of resilience and well-being among CHWs

Objective 1: To explore how CHWs in the Upper East Region of Ghana understand and describe resilience and well-being within their social and work contexts.

Research question 1: How do CHWs understand and describe resilience and well-being within their everyday social and work contexts?

Resilience and well-being are increasingly recognized as important to CHWs who often work under demanding social, material, occupational, and environmental conditions. However, much of the existing literature has approached these concepts using predefined measures or related outcomes such as motivation, job satisfaction, burnout, and psychological distress. Such approaches may not fully capture how resilience and well-being are understood and experienced by CHWs within specific sociocultural contexts. This objective therefore uses qualitative inquiry to centre CHWs' own perspectives and examines the meanings, experiences, and dimensions they associate with resilience and well-being. Establishing this contextual understanding provides the conceptual foundation for examining the broader processes that enable or constrain CHWs' ability to cope and remain well.

1.2.2 Objective 2: Contextual processes and factors shaping resilience and well-being

Objective 2: To identify the contextual processes and interactions that shape CHW resilience and well-being across individual, relational, community, structural and health system, and seasonal domains.

Research question 2: What contextual processes and interactions shape CHW resilience and well-being across social-ecological and seasonal contexts?

CHWs are embedded simultaneously within households, communities, health programmes, and broader social and environmental systems. Their resilience and well-being may therefore depend not only on individual coping capacities, but also on family and peer relationships, community recognition and expectations, supervision, incentives, material resources, gendered roles, programme arrangements, and changing environmental conditions. This objective builds on the meanings identified under Objective 1 by examining how these influences interact to strengthen or undermine resilience and well-being. Guided by a social-ecological perspective, the study examines resilience and well-being as contextually produced experiences rather than solely as individual attributes.

1.2.3 Objective 3: Seasonal variation in resilience and well-being

Objective 3: To examine seasonal variation in CHW resilience and well-being across dry/early rainy, rainy, and transition/harvest periods, and to assess the association between resilience and well-being over time.

The third objective extends the qualitative findings by quantitatively examining resilience and well-being longitudinally among the same CHWs across three seasonal periods. Seasonal conditions in northern Ghana can alter disease burden, mobility, agricultural and livelihood demands, household resources, workload, and access to communities. Examining CHWs repeatedly across these changing conditions provides an opportunity to assess whether resilience and well-being vary over time and whether their relationship is itself seasonally contingent. The longitudinal study therefore addresses two related research questions and hypotheses.

Research question 3a: Do CHW resilience and well-being differ across dry/early rainy, rainy, and transition/harvest seasons?

Hypothesis 1: CHW resilience and well-being will differ across seasons, with the highest levels expected during the transition/harvest season.

This hypothesis reflects the expectation that seasonal conditions alter both the demands placed on CHWs and the resources available to them. Rainfall, mobility constraints, disease burden, agricultural work, heat, livelihood pressures, and household resources vary over the year and may therefore shape CHWs' capacity to adapt and remain well. The transition/harvest period was expected to provide relatively more favourable conditions through improved food availability, household resources, mobility, and community reciprocity compared with periods characterized by greater environmental or livelihood pressures.

Research question 3b: What is the association between resilience and well-being among CHWs across seasonal periods, and does the strength of this association vary by season?

Hypothesis 2: Resilience will be positively associated with well-being across seasonal periods, and the strength of this association will vary by season.

Resilience is conceptualized in this thesis as an adaptive process through which personal, relational, community, and structural resources may support positive functioning under adversity. Although previous research generally suggests a positive relationship between resilience and well-being, there is limited longitudinal evidence examining this relationship among CHWs in low- and middle-income countries or determining whether it changes across environmental contexts. This hypothesis therefore examines both the overall relationship between resilience and well-being and whether that relationship differs as CHWs encounter changing seasonal conditions.

1.3 Thesis Organization

This thesis is organized in an article format following the University of Ottawa doctoral thesis guidelines. It brings together three connected studies that examine resilience and well-being among CHWs in Ghana. The studies first explore how CHWs understand resilience and well-being, then identify the contextual processes shaping these experiences, and finally examine whether resilience and well-being vary across seasons.

The epistemological stance of this thesis is grounded in pragmatism, drawing on both interpretive and post-positivist perspectives to recognize that both qualitative and quantitative approaches offer complementary ways to understanding resilience and well-being in ways that are conceptually meaningful, context-sensitive, and useful for programme and policy action (33).

The qualitative studies provide insight into community health workers' lived experiences, meanings, and contextual realities, while the longitudinal study examines patterns of resilience and well-being across dry, rainy, and transition seasons.

My positionality in this research programme was also informed by my position as a Ghanaian-Canadian researcher with previous experience in community health research in Ghana. This familiarity provided important contextual understanding, while requiring ongoing reflexive attention to assumptions that could arise from my cultural and professional familiarity with the setting. Section 3.3.7 describes how I addressed these positional influences throughout data collection, analysis and interpretation.

The following outlines a summary of each chapter in the thesis.

1.3.1 Chapter 1: Introduction

This chapter discusses the role of CHWs in the delivery of primary health care in Ghana and other low- and middle-income countries. This thesis defines CHWs as individuals who have a deep understanding of their communities' cultures and languages, have received standardized job-related training that is shorter than that of professional health workers, and provide culturally appropriate health care services (5). The chapter situates their work within Ghana's Community-based Health Planning and Services (CHPS) programme and highlights their role in health promotion, referrals, household follow-up, community mobilization, and public health campaigns.

The chapter then discusses resilience and well-being, which are important aspects of community health work but are less explored. It positions both concepts as dynamic experiences rather than fixed individual characteristics. By doing so, it draws attention to the social, cultural, health system, and environmental factors that influence the ability of CHWs to cope with, perform, and remain well in their positions. Furthermore, the chapter introduces the social-ecological and seasonal frameworks that will guide the thesis. It concludes by outlining the central issue that has been addressed throughout the thesis: how community health workers sustain themselves while also supporting community-based primary health care in an environment that is both demanding and seasonal.

1.3.2 Chapter 2: Literature Review

The second chapter reviews literature on resilience and well-being among community health workers to situate the thesis within existing scholarship and strengthen the rationale for examining these concepts as context-dependent and seasonally shaped experiences. It first discusses Ghana's Community-based Health Planning and Services programme as a key platform for bringing primary health care closer to communities and situates CHWs within this community-based health system context. The chapter then discusses resilience and well-being as important dimensions of CHW experience, with attention to their implications for CHW functioning, motivation and overall well-being. It also reviews the theoretical foundations of the thesis from a social-ecological perspective.

The chapter also examines seasonal challenges in healthcare and how these may affect CHWs' work, coping, and well-being. It situates these challenges in the context of the geoclimatic conditions of the Upper East Region of Ghana, where dry, rainy, and transition seasons affect mobility, livelihoods, disease burden, workload, and community access. The chapter then discusses the relationship between resilience and well-being, demonstrating why the two concepts should be examined together rather than as separate experiences. It concludes by providing the rationale for examining CHW resilience and well-being as dynamic, social-ecological, context-dependent, and seasonally shaped processes.

1.3.3 Chapter 3: Methods

This third chapter outlines the methodological rationale for the thesis and covers details that are discussed in the subsequent manuscripts. The chapter provides an overview of the three study designs that are the basis for this thesis: the qualitative exploratory study, the qualitative study of contextual processes, and the longitudinal cohort study. It goes on to describe the study setting, participant selection, data collection procedures, and the analytic approaches that connect the three studies.

The qualitative component of the chapter shows how CHWs describe and interpret resilience and well-being in their everyday social and work contexts using a phenomenological approach and interpretative phenomenological analysis. For the longitudinal component, the chapter outlines the statistical approach used to examine seasonal variation and the relationship between resilience and well-being over time. This includes the definition and derivation of key variables,

seasonal classification, model formulas, choice of mixed-effects models, covariance structure, model-building strategy, and interpretation of the resilience–well-being relationship across the three study periods.

1.3.4 Chapter 4-6: Articles

The three articles that comprise the core of this thesis are presented in chapters four through six. Before each article, I briefly describe my contribution to the work, ethics approval obtained and the manuscript's publication or submission status. Because these chapters are presented in manuscript format, tables and figures within the article chapters retain the numbering used in the manuscripts.

The first article is titled "What does resilience and well-being mean to community health workers? An exploratory study in the Upper East Region, Ghana." Published in BMJ Public Health, this article examines how CHWs themselves understand and describe resilience and well-being within their social and work contexts. The findings show that resilience is not experienced as a single personal attribute, but as a dynamic process involving cognitive and adaptive strategies, emotional regulation, communal support, and spiritual coping. Well-being was similarly described as broad and interconnected, encompassing environmental, financial, mental and emotional, physical, social, and spiritual dimensions.

The second article builds on this by examining the processes and contextual factors that shape CHWs' resilience and well-being across individual, relational, community, structural and seasonal levels. It is titled "Processes and contextual factors that shape the resilience and well-being of Community Health Workers within the Community-based Health and Planning Services concept in the Upper East Region, Ghana." And is currently under review at the Journal of Health Services Research & Policy. The findings highlight how personal motivation, family support, peer relationships, community recognition, supervision, incentives, gendered expectations, resource constraints, and seasonal pressures interact to either strengthen or undermine CHWs' ability to cope and remain well.

The third article examines whether resilience and well-being vary across dry, rainy, and transition seasons, and whether resilience is associated with well-being over time. It is titled "Seasonal Variation in Resilience and Well-being among Community Health Workers in Northern Ghana: A Longitudinal Cohort Study" and will be submitted to BMC Human Resource

for Health. The findings show clear seasonal patterns in both resilience and well-being, with higher resilience consistently associated with higher well-being. Importantly, the article shows that this relationship is not fixed, but varies across seasonal and programme conditions, reinforcing the need to understand CHW resilience and well-being as dynamic and context dependent.

1.3.5 Chapter 7: Discussion

Chapter seven synthesizes the findings from the three thesis articles and discusses their overall contribution to understanding CHW resilience and well-being in Ghana. It synthesizes the key findings across meanings, contextual processes, and seasonal patterns, and considers what they imply for CHW programmes, policy, and future research. The chapter concludes by arguing that CHW resilience and well-being should be understood as dynamic, social-ecological, and seasonally shaped experiences that require supportive systems, in addition to individual commitment.

CHAPTER 2

Literature Review

2.1 Community-based Health Planning and Services and the Role of CHWs in Ghana

Community-based Health Planning and Services is Ghana's flagship strategy for bringing primary health care closer to households and communities. Introduced as national policy in 1999, CHPS emerged from earlier community health experiments, the Navrongo model, which showed that relocating nurses into communities, mobilising local volunteers, and engaging traditional and community structures could improve access to essential health services (9,10,34). The programme was designed to shift care from facility-centred delivery toward community-based service provision, especially in rural and underserved areas where geographic, financial, and social barriers limit access to formal health services (34,35).

Within CHPS, Community Health Officers (CHOs) are deployed to CHPS zones and compounds to provide preventive, promotive, and basic curative services. Their work is supported by CHWs, Community Health Management Committees, local leaders, and other community actors who assist with household follow-up, health education, referrals, mobilisation, disease control activities, public health campaigns, and broader community engagement (16,36). This makes CHPS not only a service delivery model, but also a community engagement strategy that depends on trust, participation, volunteerism, and local ownership.

Community health workers have long been recognized as essential actors in extending health services to populations that are difficult to reach through facility-based care alone (1–4). In Ghana, their everyday work is shaped by a dual position. They are embedded within the communities they serve and draw legitimacy from their closeness to households, local norms, and community relationships. At the same time, they operate within broader health system and programme structures that may not always provide the resources, recognition, or support required for their expected responsibilities (7,11,37). This tension is central to understanding CHW work, because discussions of effectiveness, retention, and programme sustainability cannot be separated from questions of workload, incentives, supervision, recognition, and the broader social and material conditions in which CHWs live and work (14,16,38–40).

Evidence suggests that CHPS has contributed to improved access to primary health care and has been associated with gains in maternal and child health, family planning uptake, skilled birth attendance, and under-five survival, particularly among rural and poorer populations in Ghana

(34,35). However, implementation has remained uneven. Studies have identified persistent challenges related to infrastructure, logistics, staffing, supervision, community participation, volunteer motivation, and the availability of resources needed to sustain close-to-community care (16,41). These challenges are important for this thesis because CHWs operate at the centre of CHPS, but often do so under demanding social, material, and programme conditions. This makes CHPS a relevant setting for examining resilience and well-being, because CHW experiences are shaped not only by personal motivation, but also by the broader programme and community conditions in which they work.

2.1.1 Ghana Health Service policy context and CHW integration

Ghana's CHW arrangements are best understood within the broader policy architecture of CHPS and Ghana Health Service efforts to strengthen community-based primary health care. Community Health Officers provide community-level services through CHPS zones, while community volunteers and Community Health Management Committees support mobilization, household follow-up, health education, referrals, disease control activities, and community engagement. (9,10,16,34). Ghana Health Service has also developed operational policies and implementation guidance for CHPS, including steps and milestones intended to standardize implementation across districts (42,43). Schwarz et al. note that Ghana's GHS developed "15 steps and six milestones" to guide CHPS implementation nationally (42).

Beyond CHPS, Ghana formally launched the National Community Health Worker programme in 2014 to augment existing community-based service delivery (42,44). This programme was intended to strengthen community health systems and standardize the role of CHWs within CHPS and broader primary health care. The Ghana Community Health Worker training curriculum, developed through collaboration among the Ministry of Health, Ghana Health Service, World Vision Ghana, and other partners, describes CHWs as community members selected to provide basic health and medical care within their communities (44). It identifies roles such as home visits, health promotion, counselling for pregnant and postpartum women, disease surveillance, treatment of minor ailments, and referral for emergencies (42,44). The national CHW curriculum states that CHWs need regular training, supervision, and reliable logistical support to carry out their roles effectively.

Concurrently, the integration of CHWs into Ghana's health system has remained uneven. Evidence from Ghana shows variability in CHW selection procedures, supervision, service-delivery activities, incentives, and local implementation arrangements. Sakeah et al. (2021) found that Community Health Volunteers and Community Health Management Committees are selected in different ways across communities and play important roles in mobilization, health promotion, translation of health messages, support for minor illness management, and encouraging maternal health service use. However, they also concluded that selection procedures need to be standardized and that volunteers are sometimes given non-financial incentives, with ongoing debate about financial support (11).

In sum, CHWs are not external to Ghana's health system, even when they are unpaid or only partially compensated. They are connected to CHPS zones, CHOs, CHMCs, District Health Management Teams, Ghana Health Service structures, and vertical programme activities. However, their position remains marked by ambiguity: they are expected to support essential primary health care functions, but their formal status, remuneration, supervision, training, and material support are not always consistent. This creates a policy-practice gap that is central to understanding CHW resilience and well-being in Ghana. The thesis therefore examines CHWs not only as community volunteers or programme implementers, but as community-based health actors whose well-being is shaped by the way Ghana's health system recognizes, supports, and integrates them.

2.2 Resilience and Implications for CHWs

Resilience is a complex concept that has gained significant attention across various fields (45–50). The concept captured the interest of researchers in mental health during the early 20th century, as psychologists sought to understand how individuals overcome challenges and thrive despite adversity (45). The foundational work of Werner on resilient children and youth established a developmental perspective to understand human adaptability and laid the groundwork for current resilience research (49). Subsequent studies deepened the comprehension of resilience as a dynamic process, involving the interplay of risk and protective factors at various levels of influence, such as the individual, family, and community (18,51–54). This research on resilience was influenced by the emergence of positive psychology, which

explores and promotes individuals' strengths and assets that enable them to thrive despite adversity (55).

Although different fields highlight distinct aspects of resilience, the overarching definition encompasses the capacity to recover or adapt in response to adversity, stress, or change (45). Windle builds upon this understanding by underscoring that resilience is not a singular event, but rather a dynamic process that enables individuals to effectively manage stress or trauma by leveraging personal and environmental resources (56). This process involves a range of strategies, such as negotiation, adaptation, and management, aimed at mitigating negative consequences and preserving well-being (56). Resilience is therefore typified by the ability to recover, adapt, and potentially emerge stronger in the aftermath of adversity (45,56,57). Consequently, there is a need for multidisciplinary and integrated approaches to comprehend and cultivate resilience in various contexts and populations (18,56–58). Gillespie et al. (2007) contributed to the field by developing a resilience model specifically for nursing staff, offering valuable insights into resilience among healthcare workers (59).

CHW resilience is increasingly acknowledged within the context of the demanding and challenging work-life situations they face (22,60–63). CHWs play a critical role in healthcare systems, particularly in low-resource settings, where they act as intermediaries between communities and formal healthcare services (3,5,7,8). Understanding CHW resilience and its implication for their well-being is essential for several reasons. Firstly, it contributes to the growing body of knowledge on this important topic. Secondly, it provides valuable insights into how resilience can be fostered and supported among CHWs. This understanding can inform the development of targeted interventions and policies aimed at bolstering CHWs' resilience, enhancing their job satisfaction and subsequently their performance. Ultimately, it can lead to improvements in the quality of healthcare services delivered to the communities they serve (64). In this thesis, CHW resilience is examined not only as their ability to continue working under pressure, but also as a process shaped by the social, cultural, programme, and seasonal conditions in which they live and work

2.3 Well-being and Implications for CHWs

Well-being is a multidimensional concept that encompasses various aspects of an individual's life, including physical, mental, and social aspects (65–67). Its study has developed across public

health, psychology, social psychology, and workplace research, with each field emphasizing different but related dimensions of human functioning. In psychology, subjective well-being has been used to describe how people evaluate their lives, including life satisfaction, positive affect, and negative affect (68). Psychological well-being has also been framed in eudaimonic terms, emphasizing purpose in life, personal growth, autonomy, environmental mastery, self-acceptance, and positive relations with others (69,70). Social well-being extends this discussion by focusing on how individuals experience their relationships with society, including social integration, contribution, acceptance, coherence, and actualization (67,71). These perspectives are also reflected in integrative models of well-being, which show that subjective, psychological, and social well-being are related but distinct dimensions of a broader well-being construct (72). Workplace research further shows that well-being is connected to motivation, engagement, performance, and the quality of work environments (73)

In the context of work, most of the well-being literature has centered on paid labor. However, recent research has expanded the focus of the concept to explore the relationship between unpaid work and well-being, delving into the exploration of various forms of unpaid labour, notably volunteer work (22,70,73–78). The research findings are diverse, presenting both positive and negative impacts of volunteerism on well-being. On the one hand, some studies demonstrate that engaging volunteer work contributes to an enhanced sense of purpose, increased social connections, and a positive self-perception, ultimately fostering positive well-being outcomes (75,76). Others suggest that while volunteerism can be fulfilling, excessive involvement may lead to adverse consequences such as emotional strain, burnout and psychosocial distress due to the demanding nature of volunteerism (22,78). This duality is particularly important for CHWs, whose work is often meaningful but also demanding, under-resourced, and only partially supported by formal health systems.

Community health workers (CHWs) engage in volunteer work as an inherent part of their job description. In Ghana, they are non-salaried community members trained to assist Community Health Officers (CHOs) in delivering basic healthcare services within their local communities on behalf of the local healthcare system (11). Their roles encompass community mobilization, assisting healthcare professionals in vaccine administration, the management of minor ailments, and bridging communication gaps by facilitating the translation of health information into local

languages. The participation of CHWs as volunteers can reflect a sense of purpose and commitment to their communities, while also creating opportunities for social connection, community recognition, and meaningful engagement (11,61,79,80). However, these experiences are not uniform. CHW motivation, performance, and relationships with community members can vary depending on programme conditions, supervision, incentives, workload, recognition, and trust. This engagement may therefore support positive self-perception, job satisfaction, and personal fulfilment for some CHWs, but these outcomes should not be assumed across all contexts (79,81).

Despite this, CHWs also face challenges related to their well-being. Multiple studies underscore the adverse impact of unfavourable working conditions on the well-being, job satisfaction, and retention of CHWs (22,63,80,82). For instance, CHWs have reported elevated levels of stress, burnout, and psychosocial distress, which were associated with diminished job satisfaction, inadequate remuneration and recognition (22,82,83). These findings suggest that CHW well-being cannot be separated from the social, material, and programme conditions under which they work.

The examination of CHW well-being in low- and middle-income countries (LMICs) holds significance for several reasons. CHWs play a pivotal role in achieving universal health coverage, aiding in the achievement of the sustainable development goals (SDGs), and contributing to the improvement of health outcomes in LMICs (84). Hence, their well-being has likely implications for the communities they serve as they usually come from the communities they serve, establishing a close link between their well-being and that of their communities (22,63,82). Consequently, addressing CHW well-being may have broader impacts on community health outcomes. For this thesis, well-being is therefore examined not only as an individual outcome, but as a contextually shaped experience linked to CHWs' work, relationships, community position, and broader health system condition.

2.4 The impact of resilience on well-being

The relationship between resilience and well-being has become increasingly central in discussions of mental health paradigms. Resilience, usually viewed as a robust defence against adversity, can directly influence an individual's overall well-being (19,20,85). Individuals with higher levels of resilience tend to report better well-being and demonstrate reduced vulnerability

to mental health conditions (20). They tend to utilize effective coping strategies and have better emotional regulation than individuals with lower resilience (86,87). Such benefits underscore the protective and adaptive roles of resilience, which are essential in countering trauma and promoting mental well-being (19,20). At the same time, while resilient individuals generally report better well-being, individuals with stronger well-being may also show increased resilience when encountering adversity (88).

In the context of CHWs, the importance of resilience is particularly evident given the demanding nature of their roles (22,60,61). CHWs often work in environments marked by limited resources, competing livelihood demands, social expectations, and changing seasonal conditions. At the same time, studies have shown that their occupational conditions can affect their well-being, including through stress, burnout, psychosocial distress, inadequate remuneration, and limited recognition (22,63,82,89). Despite these insights, there remains limited evidence on the relationship between resilience and well-being among community health volunteers in low- and middle-income countries.

Ungar and Theron suggest that resilience is not the ultimate aim; rather, it serves as a pathway through which outcomes such as stable mental health and well-being may be achieved (19). They also emphasize that promotive and protective factors operate across different systemic levels, helping to shield individuals from threats to mental health and well-being (19).

2.5 Social-Ecological Perspective on CHW Resilience and Well-being

Bronfenbrenner's social-ecological model of human development offers a useful lens for examining the relationship between individuals and the environments in which they live and work (90). The model suggests that human development is shaped by nested systems of influence, ranging from immediate settings such as the microsystem, which includes direct relationships and everyday experiences, to broader social, cultural, and institutional contexts reflected in the macrosystem (18,90). Applied to this thesis, the social-ecological perspective helps to move the discussion of CHW resilience and well-being beyond individual coping alone. It draws attention to the ways in which CHWs' experiences are shaped by their personal resources, family and peer relationships, community expectations, cultural norms, health system arrangements, and wider material and environmental conditions.

This perspective is useful for examining CHW resilience and well-being because CHWs often work in resource-constrained environments shaped by social, material, environmental, and health system pressures (22,37,60). Their capacity to cope, function, and remain well is therefore not only a matter of personal motivation or temperament. It also depends on whether the contexts in which they live and work provide access to meaningful relationships, community recognition, supervision, incentives, resources, and other forms of support. In this thesis, resilience and well-being are therefore understood as processes shaped through interaction between CHWs and the relational, community, cultural, and health system contexts surrounding them.

Using a social-ecological perspective makes it possible to examine how different levels of influence work together to shape CHW experience. For example, individual coping may be strengthened or weakened by family responsibilities, peer support, community trust, supervision, incentives, gendered expectations, and seasonal pressures (22,60,80). The sections that follow review these levels of influence, beginning with individual factors and then moving to relational, community, and broader cultural and health system conditions

2.5.1 Social-Ecological Levels of Influence on CHW Resilience and Well-being

Bronfenbrenner's model illustrates similar processes related to resilience and well-being that occur across different systemic levels, including the microsystem, mesosystem, exosystemic, and macrosystem in this study, these systemic levels will correspond to individual, relational, community, health systems, and culture.

The individual level**,** as part of the social ecological model, focuses on individual characteristics, behaviours, beliefs, health status and experiences. Within the context of resilience and well-being, this system encompasses an individual's characteristics such as self-efficacy, positive outlook and optimism and sense of duty especially within tangible and material settings like the family, neighborhood, or religious community (91,92). In their study conducted in a South African healthcare context, Barnard and Furtak showcased the connection between microsystems and resilience (61). They highlighted that volunteer resilience is rooted in specific aspects of work-life orientation, characterized by a unique inner drive, a focus on others, and a sense of calling in their work. These orientations at the microsystem level enable volunteers to effectively navigate and thrive in demanding work-life situations, sustaining their commitment to volunteering. Other microsystemic factors, such as intrinsic motivation, participation costs, and

personal definitions of success, have also been identified elsewhere as driving forces behind CHW resilience (60,93). At the same time, evidence from Ethiopia shows that stressful life events and limited social support can negatively affect the psychological well-being of unpaid CHWs (22). Taken together, these findings show that individual attributes matter, but they are shaped by the conditions in which CHWs carry out their work.

The relational or interpersonal level examines the immediate social environment that encompasses CHWs. This domain encompasses CHWs' relations with their families, friends, peers, as well as their immediate social settings (8,11,22,82,83). Ungar identifies crucial relational factors such as social competence, meaningful relationships, and positive mentors as important aspects related to resilience and well-being (92). For instance, in Ethiopia, trust in co-workers emerged as an essential relational factor influencing work interactions among diverse CHWs, and deficits in social support have been linked to elevated psychological distress (22,83). Furthermore, in other contexts, the presence of effective communication channels among CHWs, their colleagues, and family members has been identified as a crucial facilitator of mental health and overall well-being among CHWs, while the absence of support from family members serves as a significant demotivator (8,82).

The community level of the social-ecological model encompasses the interconnections and dynamics that exert indirect influence on the immediate surroundings of an individual (92,94). In the context of resilience and well-being, these are characterized as a multitude of distant societal interactions that may indirectly impact an individual (92). For CHWs, resilience and well-being at this level encompasses their access to community resources, their sense of belonging and integration within the community, as well as their capacity to tap into community support during challenging times (11,37,60,95). Research highlights the significance of positive relationships between the community and CHWs (60). These relationships are crucial in helping CHWs adapt to the adversities they encounter in their work. Conversely, a lack of involvement and support from community leadership can be detrimental to CHWs' resilience. For example, community trust and respect for CHWs have been associated with their motivation, performance, and retention (37,95). The relationship between CHWs and the community, along with its consequential effects on CHW resilience and well-being, can be considered implicit, given that

communities are heavily involved in the selection process of CHWs, thereby influencing their ultimate success or lack thereof (11,37).

The cultural or systems level within the framework of the social-ecological model encompasses a set of all-encompassing cultural or systemic influences. These influences encompass belief systems, bodies of knowledge, material resources, customs, opportunity structures, and life course options that are deeply ingrained within these larger systems (92,94). This perspective goes beyond the overarching term "culture" and emphasizes the importance of identifying specific social and psychological attributes at the systems level, which significantly shape the conditions and processes within an individual's immediate environment (94). Ungar underscores that, despite its seemingly abstract nature in terms of resilience influence, this level is intricately interconnected with the practical consequences of global factors that impact our daily life experiences (92). Regarding CHWs, research has shown that culture, customs, community resources, and the healthcare system are intricately linked to CHWs' motivation, well-being, and resilience in their roles (96,97). A study investigating attrition among CHWs in home-based care programs for individuals living with HIV/AIDS in western Kenya revealed that male CHWs were more likely to leave their positions. Part of this phenomenon was attributed to the traditional role of men as primary breadwinners in households, where the absence of compensation within the program fails to stimulate their engagement. During a focus group discussion, CHWs emphasized that introducing a salary would likely attract and retain more male CHWs, aligning with the cultural expectations of men as providers (96). Additional factors at the systems level are healthcare system integration and supports such as training, supervision, and remuneration, have been identified elsewhere as crucial contributors to CHWs' motivation, resilience, and overall well-being (11,22,37,80).

Applying a social-ecological perspective rooted in Bronfenbrenner’s model therefore allows for a more comprehensive examination of CHWs’ resilience and well-being in complex and resource-constrained environments. The approach does not situate resilience only within the individual CHW. Rather, it shows how resilience and well-being are shaped through the interaction of personal resources, relationships, community support, cultural expectations, and health system conditions. By integrating these levels in its interpretation, the thesis develops a context-sensitive understanding of CHWs’ ability to cope, function, and remain well in

challenging circumstances. This perspective also supports the development of strategies that strengthen not only individual coping, but also the relational, community, and system conditions that sustain community health programmes.

Table 2.1 Social-ecological framework guiding the thesis

Level	Core focus in the thesis	Illustrative processes and conditions
Individual	Personal interpretation and adaptation	Coping, emotion regulation, livelihood strain, faith, motivation
Relational	Immediate social supports and tensions	Family obligations, peer solidarity, supervision, household conflict
Community	Local expectations and reciprocity	Recognition, trust, cooperation, social value of CHW work
Structural / system	Programme and institutional arrangements	Incentives, resources, labour status, training, formal recognition
Seasonal / environmental	Temporal and ecological conditions	Rainfall, heat, mobility, agricultural calendar, workload changes

2.6 Seasonal Challenges in Healthcare and Impacts on CHWs

Seasonal variations present significant challenges to healthcare (13,98–101). These challenges influence healthcare priorities and the planning and implementation of both preventive and therapeutic initiatives. Seasonal variations also impact the personnel crucial to healthcare delivery (13,15,28,99). For community-based health programmes, these seasonal changes can affect workload, population mobility, household livelihoods, and access to the communities where services are delivered.

In tropical and sub-tropical regions, clear disparities exist between the dry and wet seasons in terms of disease prevalence, demand and supply of healthcare services, the economic burden of illnesses, and the workload and availability of health workers (13,102–104). The rainy season is often associated with heightened morbidity and mortality rates, stretched healthcare resources, increased economic strain due to illnesses, and a rise in non-medical activities such as farming (13,105,106). Conversely, the dry season, while presenting its unique challenges like severe heat and seasonal migration of healthcare providers (28,107), typically offer a more favorable environment for healthcare delivery and access (13). This period is characterized by decreased morbidity and mortality, enhanced healthcare accessibility, reduced disease transmission, relatively efficient economic output and steady service provider availability (13,105,108). However, in northern Ghana, the dry season also has extreme heat and prolonged environmental stress which creates physical strain and affects the delivery of community-based services (12)

Several studies have highlighted the influence of seasonal variations on CHW activities. (15,28,89,99,107). These variations not only alter their daily routines and priorities but also introduce potential stressors into their work. For instance, there is well-documented evidence of an increased workload during the rainy season, largely attributed to a surge in diseases and morbidity rates (13,89,99). This season also presents challenges in accessing communities for health services because of intense rainfall and subsequent flooding (109). Such accessibility issues are further exacerbated by the lack of adequate transportation and weather appropriate equipment, leading to longer commutes for CHWs and greater exposure to wet, flooded, or poorly maintained routes, which can adversely affect their well-being (15,89,107,110). Additionally, these rainy periods often coincide with peak agricultural activities in rural areas, compounding the burden on CHWs (13,15,89). The dual demands of professional and domestic responsibilities can conflict, potentially causing delay or even neglect of vital income-generating endeavors like farming and seasonal trading, adding further strain to CHWs. As CHWs come from the communities in which they serve, they face the same seasonal pressures on their households and livelihoods that their community peers also face.

2.7 Geoclimatic Context and Seasonal Variations of the Upper East Region

The study was conducted in Ghana's Upper East Region. This region is situated in northeastern Ghana, bordered by Burkina Faso to the north, Togo to the east, the Northern Region to the south, and the Upper West Region to the west (30,111). The region's climate is best described as tropical continental or interior savanna, largely influenced by the tropical continental air mass (29,30,111). Unlike Ghana's southern regions, which have two rainy seasons that generally extends from July to October, although rainfall patterns may begin earlier in some years. Annual rainfall here varies between 645mm and 1250mm. A prolonged dry season ensues from October to early June, characterized by dry harmattan winds, reduced humidity, and cooler nighttime temperatures. The region's average annual temperatures fluctuate between 15°C (December to February) and 45°C (March to April) (29,30,111).

For the context of this research, the study periods are classified as dry/early rainy, rainy, and transition/harvest seasons. These months bridge the gap between heavy rainfall and extreme dryness, coinciding with the harvest season. Notably, while harvest is an agricultural task, it is often associated with better health outcomes (32,112). In this region, CHWs frequently find their

work during this season particularly rewarding, as communities often compensate them with agricultural produce (28). This transition or harvest period may therefore represent a period of relative relief, when food availability, household resources, and community reciprocity can improve, with potential implications for CHW resilience and well-being.

2.8 Summary of Chapter

This chapter situates the thesis within the broader literature on CHWs, primary health care, resilience, well-being, and seasonality. First, it examines Ghana's Community-based Health Planning and Services programme as a key platform for bringing primary health care closer to communities. It also shows how CHWs play a dual role as both community members and actors in the health system.

The chapter then reviews resilience and well-being as multidimensional and context-dependent concepts, with particular attention to their relevance for CHWs who often work under demanding social, material, and programme conditions. It also introduces the social-ecological perspective that guides the thesis, emphasizing that CHW resilience and well-being are shaped not only by individual characteristics, but also by relationships, community expectations, cultural norms, health system structures, material resources, and environmental conditions. However, much of the existing literature has focused on related outcomes such as motivation, performance, retention, job satisfaction, and distress, with less attention to how CHWs themselves understand and experience resilience and well-being within their specific social and cultural contexts. Similarly, although individual, relational, community and health system factors have been linked to CHW experiences, there is also limited understanding about how these influences interact across scial-ecological levels to shape resilience and well-being.

Building on this foundation, the chapter discusses how seasonal variations can affect healthcare delivery, mobility, workload, livelihoods, disease burden, household resources, and CHWs' ability to fulfil their duties. By situating these issues within the geoclimatic context of the Upper East Region, the chapter shows why dry, rainy, and transition seasons are important for understanding CHWs' lived and work experiences. The chapter also examines the relationship between resilience and well-being, highlighting resilience as a potential pathway through which CHWs may sustain well-being in the face of adversity.

That said, there remains limited limited longitudinal evidence on whether resilience and well-being among CHWs vary across seasonal conditions, or whether the relationship between resilience and well-being varies over time. This chapter therefore establishes the rationale for studying CHW resilience and well-being as dynamic, social-ecological, and seasonally shaped experiences. These gaps provide the basis for the three studies in this thesis. That is, to examine how CHWs understand resilience and well-being; to isentify the contextual processes and interactions that shape these experiences; and to assess how resilience and well-being vary and relate to one another, across dynamic seasonal conditions.

CHAPTER 3

Methods

3.1 Chapter Overview

This chapter provides a general overview of the methods used throughout the thesis, including the overall design of the study, the study context, qualitative and quantitative approaches, sampling procedures, data collection processes, analytic strategies and formulae, and the process to integrate the findings across the three studies.

The first qualitative study explored how CHWs understand and describe resilience and well-being within their everyday social and work contexts. The second qualitative study extended this by examining the processes and contextual factors that shape resilience and well-being across individual, relational, community, structural, and seasonal domains. The third study used a prospective longitudinal cohort design to examine whether resilience and well-being varied across dry, rainy, and transition seasons, and whether resilience was associated with well-being over time. Although the thesis was not initially framed in formal mixed-methods terms, its structure reflects a sequential exploratory mixed-methods design. The qualitative studies first explored the meanings and contextual processes of resilience and well-being among CHWs, while the longitudinal cohort study then examined whether these experiences varied across time and seasonal conditions. This approach was appropriate because the qualitative findings helped situate resilience and well-being within CHWs' lived and work contexts before the quantitative study examined their seasonal patterns and relationship over time.

Within this pragmatic orientation, the qualitative phase focused on how CHWs understood and experienced resilience and well-being in their own context, while the longitudinal phase examined how these experiences varied over time and across seasons using standardized measures. The qualitative findings also informed the development of the longitudinal hypotheses, the selection of relevant social, occupational, programme, and seasonal variables, and the interpretation of the longitudinal findings.

3.2 Study setting

The studies were conducted in Ghana's Upper East Region, a setting shaped by strong reliance on community-based primary health care, marked seasonal variability, and substantial dependence on volunteer or partially compensated CHW labour. The region is located in northeastern Ghana and is bordered by Burkina Faso to the north and Togo to the east. It has a largely rural population and includes districts that were central to the early development of

Ghana's Community-based Health Planning and Services (CHPS) model. The qualitative studies were conducted in the Kassena-Nankana Municipality and Kassena-Nankana West District, while the longitudinal cohort study expanded the study area to include the Builsa North District, also in the Upper East Region (21).

The Kassena-Nankana Municipality and Kassena-Nankana West District were selected because of their early involvement in the implementation of the CHPS programme, which provided an opportunity to include CHWs with varying lengths of experience (10). Builsa North District was subsequently added to broaden contextual variation while maintaining a comparable Upper East Region setting with distinct seasonal patterns.

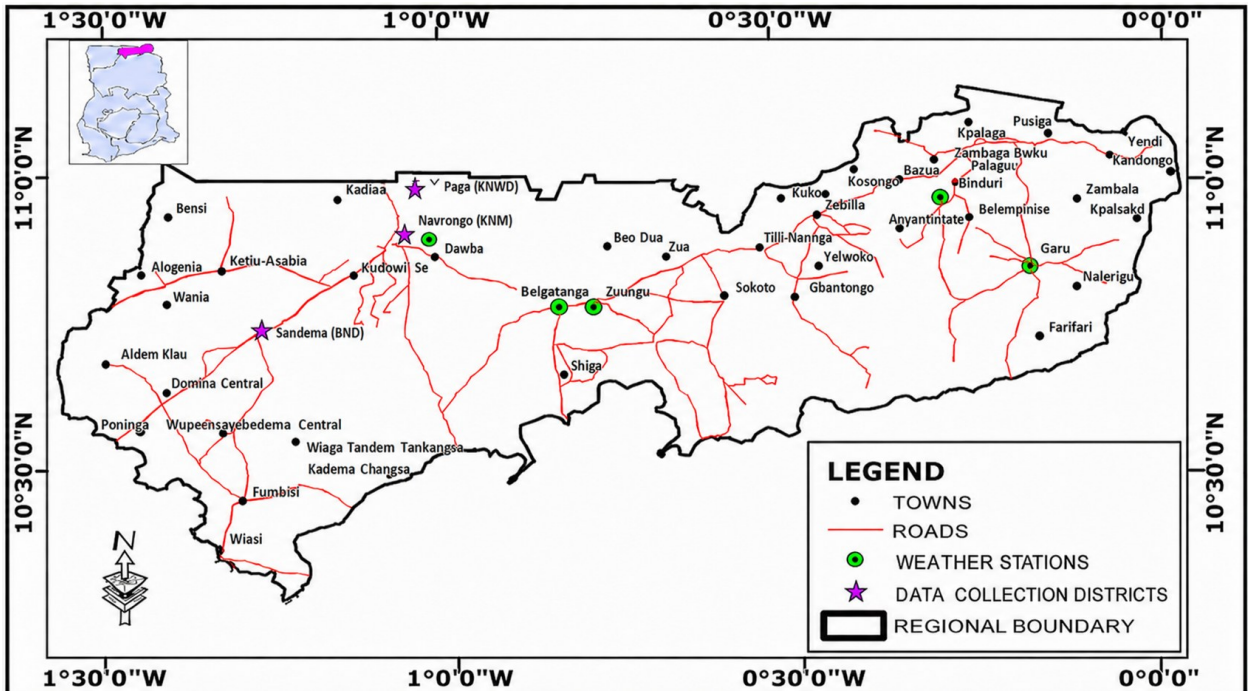


Figure 3.1. Map of the Upper East Region of Ghana showing towns, roads, weather stations, and study districts. Adapted from Issahaku, Campion, and Edziyie (2016)

3.2.1 Health profile of the Upper East Region

The health profile of the Upper East Region reflects both the communicable disease burden common in northern Ghana and the broader primary health care needs of rural communities. Malaria remains important, and national health sector studies and reports continue to identify the disease as a leading outpatient condition in Ghana (113–115). Recent malaria programme data

show that CHWs contribute substantially to malaria testing and case reporting; in 2022, CHW-reported malaria cases accounted for about one-third of total reported malaria cases nationally (116). The Upper East Region is also included in targeted malaria interventions such as seasonal malaria chemoprevention and indoor residual spraying, reflecting the relevance of seasonal malaria transmission to the region (116). Alongside malaria, common primary care concerns relevant to CHW activities include diarrhoeal diseases, pneumonia or acute respiratory infections, anaemia, undernutrition, skin conditions, and maternal and child health needs (117,118). The 2022 Ghana Demographic and Health Survey also reported regional variation in child health and nutrition indicators, including malaria parasitaemia and stunting, with the Upper East Region showing notable levels of child malaria and stunting (117,118).

Concurrently, the region's health profile should also be understood within Ghana's increasing burden of non-communicable diseases (NCDs) and related comorbidities. Nationally, NCDs account for approximately 45% of all deaths in Ghana, with cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes identified as major contributors (119). The 2023 Ghana STEPS survey further showed that 21.7% of adults aged 18–69 years were living with hypertension, 5.2% had elevated fasting blood glucose or were currently on medication for diabetes, and 10.2% had impaired fasting glucose, indicating a growing need for screening, prevention, referral, and long-term follow-up within primary health care (119). Evidence from the context of this thesis also points to the local relevance of this transition. In the Kassena-Nankana districts, community members and health workers have identified hypertension and type 2 diabetes as increasingly common concerns, while local screening studies have reported hypertension, diabetes risk, depression, and gaps in awareness, treatment, and control (120,121). This changing disease profile suggests that CHWs may increasingly be expected to support not only communicable disease control and maternal and child health activities, but also health education, referral, follow-up, and community mobilization around chronic conditions and their comorbidities.

Neglected tropical diseases are also relevant to the health context in which CHWs work. Ghana's NTD programme includes conditions such as lymphatic filariasis, onchocerciasis, schistosomiasis, soil-transmitted helminth infections, and trachoma, with community-based mass drug administration relying heavily on community drug distributors and other community-level actors (122). In the Upper East Region specifically, studies have identified persistent lymphatic

filariasis hotspots in districts such as Kassena-Nankana East Municipality and Nabdam after several years of mass drug administration (123).

This disease profile helps explain why CHWs in the region may be involved in a wide range of activities, including household visits, health education, referrals, malaria prevention and treatment support, seasonal malaria chemoprevention activities, immunization and child health outreach, maternal health follow-up, community mobilization, and support for public health campaigns such as NTD mass drug administration.

This setting was important for the thesis for several reasons. First, CHWs in the region operate within the CHPS programme, where they support Community Health Officers and other health system actors to support community-based primary health care. Second, the selected districts were among the first to implement CHPS in Ghana, providing a study context where both experienced and relatively new CHWs could be included (9,10). This was important for capturing a range of perspectives on resilience and well-being across different lengths of service and exposure to the CHPS model. Third, the Upper East Region has clear dry, rainy, and transition/harvest periods, which shape livelihoods, disease burden, mobility, agricultural work, household resources, and health service delivery (30,113). The setting was therefore not treated as a mere background, but as a constitutive part of the social, programme, and environmental context shaping CHW resilience and well-being.

3.3 Qualitative Studies

3.3.1 Qualitative Objectives and Design

The qualitative component of the thesis examined resilience and well-being among CHWs in Ghana and the social-ecological processes that shaped these experiences. This component was carried out through two related qualitative studies using the same semi-structured topic guide and the same CHW interview dataset, with the second study also drawing on stakeholder interviews (12,21).

The first qualitative study explored how CHWs in the Upper East Region understood and described resilience and well-being within their everyday social and work contexts. This was important because existing research on CHW resilience and well-being has often relied on standardized quantitative measures, which may not fully capture how these concepts are

experienced and expressed in specific cultural, social, and programme contexts. Using a phenomenological approach (124), the study examined CHWs' own accounts of resilience and well-being, including how these concepts were connected to personal coping, social support, spirituality, livelihood conditions, community relationships, and health system realities.

The second qualitative study built on this understanding by examining the contextual processes and interactions that shaped CHW resilience and well-being across different levels of their social ecology. This included individual, relational, community, cultural, health system, and seasonal influences. Rather than treating resilience and well-being as individual attributes alone, the analysis examined how CHWs' experiences were shaped through the interaction of personal resources, family and community relationships, supervision, incentives, workload, recognition, material resources, and environmental conditions.

3.3.2 Sampling and Participants

Data for the first and second qualitative studies were collected at the same time using the same semi-structured topic guide. Interviews were conducted between June and August 2023 in the Kassena-Nankana Municipality and Kassena-Nankana West District. The sampling frame consisted of active CHWs in the two study districts who were listed in administrative records provided by the district CHPS coordinators. These lists were used only to identify the pool of eligible CHWs across the study districts and CHPS zones.

Sixteen CHWs were selected using a multistage purposive sampling process designedto capture variation across district ormunicipality, gender, and length of CHW experience, public health campaign involvement and CHPS zone context These characteristics were considered relevant because they could shape how resilience and well-being were experienced, interpreted, and enacted in everyday work and social contexts. The sampling process began with identifying eligible active CHWs from district administrative lists across CHPS zones, followed by purposive selection of participants to ensure representation of CHWs across the predefined sampling criteria and service-area conditions.

To select CHWs, district CHPS coordinators provided lists of CHWs in their respective districts, but recruitment was conducted without the involvement of the coordinators. The selection criteria were communicated to district CHPS coordinators and CHWs during the recruitment process. This approach allowed the study team to identify eligible participants through the CHPS

system while ensuring that coordinators did not determine who ultimately participated in the study.

Participation was voluntary, and interviews were conducted only after participants had received information about the study and provided informed consent. Recruitment continued until sufficient thematic recurrence was observed within the dataset, with attention to whether successive interviews were producing recurring patterns relevant to the study aims. If more CHWs were eligible or expressed interest than required, participants were selected based on the purposive criteria described above.

For the second qualitative study, the analysis drew on the same 16 CHW interviews and four additional stakeholder interviews, giving a total of 20 in-depth interviews. Stakeholders were purposively selected because they were directly involved in CHW activities or worked closely with CHWs within the CHPS system. Eligible stakeholders included regional and district CHPS coordinators, CHW supervisors, community health nurses who worked with CHWs, and members of the District Health Management Teams. Stakeholder participation was also voluntary, and interviews were arranged only after participants had received study information and provided informed consent

3.3.3 Data Collection

Data were collected through one-on-one semi-structured interviews conducted by me and two male graduate research assistants who were fluent in Kasem and Nankani, the main local languages used in the study area. Before data collection, the research assistants were oriented to the study objectives, topic guide, consent procedures, confidentiality, audio-recording, field notetaking, probing techniques, and the importance of conducting interviews in a respectful and non-leading manner.

The research team also reviewed the topic guide together to support consistency across interviewers while allowing flexibility for participants to describe their experiences in their own words. The topic guide was developed in English, translated into Kasem and Nankani by a trained bilingual translator, and checked for conceptual consistency across the English and local-language versions. The translated guides were pre-tested with two CHWs to assess clarity, cultural relevance, and appropriateness before formal data collection began.

The CHW and stakeholder interview guides, including the local-language translations and back-translations, are provided in Appendices 2.7–2.16.

Each participant took part in one guided conversation lasting approximately 30 to 67 minutes. Interviews were scheduled at times convenient for participants and conducted in community locations where participants felt comfortable and could speak privately. Interviews were conducted in Kasem, Nankani, or English, depending on participants' preference. All interviews were audio-recorded with participants' permission, and field notes were taken during and immediately after interviews to document contextual observations, non-verbal cues, and preliminary analytic reflections (125). Before each interview, informed consent was confirmed, and participants were reminded that participation was voluntary, that they could skip any question they did not wish to answer, and that they could stop the interview at any time without penalty.

The topic guide first elicited participants' everyday experiences, roles, challenges, and memorable events as CHWs before moving into direct questions about resilience and well-being. This sequencing allowed participants to describe their lived experiences before being asked to reflect on more abstract concepts. Resilience was described in lay terms as "picking oneself up after facing difficulties or challenges," while well-being was described as "to possess good health and happiness." These explanations were used only as conversational anchors in the local languages, after which participants were invited to define and describe both concepts in their own words.

The topic guide also explored relationships, social support networks, community influences, cultural and spiritual beliefs, supervision, health system factors, and other contextual conditions that could shape resilience and well-being. Stakeholder interviews focused on how health system actors perceived the factors influencing CHW resilience and well-being, including the role of individuals, groups, social networks, and health system structures. Probes were used throughout the interviews to clarify responses and encourage richer descriptions.

3.3.4 Translation, Transcription, and Data Management

Local-language interviews were transcribed into English by a professional transcriptionist, while English-language interviews were transcribed verbatim. Because translation can involve shifts in meaning, translated transcripts were reviewed by members of the research team who were

familiar with the local languages and study context (126). Two members of the analytic team who were native speakers also verified selected translations against the audio recordings to help preserve culturally specific meanings and minimize distortion. This process supported collaborative analysis and helped maintain consistency across transcripts.

Transcripts were organized using unique participant identifiers and imported into NVivo 14.0 for data management and analysis. Participant names and contact information collected for interview scheduling were stored separately from the transcripts. CHPS zone and district/municipality information were retained only for contextual and sampling purposes. Direct identifiers were removed before analysis, and quotations were presented without names or other details that could compromise confidentiality.

Audio files, transcripts, and analytic files were password-protected and stored on a secure Sync.com server and a University of Ottawa research drive. Written field notes and consent forms were stored separately in locked storage. Access to identifiable data was restricted to the principal investigator, data analyst, thesis supervisors, and authorized research assistants, all of whom were required to maintain confidentiality. Data will be retained for ten years, after which written notes will be shredded and electronic files will be securely deleted.

3.3.5 Interpretative Phenomenological Analysis

Interpretative phenomenological analysis was used to analyse the qualitative data (127). This approach was appropriate because we sought to understand how CHWs made sense of resilience and well-being in their everyday social and work contexts. IPA combines a phenomenological focus on lived experience with an interpretive process that examines how participants give meaning to those experiences (127).

In this thesis, IPA allowed the analysis to attend not only to what CHWs explicitly said about resilience and well-being, but also to how these concepts were expressed through their narratives of work, challenge, coping, support, spirituality, community relationships, and everyday life. The analysis was therefore grounded in participants' narratives, while the final themes represented an interpretive synthesis of shared patterns of meaning across accounts rather than a simple listing of responses.

The analytic process was iterative. My co-coder and I first discussed the IPA framework and analytic approach before coding began. Transcripts were organized by unique identifiers and imported into NVivo 14.0. Both analysts read the transcripts multiple times and listened to selected audio recordings to deepen familiarity with participants' accounts and the context in which they were produced. Initial coding focused on statements and narratives that illuminated resilience, well-being, CHW roles, work-related challenges, coping, support systems, and contextual influences. Detailed notes were attached to relevant sections of transcripts to capture observations, reflections, and early interpretations.

A working codebook and framework were developed iteratively throughout analysis to organize and refine the coding structure. Initial coding was primarily inductive, with codes generated through close reading of the transcripts to capture CHW roles and functions, experiences of resilience and well-being, and contextual factors that positively or negatively shaped these experiences. As the analysis progressed, these data-driven codes were refined and organized in relation to the study objectives and the social-ecological framework, allowing the analysis to remain grounded in participants' accounts while also examining how experiences operate across individual, relational, community, structural and seasonal contexts. Each code included a brief description to support consistent application during coding. The codebook was refined as related codes were clarified, merged, reorganized, or clustered into broader analytic categories. For example, resilience-related codes were grouped under cognitive and adaptive resilience, collective or communal resilience, emotional resilience, and spiritual and faith-based resilience, while well-being codes were organized around environmental, financial, mental and emotional, physical, social, and spiritual dimensions.

Emergent themes were identified within individual transcripts and then compared across participants. My co-coder and I regularly met to refine first-level codes, clarify meanings, identify relationships among codes, and remove redundant or overlapping codes. Where code clusters overlapped or where interpretation was unclear, the analysts reviewed relevant transcript sections and audio recordings together to ensure that meanings were accurately captured. Common themes were then grouped across interviews based on conceptual similarities and connections, leading to the development of subthemes and overarching themes. Attention was also given to convergence and divergence across accounts, including counterpoints or perspectives that differed from the dominant patterns.

Although my co-coder and I led the coding and analysis, interpretation was not undertaken in isolation. Emerging codes, theme groupings, and interpretations were discussed with the thesis supervisors, thesis advisory committee and research assistants to compare interpretations, clarify culturally specific meanings, challenge assumptions, and refine the thematic structure. These discussions served as a form of analytic validation and helped ensure that the themes reflected participants' accounts and the broader study context rather than the interpretation of a single analyst. The final themes were interpreted in relation to the study objectives, the social-ecological framework, and the broader literature on CHW resilience and well-being. An intersectional lens was also applied during interpretation to examine how participants' experience of resilience and well-being were shaped by the interaction of gender, length of CHW experience, district context, livelihood roles, community expectations, and access to support. For sampling and descriptive purposes, participants were identified in the study records as men or women, consistent with the contextual understanding and use of these terms within the study setting. Gender was then examined analytically as a social and contextual influence reflected in participants' accounts of household responsibilities, livelihood expectations, work burden, social roles, and access to supports.

3.3.6 Socio-Ecological Analysis

The second qualitative analysis applied a social-ecological perspective to examine how resilience and well-being were shaped across interacting levels of influence. Rather than treating barriers and facilitators as isolated factors, this analysis examined how individual, relational, community, health system, structural, and seasonal conditions interacted in CHWs' everyday experiences.

This approach made it possible to examine how the same factor could operate differently depending on context. For example, community relationships could strengthen resilience through recognition, trust, and support, while community expectations, resistance, or lack of material support could also create stress and undermine well-being. Similarly, family responsibilities, supervisory demands, financial insecurity, lack of formal status, and seasonal workload were examined as connected conditions that shaped CHWs' resilience and well-being

3.3.7 Reflexivity and Trustworthiness

Reflexivity was maintained throughout data collection, analysis, and interpretation. As a Ghanaian-Canadian researcher with prior experience conducting community health research in

Ghana, I occupied both insider and outsider positions in relation to the study. My familiarity with the CHPS programme, the local health system, and the study context helped build rapport with participants and supported contextual interpretation. At the same time, this familiarity required ongoing reflection to avoid assuming shared understanding or imposing prior knowledge of CHW programmes onto participants' accounts.

The research team also reflected on the fact that all interviewers were male, and how this could shape rapport, disclosure, and responses among both male and female CHWs. These gendered positional considerations were discussed during team debriefings and analytic discussions. Reflexive notes and analytic memos were maintained to document emerging interpretations, coding decisions, and changes to the thematic structure.

Trustworthiness was strengthened through careful documentation of the analytic process. Credibility was supported through team-based review of codes and themes, comparison of transcript interpretations with audio recordings where needed, attention to convergent and divergent accounts, and consideration of counterpoints that did not fit dominant patterns. Dependability was supported through maintenance of a codebook and a framework outlining coding and theme development. Confirmability was enhanced through reflexive and collaborative interpretation, while transferability was supported by detailed description of the study setting, participant selection, recruitment, data collection, and analytic procedures. The qualitative manuscripts were also reported using the Consolidated Criteria for Reporting Qualitative Research (128), which supported transparency in reporting participant selection, data collection, analysis, and interpretation.

3.4 Longitudinal cohort study

3.4.1 Study Design and Objectives

The third study used a prospective longitudinal cohort design to examine seasonal variation in resilience and well-being among CHWs in Ghana. This study built on the qualitative findings by quantitatively examining whether resilience and well-being changed across seasonal conditions and whether resilience was associated with well-being over time. The same CHWs were followed across three seasonal data-collection waves in 2024: dry/early rainy season from March to June, rainy season from July to August, and transition/harvest season from October to December.

The study had two related objectives. The first was to determine whether CHW resilience and well-being differed across the three seasonal periods. This was important because seasonal conditions in northern Ghana can influence disease burden, mobility, workload, farming responsibilities, household economic conditions, and access to communities. The second objective was to examine the association between resilience and well-being across seasons, including whether this relationship differed by season.

The longitudinal design was appropriate because it allowed resilience and well-being to be examined within the same CHWs across changing seasonal conditions. The repeated-measures design also made it possible to examine both differences between CHWs and changes within the same CHW over time.

3.4.2 Study Hypotheses

This study tested two hypotheses. First, it was hypothesized that CHW resilience and well-being would differ across seasons, with the highest levels expected during the transition/harvest season. Second, it was hypothesized that resilience would be positively associated with well-being across seasonal periods, and that the strength of this association would vary by season.

3.4.3 Study Population and Sampling

The cohort was drawn from active CHWs in three administrative areas in the Upper East Region: Kassena-Nankana West District, Kassena-Nankana Municipality, and Builsa North District. These districts were selected from the 15 districts in the region and served as the primary clusters for the longitudinal study. Within each selected district, CHWs were randomly sampled from administrative lists provided by the Ghana Health Service and maintained by the district health administrations.

Eligible participants were required to be actively engaged in CHW duties and to have access to a telephone, as the survey was administered by phone. CHWs without telephone contact information on the administrative lists were excluded from the sampling frame. After the lists were obtained, each eligible CHW was assigned a unique study identifier, and random numbers were generated and matched to these identifiers to select the preliminary sample.

Selected CHWs were contacted by the research team, informed about the study, assessed for eligibility, and invited to participate using a prepared recruitment script. Participation was voluntary, and eligible CHWs were enrolled only after providing informed consent.

The sample size was determined using power analysis in WebPower for repeated-measures mixed-effects analysis. The calculation assumed an autoregressive correlation structure among repeated measures within the same CHW, an expected within-person correlation of 0.6, a two-sided alpha of 0.05, power of at least 80%, and a modest effect size of 0.2. Anticipated retention rates were 100%, 80%, and 75% across the three seasonal assessments. Based on these assumptions, 420 CHWs were sampled for contact and recruitment.

3.4.4 Data Collection Procedures

Data were collected through phone-based surveys at each of the three seasonal waves described above. Each survey lasted approximately 15 to 25 minutes and was scheduled at a time convenient for the participant. Participants who were available during the first call completed the survey immediately, while those who preferred another time were scheduled for a later call. At each data-collection wave, research assistants attempted to contact selected or enrolled CHWs by phone up to three times before classifying them as unreachable for that wave.

Data were collected by the principal investigator and four trained research assistants. Before data collection began, the research assistants were oriented to the study objectives, questionnaire content, phone-survey procedures, verbal consent process, confidentiality requirements, participant withdrawal procedures, and documentation of completed, incomplete, rescheduled, and unsuccessful calls. The training emphasized neutral administration of the questionnaire, respectful communication, and consistency across survey waves.

Surveys were administered in the participant's preferred language, including English, Kasem, Nankani and Buli, which were languages used in the study districts. The questionnaire was translated into these three main local languages and back-translated to check consistency with the English version. The translated and back-translated versions are included in the appendices.

Before each survey, the consent form and study information were read to participants by phone. This included the study purpose, what participation involved, confidentiality protections, potential risks and benefits, and participants' right to decline or stop participation. Verbal

consent was obtained at baseline and reconfirmed at each follow-up wave. Participants could skip any question they did not wish to answer or withdraw from the study without penalty. After consent was obtained, information sheets were later deposited at the CHPS compounds closest to participants so they could pick them up and keep them for future reference. To reduce the cost burden of participation, participants received mobile phone credit valued at GHC 10 after each completed survey.

3.4.5 Data Collection Instrument

The same questionnaire was administered at each seasonal time point. The two primary outcomes were resilience and well-being. Resilience was measured using the 28-item Resilience Research Centre–Adult Resilience Measure (RRC-ARM) developed for assessing resilience resources among adults from a social-ecological perspective (129). Each item is scored on a five-point Likert scale ranging from 1 ("not at all") to 5 ("all the time"), giving a total score range of 28 to 140. Higher scores indicate higher resilience. The RRC-ARM was appropriate for this thesis because it captures social-ecological dimensions of resilience, including individual, relational, community, cultural, and contextual resources.

Well-being was measured using the World Health Organization 5-Item Well-Being Index (WHO-5) (130). Each item is scored from 0 ("never") to 5 ("always"). Raw scores range from 0 to 25 and were transformed to a 0–100 scale, with higher scores indicating better well-being. Before total scores were used in the longitudinal analyses, internal consistency of the RRC-ARM and WHO-5 was assessed using Cronbach's alpha by district and season.

Independent variables were selected a priori based on findings from the qualitative studies and the social-ecological framework. These included individual characteristics, stressful or nodal life events, relational factors such as supervision and social support, community-level factors such as trust and community relationships, and health system factors such as training, remuneration, institutional support, and integration. Most social, occupational, programme, and environmental variables were recorded directly in the questionnaire at each survey wave. Time-fixed variables, such as sex, age, years as a CHW, and district, were collected at baseline. Time-varying variables, including household income, nodal life events, incentive frequency, resources received, training, supervision, campaign participation, transportation, equipment, protective gear, and perceived climate-related challenges, were collected at each wave where applicable.

Climate related conditions were assessed using both perceived and objective measures. Participants reported how climate change had affected local climate patterns and weather conditions in their community over the previous decade; this was treated as a measure of perceived climate related change. Objective environmental exposures, including daily temperature and rainfall from the Ghana Meteorological Agency, were assigned to participants based on interview date and district to reflect the climatic conditions corresponding to each survey wave.

3.4.6 Variable Definitions and Score Derivations

The RRC-ARM total score was calculated as the sum of the 28 item scores:

$$\text{RRC-ARM}_{it} = \sum_{k=1}^{28} X_{kit}$$

where X_{kit} represents the score for item ***k*** for participant ***i*** at season ***t***. The possible score range was:

$$28 \leq \text{RRC-ARM}_{it} \leq 140$$

The WHO-5 raw score was calculated as the sum of the five item scores:

$$\text{WHO5 Raw}_{it} = \sum_{k=1}^{5} W_{kit}$$

where W_{kit} represents the score for WHO-5 item **k** for participant ***i*** at season ***t***. The raw score was then transformed to a 0–100 scale:

$$\text{WHO5}_{it} = \text{WHO5 Raw}_{it} \times 4$$

where higher values indicate better well-being.

Season was treated as a categorical exposure with three levels:

$$\text{Season}_{it} \in \{\text{Dry/Early Rainy}, \text{Rainy}, \text{Transition/Harvest}\}$$

The transition/harvest season was used as the reference category in the main seasonal models because it represented a period of relative environmental and workload stability.

3.4.7 Data Cleaning and Preparation

Before analysis, the longitudinal dataset was checked for duplicate participant identifiers, invalid values, inconsistent coding, and correct linkage of repeated observations to the same CHW across the dry, rainy, and transition seasons. Survey dates were also reviewed to confirm that each observation was assigned to the appropriate seasonal wave.

Categorical variables were formatted and recoded in SAS to ensure consistent interpretation across models. These included season, district, sex, education, marital status, household income, years as a CHW, selection pathway, campaign participation, transportation, resources received, training, supervision, incentive frequency, community involvement, nodal life events, perceived climate change effects, severity of extreme weather events, and climate-related work challenges. Where needed, sparse, missing, or non-applicable responses were recoded into analytically meaningful categories.

Cell sizes were examined for key cross-tabulations, including district by season, season by incentive frequency, and district by season by incentive frequency, to assess whether planned interaction models had sufficient observations across strata. Descriptive summaries were also generated at the participant level to examine the number of repeated observations per CHW and average resilience and well-being across waves.

Scale items were reviewed for valid response ranges before total scores were calculated. Resilience was calculated from the 28 RRC-ARM items, and well-being from the five WHO-5 items. Internal consistency of both measures was assessed using Cronbach's alpha by district and season before total scores were used in longitudinal models.

Weather variables, including rainfall, average temperature, and maximum temperature, were obtained from the Ghana Meteorological Agency and checked before analysis. Perceived

changes in local weather conditions were recoded into broader categories, and weather variables were examined as potential environmental covariates.

3.4.8 Statistical Analysis Overview

The analysis began with descriptive statistics. Resilience and well-being scores were summarized by season using means, standard deviations, and ranges.

Exploratory longitudinal plots were generated to examine mean resilience and well-being patterns across seasons and by participant characteristics such as sex. These plots were used to assess whether the seasonal patterns appeared approximately linear or whether more flexible seasonal modelling was needed.

All primary longitudinal analyses used linear mixed-effects models. This modelling approach was appropriate because resilience and well-being were continuous outcomes measured repeatedly in the same individuals. Repeated observations within the same CHW are correlated and therefore violate the independence assumption of ordinary linear regression. The mixed-effects approach accounts for this by including participant-specific correlation structures.

Model building proceeded in stages. First, unadjusted season-only models were fitted for resilience and well-being. Second, candidate covariates were examined in relation to each outcome using models informed by the social-ecological framework. Third, adjusted models were fitted using prespecified covariates and theoretically important variables, with interaction terms added where the research questions required assessment of contextual differences in seasonal patterns.

3.4.9 Linear Mixed-Effects Model

The general linear mixed-effects model used in this thesis can be written as:

$$Y_{it} = \beta_0 + \beta_1 Season_{it} + \sum_{p=1}^{P} \beta_p X_{pit} + b_i + \varepsilon_{it}$$

Where;

Y_{it}	Outcome for participant ***i*** at season ***t***, either resilience or well-being
β_0	Fixed intercept

X_{it}	Time-varying predictors, such as season or resilience;
Z_i	Time-invariant or baseline covariates, such as district or participant characteristics
b_i	Participant-specific random intercept
ε_{it}	Residual error term
$b_i \sim N(0, \sigma_b^2)$	The random intercept was assumed to follow a normal distribution
$\varepsilon_{it} \sim N(0, \sigma^2)$	Residual errors were assumed to follow

Models were fitted using SAS PROC MIXED. Restricted maximum likelihood estimation was used for final model estimation, and Kenward–Roger degrees of freedom were used to improve inference for fixed effects in the presence of repeated measures and an unbalanced longitudinal dataset.

Several residual covariance structures were evaluated to account for within-person correlation across the three seasonal waves. Candidate structures included autoregressive AR(1), heterogeneous autoregressive ARH(1), and unstructured covariance. Model fit was assessed using convergence, likelihood-based fit statistics, AIC, BIC, and likelihood-ratio tests where models were nested. The SAS assumption-checking output confirmed that the diagnostic models converged and that repeated observations were modelled using participant-level correlation structures.

Because the study included only three repeated seasonal observations, the covariance structure was chosen to balance model fit, convergence, and interpretability. The final models therefore accounted for within-person correlation across seasons and allowed the residual variance structure to reflect seasonal differences in variability.

3.4.10. Heterogeneous Autoregressive Covariance Structure

The ARH (1) covariance structure assumes that measurements closer in time are more strongly correlated than measurements farther apart, while also allowing the residual variance to differ across seasons.

For two observations at seasons ***t*** and ***s***, the covariance can be written as:

$$\text{Cov}(\varepsilon_{it}, \varepsilon_{is}) = \sigma_t \sigma_s \rho^{|t-s|}$$

Where:

σ_t^2	The residual variance at season ***t***
σ_s^2	The residual variance at season ***s***
ρ	The autoregressive correlation between adjacent seasonal observations

This covariance structure was used because the data were collected across ordered seasonal periods and because residual variability was expected to differ across dry, rainy, and transition conditions.

3.4.11 Hypothesis 1: Seasonal Variation in Resilience and Well-being

To test whether resilience and well-being differed across seasons, separate mixed-effects models were fitted for each outcome. Season was modelled as a categorical exposure, with transition/harvest season as the reference category.

The unadjusted model was:

$$Y_{it} = \beta_0 + \beta_1 \text{Dry}_{it} + \beta_2 \text{Rainy}_{it} + b_i + \varepsilon_{it}$$

where Y_{it} represents either resilience or well-being for participant ***i*** at season ***t***. The coefficients β_1 and β_2 represent the mean difference in the outcome during the dry/early rainy and rainy seasons, respectively, compared with the transition/harvest season.

The adjusted model included district and prespecified socio-demographic, occupational, relational, structural, and environmental covariates:

$$Y_{it} = \beta_0 + \beta_1 \text{Dry}_{it} + \beta_2 \text{Rainy}_{it} + \sum_{p=1}^{P} \gamma_p C_{pit} + b_i + \varepsilon_{it}$$

where C_{pit} represents the set of covariates selected a priori based on the social-ecological framework.

Covariates were selected based on the social-ecological framework, prior qualitative findings, and model-building checks conducted in SAS. Candidate variables were assessed across individual, relational, community, health-system, and environmental domains. Variables examined included sex, age, household income, years as a CHW, selection pathway, nodal life events, supervision, incentive frequency, resources received, perceived climate effects, severity of extreme weather events, rainfall, and temperature. Operational details and questionnaire items for these variables are provided in Appendix 2.3.

To assess whether seasonal patterns differed by context, interaction terms were added for season by district and season by incentive frequency:

$$Y_{it} = \beta_0 + \beta_1 \text{Season}_{it} + \beta_2 \text{District}_i + \beta_3 \text{Incentive}_{it} + \beta_4 (\text{Season}_{it} \times \text{District}_i) + \beta_5 (\text{Season}_{it} \times \text{Incentive}_{it}) + \sum_{p=1}^{P} \gamma_p C_{pit} + b_i + \varepsilon_{it}$$

When interaction terms were statistically significant, interpretation focused on adjusted marginal means, simple effects within strata, and multiple-comparison-adjusted contrasts rather than only the main season coefficients. This was important because the meaning of seasonal differences depended on district and incentive context in some models.

3.4.12 Hypothesis 2: Association Between Resilience and Well-being

To test whether resilience was associated with well-being, mixed-effects models were fitted with well-being as the outcome and resilience as the main exposure. Interaction terms between resilience and season were included to assess whether the association varied across seasonal periods.

The unadjusted model was:

$$WB_{it} = \beta_0 + \beta_1 R_{it} + \beta_2 \text{Season}_{it} + b_i + \varepsilon_{it}$$

where WB_{it} is the well-being score for participant ***i*** at season ***t***, and R_{it} is the resilience score for participant ***i*** at season ***t***.

The adjusted model included district and prespecified socio-demographic, occupational, relational, structural, and environmental covariates:

$$WB_{it} = \beta_0 + \beta_1 R_{it} + \beta_2 \text{Season}_{it} + \beta_3 (R_{it} \times \text{Season}_{it}) + \sum_{p=1}^{P} \gamma_p C_{pit} + b_i + \varepsilon_{it}$$

Resilience was centred at the sample mean before creating interaction terms to improve interpretability:

$$R_{it}^{c} = R_{it} - \bar{R}$$

where R_{it}^{c} is the centred resilience score and $\bar{R}$ is the overall sample mean resilience score.

3.4.13 Within-Person and Between-Person Decomposition of Resilience

To distinguish stable differences between CHWs from seasonal change within the same CHW, resilience was decomposed into between-person and within-person components.

The between-person component was calculated as each CHW's mean resilience across observed waves:

$$R_i^{BP} = \frac{1}{T_i} \sum_{t=1}^{T_i} R_{it}$$

where T_i is the number of observed waves for participant ***i***.

The within-person component was calculated as the seasonal deviation from each CHW's own mean:

$$R_{it}^{WP} = R_{it} - R_i^{BP}$$

The model for well-being then became:

$$WB_{it} = \beta_0 + \beta_1 R_i^{BP} + \beta_2 R_{it}^{WP} + \beta_3 \text{Season}_{it} + \beta_4 (R_{it}^{WP} \times \text{Season}_{it}) + \sum_{p=1}^{P} \gamma_p C_{pit} + b_i + \varepsilon_{it}$$

In this model, β_1 estimates whether CHWs with higher average resilience across waves also reported higher well-being, while β_2 estimates whether seasonal increases in resilience above a CHW's own average were associated with changes in well-being. The interaction term tests whether the within-person resilience–well-being association differed across seasons.

3.4.14 Missing Data and Sensitivity Analyses

After data cleaning, completeness and retention were assessed across the three survey waves. Participants with at least one valid outcome measure were retained in the longitudinal mixed-effects analyses. Because retention was high and missingness for the primary outcomes was minimal, analyses used available observed data. Linear mixed-effects models use likelihood-based estimation and can incorporate all available repeated observations per participant; therefore, imputation was not conducted.

Model diagnostics were conducted using residual plots, histograms, quantile–quantile plots, and residual summaries from the final fitted models. Conditional and marginal residuals were examined for both resilience and well-being models. Residuals were generally centred close to zero, supporting the adequacy of the fixed-effect structure. Although formal normality tests indicated departures from normality, these were interpreted alongside visual diagnostics because of the large number of observations and the bounded nature of the resilience and well-being scales. Visual inspection did not suggest patterns that materially altered interpretation of the main models.

Sensitivity analyses were conducted to assess robustness to model specification. These included comparing alternative covariance structures, assessing models with and without participant-level random intercepts, checking district-specific residual structures, and re-estimating models using alternative environmental covariates, such as maximum temperature in place of average temperature. The substantive interpretation of the main findings was considered robust when seasonal patterns and the resilience–well-being association remained consistent across these alternative specifications (131,132).

3.4.15 Statistical Software

All quantitative analyses were conducted in SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). PROC FREQ was used to examine cell sizes and categorical distributions; PROC MEANS was used to summarize participant-level and seasonal patterns; PROC CORR with alpha was used to assess internal consistency of the RRC-ARM and WHO-5 scales; PROC MIXED was used for longitudinal mixed-effects models; and PROC UNIVARIATE was used to examine residual distributions and model diagnostics. Model-based predictions and plots were generated using stored PROC MIXED estimates and post-estimation scoring procedures.

Linear mixed-effects models were fitted using likelihood-based estimation, Kenward–Roger degrees of freedom, participant-level repeated-measures structures, and covariance structures selected through model diagnostics and fit statistics. Statistical tests were two-sided, and p-values less than 0.05 were considered statistically significant.

3.5 Integration Across Studies

The integration of the three studies occurred conceptually, analytically, and interpretively. Conceptually, the first qualitative study established how CHWs understood resilience and well-being. Analytically, the second qualitative study used a socio-ecological lens to identify the contextual and seasonal processes shaping these experiences. Interpretively, the longitudinal study examined whether these patterns were observable quantitatively across seasons and programme conditions.

This integration strengthened the overall coherence of the thesis. The longitudinal study did not treat resilience and well-being as abstract outcomes detached from local meaning. Instead, the quantitative analysis was informed by the qualitative evidence that CHW resilience and well-

being are shaped through the interaction of personal agency, family and peer support, community recognition, health system structures, material resources, incentives, supervision, and seasonal realities. In this way, the qualitative studies provided the conceptual and contextual foundation for interpreting the longitudinal findings, while the longitudinal study added temporal evidence on how these experiences changed across seasonal conditions.

3.6 Ethical Considerations

The qualitative studies received ethical approval from the University of Ottawa Research Ethics Board (H-06-23-9302) and the Navrongo Health Research Centre Institutional Review Board (NHRCIRB534). We also obtained the necessary permissions from the regional and district health administrations of the Ghana Health Service before beginning data collection. Participation was voluntary, and written informed consent was obtained from all participants after a thorough explanation of the study procedures

For the longitudinal cohort study, ethical approval was obtained from the University of Ottawa [H-04-24-10186] Research Ethics Board and the Navrongo Health Research Centre Review Board [NHRCITB600].

3.7 Chapter Summary

This chapter provided an overview of the mixed methods used in this thesis, notably two qualitative studies and one longitudinal cohort study to examine resilience and well-being among CHWs in Ghana. The qualitative studies used phenomenological inquiry and interpretative phenomenological analysis to explore meanings and contextual processes, with the second qualitative study included an analysis of the interviews through a socio-ecological lens. The quantitative longitudinal study used surveys repeated at three intervals corresponding to three distinct seasons. Analysis employed linear mixed-effects models to examine seasonal variation in resilience and well-being and tested the association between resilience and well-being over time. By linking qualitative meanings, contextual processes, and quantitative seasonal trajectories, the chapter demonstrates how the thesis methods were designed to produce a context-sensitive and programme-relevant understanding of CHW resilience and well-being.

Table 3.1 Overview of the three studies included in the thesis

Objective / Chapter	Design	Participants / data source	Primary focus	Analytic approach
Objective 1 / Chapter 4	Qualitative phenomenological study	CHWs in the Upper East Region, Ghana	Meaning of resilience and well-being	Interpretative phenomenological analysis
Objective 2 / Chapter 5	Qualitative phenomenological study with socio-ecological interpretation	CHWs and stakeholders in the CHPS context	Contextual barriers and facilitators across levels	Interpretative phenomenological analysis with social-ecological framing
Objective 3 / Chapter 6	Prospective longitudinal cohort study	CHWs followed across dry, rainy, and transition seasons	Seasonal trajectories in resilience and well-being and their association	Mixed-effects longitudinal modelling

CHAPTER 4

Objective 1 - Meaning of resilience and well-being among community health workers

4.1 Article Preface

This article addresses Objective 1 of the thesis, explored how community health workers in Ghana understand and describe resilience and well-being in their own terms. The article has been published in BMJ Public Health in 2026. This paper provides the conceptual foundation for the thesis, establishing the local meanings of these constructs before moving on to examine contextual processes and seasonal dynamics. This sequencing is important because resilience and well-being are often discussed in the literature using standardized definitions or measurement tools, however, these may not accurately reflect how CHWs themselves make sense of these experiences in their everyday social and work contexts.

The article therefore grounds the thesis in CHWs' own language, values, and lived realities. It shows that resilience is not understood simply as an individual trait or personal strength, but as a dynamic process involving cognitive and adaptive strategies, emotional regulation, communal support, and spiritual coping. Similarly, well-being is described as broad and interconnected, encompassing environmental, financial, mental and emotional, physical, social, and spiritual dimensions. These findings provide an important starting point for the rest of the thesis because they clarify what is being examined when resilience and well-being are later discussed as contextual and seasonally shaped experiences.

By beginning with CHWs' own interpretations, this article reduces the risk of imposing externally defined constructs onto their experiences. Instead, it allows the subsequent chapters to build from meanings that are rooted in the realities of CHW work in the Upper East Region of Ghana. In this way, Chapter 4 provides the conceptual grounding for Chapter 5, which examines the social-ecological factors that shape resilience and well-being, and Chapter 6, which examines how these experiences vary across dry, rainy, and transition seasons.

4.1.1 Contribution

As first author, I led the conceptual development of this research with guidance from my supervisors, Drs. Alison Krentel and Ian Colman, and the rest of the thesis advisory committee. I and AK contributed to the design of the qualitative study, development of the interview guide, recruitment of participants, and data collection in the Upper East Region of Ghana. I led the interpretative phenomenological analysis with PA, including transcript review, coding, theme development, and interpretation of findings. I also prepared the first draft of the manuscript and

coordinated revisions through the peer-review process. Co-authors contributed to refinement of the study design, interpretation of findings, methodological guidance, and critical revision of the manuscript for important intellectual content. The findings of this study were also presented at the American Society of Tropical Medicine and Hygiene Annual Meeting – New Orleans 2024.

4.1.2 Ethics approval

This study received ethical approval from the University of Ottawa Research Ethics Board (H-06-23-9302) and the Navrongo Health Research Centre Institutional Review Board (NHRCIRB534). We also obtained the necessary permissions from the regional and district health administrations of the Ghana Health Service before beginning data collection. Participation was voluntary, and written informed consent was obtained from all participants after a thorough explanation of the study procedures.

4.1.3 Citation

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4.2 Article Content

What does resilience and well-being mean to community health workers? An exploratory study in the Upper East Region, Ghana

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Abstract

Introduction: Community Health Workers (CHWs) are critical in achieving universal health coverage, particularly in resource-constrained settings. However, CHWs' experiences of resilience and well-being in their social and work contexts have received limited attention. Considering the role CHWs play in sustaining primary healthcare, understanding their resilience and well-being is vital to workforce sustainability and health system performance. This study explores how CHWs in the Upper East Region of Ghana understand, experiences and describe resilience and well-being, to gain insight into the culturally grounded nature of these constructs.

Methods: A qualitative study was conducted in districts in the Upper East Region of Ghana using a phenomenological approach. The analysis centres on CHWs' own accounts and interpretations of resilience and well-being within their work and sociocultural contexts. In-depth interviews were conducted with 16 CHWs selected to ensure diversity in gender, experience, and geographical location. Interpretative phenomenological analysis was used to capture lived experiences and their meanings.

Results: CHWs described resilience as a dynamic process involving cognitive and adaptive strategies, emotional regulation, communal solidarity, and spiritual coping mechanisms. Resilience was shaped by the interplay of individual agency, social support systems, and cultural beliefs. Well-being was described as holistic, encompassing environmental, financial, mental, emotional, physical, social, and spiritual aspects, emphasizing the interconnectedness of these dimensions. While both female and male CHWs described resilience across all dimensions, coping strategies revealed gender-related nuances.

Conclusion: Resilience and well-being among CHWs in Ghana are experiences shaped by contextual processes. Efforts to support CHWs' resilience and well-being should reflect this complexity by recognizing relational, communal, and spiritual dimensions alongside individual capacities. Culturally and gender-sensitive, context-responsive strategies are essential for informing policies and practices that promote CHW resilience and well-being and support the sustainability of community health systems.

Keywords: Community Health Workers, Resilience, Well-being, Low and Middle-Income Countries, Africa, Ghana

Key Messages

What is already known on this topic

Community Health Workers (CHWs) are essential to the delivery of primary healthcare in low- and middle-income countries, yet their demanding roles expose them to psychosocial and structural stressors that may negatively affect their resilience and well-being. Existing studies have relied primarily on standardized quantitative measures, while little attention has been paid to how CHWs themselves understand and describe these concepts within their own socio-cultural contexts.

What this study adds

This phenomenological study describes how CHWs in the Upper East Region of Ghana conceptualize resilience and well-being as multidimensional processes shaped by cognitive, emotional, communal, financial, environmental, and spiritual factors. The findings highlight how resilience and well-being emerge through the interaction of individual coping strategies, social support systems, and cultural worldviews.

How this study might affect research, practice or policy

The findings support the development of CHW support strategies that go beyond individual-level incentives to include culturally responsive supervision, psychosocial support, peer networks, and community recognition mechanisms, thereby strengthening workforce sustainability and community health system performance.

INTRODUCTION

In resource-constrained settings, Community Health Workers (CHWs) are a vital part of the healthcare workforce, delivering essential primary healthcare services and ensuring access for underserved populations (1–3). In Ghana, the CHW program is a key component of the Community-based Health Planning and Services (CHPS) initiative. This pioneering primary care approach leverages traditional institutions and support structures to mobilize communities and bringing healthcare services to people's doorsteps (3,4). This paper adopts its definition of CHW from a review of the term "Community Health Worker", which describes CHWs as "individuals with an in-depth understanding of the community culture and language, [who] have received standardized job-related training which is of shorter duration than health professionals, and their primary goal is to provide culturally appropriate health services to the community" (p.8) (5). The term "Community Health Worker" will be used to refer broadly to Community Health Volunteers, Community Drug Distributors, Community Health Navigators, and all other formal or informal health workers who fit this definition.

In Ghana, CHWs function as important community liaisons within the healthcare system through their work with community-based healthcare providers called Community Health Officers (CHOs), to ensure healthcare is both accessible and culturally relevant for the communities they serve (3,6). Their responsibilities range from essential tasks like delivering routine health services, including preventive and intervention care, and implementing vertical programs that address specific health concerns, such as vaccine-preventable diseases, malaria, and neglected tropical diseases (NTDs) (3,5–7). This has led to improvements in various health indicators, in alignment with the CHPS program's mission (3,8). These improvements are seen in Ghana where the collaborative work of CHOs and CHWs has improved child survival, maintained the continuity of care, advanced maternal health, and supported mass drug administration (MDA) campaigns (4,9–11).

While CHWs have been instrumental in achieving significant health gains, their work is not without difficulty. Community Health Workers often encounter challenges like inadequate resources, unclear workload guidance, as well as other stressors within their social ecology, all of which can impact their resilience and well-being (12–15). The demanding nature of their work has led to a growing recognition of the importance of supporting CHW resilience and well-being (12,15). Given that CHWs are integral to achieving universal health coverage and the

Sustainable Development Goals, their well-being has implications for the healthcare delivered to the communities they serve. Notably, since CHWs often hail from the same communities they serve, their well-being is closely linked to community health outcomes. Thus, addressing their well-being can have broader impacts on community health (15–17).

Resilience and Well-being Through CHWs' Lived Experiences in Ghana

From the inception of the CHW program in Ghana, several studies have identified challenges faced by CHWs (7,13,14), but none have examined how these challenges offer insights into the contextually meaningful ways resilience and well-being manifest in their work-life situations. Furthermore, despite the increasing acknowledgment of the importance of CHW resilience and well-being, current research approaches have limitations (12,15). The predominantly quantitative approaches used to explore these concepts in collectivist cultural settings, particularly in Africa, may not capture the nuanced, context-specific processes that shape resilience and well-being (12,15,18,19). These methods, though valuable, could also be reinforcing simplified and standardized perspectives that may overlook the complexity and diversity of individual experiences, thereby inadequately capturing the range of unique realities CHWs face (18–22). Recent research underscores the multidimensional nature of resilience, emphasizing that it is a process shaped by a combination of context-specific and normative factors (23–25).

This study adopts a phenomenological orientation. Accordingly, the aim is to describe how CHWs themselves conceptualise, interpret, and narrate resilience and well-being as lived realities in their everyday social and work contexts. The concept of resilience has been described in the literature as a dynamic process of adapting to and managing significant stressors, allowing recovery and continued functioning after adverse circumstances (26). Other definitions emphasize resilience as an individual's ability to handle stress effectively and maintain psychological stability under difficult circumstances (27). Similarly, well-being has been conceptualized in a number of ways, with hedonic models emphasizing subjective happiness and positive emotional states (28), and eudaimonic approaches focusing on personal growth, purpose, and the realization of individual potential through meaningful engagement with life (29). This study employs a qualitative approach to examine how CHWs in Ghana describe and experience resilience and well-being within their social and work contexts. By focusing on CHWs'

perspectives, we illuminate how they navigate, negotiate, and find meaning within formal and informal systems while delivering essential healthcare services. Understanding these lived experiences provides insights into culturally meaningful and sustainable ways to support resilience and well-being of CHWs in their work and daily lives. By showing the context-driven nature of resilience and well-being, this study contributes to understanding how CHWs experience and maintain them in their unique settings.

METHODS

Study Setting

Data were collected from the Kassena-Nankana Municipal (KNM) and Kassena-Nankana West Districts (KNWD) in Ghana's Upper East Region (UER). The UER lies in the northeastern corner of the country, bordered by Burkina Faso to the north and Togo to the east. Covering an area of 8,842 square kilometers, the region has a population of 1,301,226 according to the 2021 census. It has the lowest urbanization rate in Ghana, with only 25.4% of its population residing in urban areas (30,31). The region hosts 395 operational CHPS zones , with a nurse to population ratio of 1:313 and deploys over 2,000 CHWs to meet the healthcare delivery goals under the CHPS program (32). The Kassena-Nankana Municipality and Kassena-Nankana West District were instrumental in pioneering the CHPS model, known as the "Navrongo model" (3,6). These districts therefore offered a unique and diverse cohort of CHWs for this study, encompassing both long-serving workers who have been part of the program since its inception and more recent recruits. Participants were sampled from 12 CHPS zones out of approximately 150 across KNWM and KNED, with an equal distribution between the two districts.

Study Design and Data Collection

This exploratory study used qualitative methods to examine resilience and well-being, employing a phenomenological design (33). According to Langdrige (2007), phenomenology is defined as the study of human experience and how things are perceived as they appear to consciousness (33). We explored how CHWs perceive and describe resilience and well-being, capturing their subjective experiences and interpreting the meanings they attributed to these experiences within their everyday social and work contexts.

Data were collected from a target sample of 16 CHWs between June and August 2023. Consistent with Boyd's guidelines for phenomenological research, which suggest that two to ten interviews per district are adequate (34), recruitment continued until data saturation was achieved. This was determined when no new perspectives emerged across successive interviews, indicating that the topic had been sufficiently explored. To support this process, the interviewers had regular team debriefings. At the end of each interview day, interviewers met to review audio recordings and discuss emerging patterns and recurring perspectives related to resilience and well-being. As this iterative process progressed, recruitment process was terminated when subsequent interviews consistently reflected the same experiences and no substantially new viewpoints were identified. To select CHWs, the district CHPS coordinators provided a list of all CHWs in their respective districts. The recruitment of participants was done without the involvement of coordinators. CHWs were purposively selected to ensure representation across districts, gender, and length of experience, as these characteristics were expected to influence how resilience and well-being are experienced, interpreted and enacted in everyday work and social contexts (34). A multistage purposive sampling process was used to ensure representation and variation across Districts/Municipalities, gender and length of experience. This approach was deemed appropriate for identifying participants who possess relevant knowledge and lived experiences of the phenomena under study (34). These selection criteria were communicated to the district CHPS coordinators and CHWs during the recruitment process.

In-depth interviews (IDIs) were conducted by JS and two male graduate research assistants (RAs) fluent in Kasem and Nankani. Interviews were conducted in English and local languages (Kasem and Nankani), depending on participants' language preferences. Interview guides (Supplementary Material 3) were translated by a trained bilingual translator fluent in Kasem and Nankani to ensure cultural relevance, linguistic accuracy, and consistency. The guides were pre-tested with two CHWs to assess relevance and appropriateness. Interviews were conducted in-person at a time and place that was convenient and private, and accommodated the availability of each participant. Participants were informed about the study's purpose, procedures, risks, benefits, confidentiality protections, and provided written informed consent.

Interviews were guided by two broad questions: 1) Can you tell me how you understand resilience? What does this mean to you? 2) What does well-being mean to you? To support a common understanding during interviews, we used brief, non-technical prompts. For example,

resilience was described “picking oneself up after facing difficulties or challenges” and well-being as “to possess good health and happiness” only as conversational anchors. Participants were then explicitly invited to articulate these concepts in their own words and to describe examples from their lived experiences. Probing questions were used to explore how CHWs navigate and interpret resilience and well-being. Throughout the research process, the research team was mindful of reflexivity, and considered how roles as researchers and potential biases could influence the findings.

Data management and analysis

All interviews were audio-recorded with participant consent, lasting from 30 to 67 minutes in duration, based on time-stamped audio recordings. Each interviewer took field notes capturing observational insights to help situate each conversation and derive meaning during analysis (35). All interviewers were male and had prior experience working in community-based health research within the study setting. However, given that all three interviewers were males, we were aware of the gender dynamics between interviewers, and both male and female CHWs, and how this can influence rapport, disclosure, and how participants respond to questions. Therefore, as part of the team debriefing and data analysis process, we discussed and reflected upon these positional considerations in order to support reflexive interpretations of CHW narratives.

Interviews conducted in Kasem and Nankani were transcribed into English by a professional transcriptionist and reviewed by the research team for accuracy. This was necessary to enable collaborative analysis among the research team and facilitate consistent coding across transcripts. Acknowledging that translation is inherently interpretive and may involve shifts in meaning, the two data coders who are also native speakers verified the translations to minimize distortion and preserve nuanced meanings, as recommended elsewhere (36). We used interpretative phenomenological analysis (IPA) (37). This approach entails the combination of a phenomenological "core" that aims to capture participants claims, with an interpretive account to uncover the underlying meaning (37). Building on this analytic orientation, the analysis was grounded in participants' narratives and the resulting themes represent an interpretive analytic synthesis aimed at capturing shared patterns of meaning across stories rather than discrete or uniformly articulated coping strategies (37,38). Following this framework, two coders, JS and PA, first discussed the IPA framework, then organized transcripts by unique identifiers and

uploaded them into NVivo 14.0. Subsequently, both independently read transcripts multiple times and listened to recordings without interpretation. At the initial coding stage, both analysts first generated codes of statements that illuminate resilience and well-being of CHWs with detailed description on portions of each transcript on observations and reflections, with primary focus on literal content, language use, and context. They then met to refine the first level codes into well-defined clusters for each transcript by clarifying meanings, identifying relationships, and interpreting them within the broader contexts, and eliminating redundant codes. There were a few cases where clusters overlapped, so the analysts reviewed the recordings together to ensure the meanings were accurately captured. Finally, common themes were grouped across all interviews based on conceptual similarities and connections established to develop sub-themes and overarching themes to provide a structured framework within which the data can be explained (Supplementary Material 2). In the process we also identified some counterpoints that were different from the majority of perspectives, so we met to discuss and to ensure that we accounted for all diverse views on resilience and well-being per the descriptions of CHWs. In parallel with thematic analysis, an intersectional lens was applied to explore how sex and gender influenced resilience and well-being. Analytic attention was given to differences in meaning and interpretations between male and female CHWs, informed by variations in socio-cultural responsibilities, community expectations, work burden, and access to social support and opportunities. In turn, these gendered intersections were integrated into the analytic process to inform theme development and strengthened the interpretation of CHWs' understandings and lived experiences of resilience and well-being.

Results

A total of 16 IDIs were conducted with CHWs. Female CHWs accounted for 63% of the CHW IDIs (Table 1). Results are presented as thematic descriptions of how CHWs in the study articulated and made sense of resilience and well-being within their everyday work and social contexts. Themes are grouped as follows: (A) CHWs' understandings and experiences of resilience; and (B) CHWs' understandings and experiences of well-being. We applied the Consolidated Criteria for Reporting Qualitative Research (COREQ), a 32-item checklist designed for interviews and focus groups (Supplementary Material 1)(39).

Table 1. Distribution of CHW by selection criteria

Participant	Selection Criteria					
	District		Sex		Experience	
	KNE Municipal	KNW District	Male	Female	< 5 years	> 5 years
# CHPS Zones	6	6	12		12	
CHWs	8	8	6	10	8	8
% CHW	50	50	37.5	62.5	50	50

Community Health Workers' Understandings and Experiences of Resilience

Aspects of resilience identified within this CHW population were cognitive and adaptive resilience, collective or communal resilience, emotional resilience, and spiritual and faith-based resilience.

Cognitive and Adaptive Resilience

When reflecting on resilience in the context of their CHW roles and everyday responsibilities, participants frequently described cognitive and adaptive processes that shaped how they navigated their volunteer work alongside livelihood demands. CHWs described resilience as their ability to **cognitively adapt**, **remain resourceful, and find alternative ways** to fulfill their responsibilities when faced with setbacks. Instead of dwelling on disappointment, they redirected efforts toward productive activities that enhanced well-being and focus as expressed here:

> *"A challenge in my own life is about my school. I wanted to further it but couldn't. What I did at the time was, I got a small job to do so…at the end of the month, I will get something small…this helped me move on. Later I got married and at my husband's house is where I learned the machine work (seamstress). That has made me forget because I have taken that to be my education." (Female CHW005)*

Although this quote (Female CHW005) illustrates a broader life experience, participants often described applying similar adaptive strategies when navigating competing livelihood demands along with CHW responsibilities, such as maintaining household visits, participating in outreach campaigns, or maintaining engagement with supervisors despite personal constraints.

Further, CHWs described resilience as avoiding overthinking and sometimes suppressing emotions in situations that were beyond their control, recognizing that persisting with overwhelming tasks can lead to unnecessary mental strain. Instead, they deferred those tasks that seem insurmountable at the moment, in preservation of their well-being. These coping responses were often shaped by financial strain, competing livelihood demands, and work-related constraints that limited their capacity to respond immediately to emerging challenges.

> *" If you are pushing yourself to do it [a task], you will suffer without doing it…then that will lead you to too much thinking. So personally, whenever you want to do something and there is a problem…you should forget of it, because it is not time to do it." (Male CHW008)*

For others, the internal resources they drew from allowed CHWs to have **personal agency** to endure during challenges. CHWs achieved this by working to improve their circumstances by adapting to difficulties, showing a strong determination and a sense of responsibility to fulfill their duties, as highlighted below:

> *"How I understand resilience is that when you have a problem, and you try not to allow the problem weigh you down, but you force yourself to improve and survive…I had an accident and I was seriously injured…(yet) I went and distributed all the medicines till the end of the week…So, you must keep doing what keeps you moving by every means." (Male CHW004)*

Collective or Communal Resilience

CHWs highlighted the important roles that family, community, and professional networks play in their resilience. There was also some belief in future reciprocity from the community members, especially children. These elements helped CHWs to persevere through challenges, reinforcing their resilience through a shared purpose and mutual support. For instance, CHWs viewed their social networks as vital sources for their resilience during difficult times. **Family and friends** provided assistance, encouragement, as well as social and spiritual support. These social connections often stepped in to address concerns of CHWs, ensuring stability and alleviating stress as noted here:

"…receiving advice from friends and loved ones is important…if it is left with you alone, you may not know what to do. When I am not around and I have task to accomplish, they help me do it. And what I want to do, and I am not able to do, they give me some advice or show me how... They let me know that there is still a second chance…what they tell you, if you apply it, it will work…they come to help me, or they advise me...in a spiritual way, they pray for me…" (Male CHW004).

Furthermore, support and positive reinforcement from **social and community networks** are essential to CHWs' resilience:

"If I want to go and do rounds, there are people in the community that I can go to for a bicycle or transport…We have a women's group and we come together to support ourselves…that group is one of the sources of my motivation… if I'm bereaved, or I'm supposed to go to my father's house and I don't have money, they contribute money, and come to my father's house and support me through the mourning." (Female CHW013).

For some CHWs, resilience was rooted in **community solidarity** and a commitment to the health and well-being of their community, even if they felt they were not compensated enough for their work. Resilience came from genuine care for the well-being of the people, especially the health and well-being of children in the community:

"Why I am encouraged to do the work and I know it has no payment is that I like the people. If the children are healthy, that is why I devote time to volunteer. It is the reason I try to invite everyone or child to come for treatment. If I am given medicines…I go and treat the children for the benefit of (community name)." (Male CHW008).

Encouragement and support from health professionals and supervisors further bolstered CHWs' resilience and a sense of purpose, especially during work-related challenges. CHWs recognized the positive impact of being part of a supportive work environment where challenges can be shared with co-workers and supervisors, helping them cope with work demands:

"This our work is full of disappointments, but I always tell myself that if I leave this work out of someone insulting me it's like I'm punishing the entire community…the nurses encourage us and always tell us to share any challenge or problems with them in our line of work." (Female CHW001).

Shared experiences with other volunteers during meetings and training sessions were important ways CHWs built personal and collective resilience in their work-life environment. These interactions fostered a sense of solidarity and mutual support, strengthening their individual and collective resilience. For some, hearing and sharing experiences with fellow volunteers was a meaningful way to create a sense of community to reduce feelings of isolation and offers emotional strength to continue their work:

> *"When they call us for training and our colleague share their stories of what they are going through in their communities, the problems and the challenges…then you know you're not alone. Hearing experiences like that of yours gives you more strength to do [the] work." (Female CHW001).*

Some CHWs described resilience as being sustained by the hope of **reciprocal altruism** (40), whereby current voluntary service was perceived as an investment in future community support. To some CHWs, resilience came from knowing that helping a child today, they are hopeful the child will reciprocate in the future. This perspective helps balance work-related challenges like insufficient pay with intrinsic motivation, driven by a commitment to community benefit and future reward, as expressed by this CHW:

> *"When this SMC [Seasonal Malaria Chemotherapy] came, we were part…they will call me and I always say you make me suffer like this how much do you pay me? But the reason I am not worried is that it is my community and they are our children, if you help your child, in future you wouldn't send them and they say no" (Female CHW016)*

CHWs also benefited from their efforts and work in the community in terms of knowledge and experience, as expressed below:

> *"What I will say has encouraged me to support the community…there is a saying that when you wash someone's clothes your hands too are washed clean. As I made up my mind to also help the community, there are many issues with the health centre or about the health work that I should also know and can teach community members and even it could also help me. So, it is also a reason I said let me involve myself." (Male CHW004).*

Emotional Resilience

This dimension of resilience highlights CHWs' ability to navigate emotional challenges and safeguard their well-being through **emotional regulation, self-reflection**, and **positive reinforcement** from the community. In this context, emotional regulation refers to CHWs' deliberate efforts to manage distressing emotions, such as anger, frustration, or resentment, in order to maintain functional relationships and carry out their duties. Some CHWs coped with negativity through emotional regulation as illustrated by Male CHW002:

> *"There are things in life that you should ignore…if you don't ignore them, you will not get any improvement. If you want to harbour things people say you will die early, even your BP (Blood Pressure) will rise." (Male CHW002.)*

Further, the emotional reward derived from receiving **positive feedback** and appreciation from community members enhanced CHW resilience and motivated them to continue their duties despite challenges.

> *"…. we gave a woman the SMC [seasonal malaria chemotherapy] medicines and she always says we did very well because ever since we started giving the medicines to her children, the season will end without her children being sick of malaria. She is so impressed that you also feel very happy…it made me feel that I have offered something in someone's life…and you are encouraged to do the work." (Male CHW004).*

Others engaged in **self-reflection** to assess their own reaction to conflict which helped them reflect on conflict situations and their role to be able to manage it properly and continue their duties as volunteers.

> *"…in context to the SMC [seasonal malaria chemotherapy] drugs we distribute to children, the work needs a lot of courage because some of the people, the way they talk to you, you feel very bad going to them next time. If you go there and you are not careful, you are likely to retaliate to their actions, which will lead to events that are not good" (Female CHW013).*

Spiritual and Faith-based Resilience

CHWs emphasized the role of spirituality and faith as important in their resilience. These were regarded as essential tools for overcoming challenges, providing strength and motivation. Beliefs

and seeking guidance from a higher power became a way of coping with disappointment, maintaining inner peace, and persevering through adversity with a sense of purpose and gratitude. For instance, Male CHW008 underscored the power of **prayer and seeking divine guidance** as central to addressing and resolving problems, highlighting a spiritual approach to resilience. Traditional practices, such as consulting soothsayers, were utilized to seek insights and guidance for overcoming challenges in their day-to-day endeavours:

> *"If I want to do something and I am not able to do it, I ask God, he would do it for me. I pour libation or go to consult the soothsayer to find out what to do to solve this problem... The soothsayer too will show you some things to do…and later the problem will be solved." (Male CHW008).*

Belief in **divine support** allowed CHWs to remain calm and steadfast in the face of adversity, trusting that outcomes would be guided by God's will, whether to endure suffering or experience deliverance. Through this faith, they sustained a sense of peace and resilience.

> *"I was sick and could not stand up. I couldn't talk. Is there a challenge more than this one? But I recovered and I am alive, and my wife was sick I didn't know whether she would recover or not, but she is alive, is there a challenge more than this one?... God has helped me out. If I encounter a problem I don't panic and the reason I don't panic, is I know it's God's work and if God wants me to suffer it, I will suffer it and if God wants to deliver me, he will deliver me" (Male CHW008).*

Community Health Workers' Understandings and Experiences of Well-being

To some CHWs, well-being was a holistic concept that encompasses environmental, financial, mental, emotional, physical, functional, social, and spiritual dimensions. These aspects were viewed as interconnected, harmonized through a mind-body-spiritual relationship as suggested by this person:

> *"One who wakes up, you are not sick, you are strong, and you eat well, and you are happy, wouldn't you say you are well? When you wake up…thank your God and go out, what is destined for you, he will give you. So, all these things are important for well-being, it is about happiness, and if you are happy, you are well." (Female CHW016).*

Environmental Well-being

Maintaining a clean and safe living environment was essential to their overall well-being of CHWs. Practices such as keeping the surroundings tidy, eliminating stagnant water, and eating clean, nutritious food are proactive well-being measures as one CHW noted:

> *"For me, it (well-being) is about keeping your environment clean, eating clean food, disposing your bowels in the right place, keeping your compound clean and doing away with stagnant water…and eating well." (Female CHW001)*

Financial Well-being

For many CHWs, financial hardship was intertwined with well-being. Limited access to proper nutrition and healthcare due to economic constraints increased stress and hindered their ability to care for themselves. Some noted that economic pressures often compelled them to prioritize work over personal health, thus neglecting their well-being to meet financial demands. As one CHW shared, financial challenges such as housing issues directly impacted their blood pressure. They explained:

> *"…they came and asked me what was wrong, and I told them I have a headache...when they checked it was BP. They asked me what was wrong, and I explained... have you seen these block rooms? That is for my husband's first son, but I am sleeping in this room; have you not seen how it has cracked? I cannot even maintain it. After my husband's death and all that I am experiencing, what will you do? So, the problem is that you come to check on our condition, but that condition, when you wake up and you don't eat, it will attack. So, we need support." (Female CHW016)*

Mental and Emotional Well-being

CHWs also recognized that mental and emotional well-being were important for achieving their goals, maintaining stability and finding fulfilment in their work. To most, negative feeling can harm both mental and physical health, while cultivating positive emotions and managing anger, were essential for overall well-being.

> *"…if you have peace of mind and you are not sick, that is well-being.... If you are happy… and you are not sick, that is also good health...Don't be angry always…if you are always happy your well-being is there forever" (Female CHW005)*

Physical Well-being

Participants viewed physical well-being as a consequence of preventive health practices, proper nutrition, and functional physical activity. For many, maintaining well-being was closely linked to engaging in preventive measures that safeguard and enhance overall health. This included actions like sleeping under a mosquito net to prevent illness, as one CHW noted:

> *"Mosquitos give us big sickness, if you don't sleep under a net, you cause yourself a big sickness. So, in that regard it is something that supports well-being." (Male CHW011)*

For others, nutritional awareness and fitness were critical aspects of well-being:

> *"The well-being of a child depends on the parent and that means you have to give the child food that has no problem. Adults or elderly and young people, need to exercise our body and eat good food…we shouldn't do work that will be more than our body can contain..." (Male CHW002)*

Additionally, well-being was described as the physical capacity to actively engage in daily tasks and community responsibilities. Participants emphasized that good health enabled them to remain productive, sustain their livelihoods, and fulfill routine obligations, whereas poor health was perceived as a major barrier to participation in everyday life and work-related activities:

> *"Our forefathers have a saying that if you have good health, you farm the best valleys...this shows that good health is everything. If you are not healthy you cannot partake in everyday life." (Female CHW001)*

Social or Relational Well-being

This dimension of well-being emphasized the interconnectedness of personal well-being with the well-being of social connections, particularly family. One CHW expressed the deep emotional bond they share with their family, explaining how a loved one's illness affects them more profoundly than their own:

> *"You are my son... when I wake up and you are not well that is something that disturbs me. I have to do all that I can do for God to give you good health so that you will recover... if it is I myself who is sick, it is better than if you are sick. If you are sick, it rather affects me than if I am sick myself." (Female CHW009)*

Spiritual and Faith-based Well-being

Well-being was also viewed as a divine gift, obtained through spiritual practices and reliance on divine grace. CHWs highlighted the importance of prayer, rituals, and seeking divine guidance to ensure health and well-being for themselves and their families. As one CHW explained, traditional spiritual practices play a central role in their pursuit of well-being:

> *"As for me I am a traditionalist, I don't go to church I pour libation so when I go to the soothsayers, I am looking for health I am searching to know what to do so that God will give me and my family good health." (Male CHW008)*

DISCUSSION

The purpose of this study was to explore resilience and well-being within the social and work context of CHWs in the Upper East Region of Ghana, emphasizing how these constructs are conceptualized and experienced. Using a phenomenological approach, the study revealed nuanced descriptions of how these concepts were experienced by CHWs. Importantly, the findings reflect how CHWs themselves articulate their resilience and well-being in relation to their roles, without imposing predefined assumptions.

Community Health Workers' Understandings and Experiences of Resilience

The findings revealed that resilience among CHWs was expressed in four dimensions as CHWs navigate work-life challenges: cognitive and adaptive resilience, collective or communal resilience, emotional resilience, and spiritual and faith-based resilience. These dimensions align with multisystem frameworks, which view resilience as shaped by the dynamic interplay of individual traits, and contextual experiences and norms (25,41).

At the personal level, CHWs used various strategies to manage adversity, demonstrating cognitive flexibility, emotional regulation, and personal agency. They showed cognitive and adaptive resilience by remaining resourceful and finding alternative ways to fulfill responsibilities, often reframing challenges and redirecting efforts toward productive activities to protect their well-being. This reflects problem-focused coping, where individuals take constructive actions to minimize the impact of challenges rather than becoming overwhelmed by frustration or helplessness (42). CHWs also used avoidant strategies like emotional suppression

and cognitive deferral (43), recognizing that dwelling on overwhelming tasks could strain their mental health. Deferring insurmountable tasks helped preserve their well-being, consistent with findings that emotional suppression (44), and personal resourcefulness (22,45) are key to navigating adversity.

Beyond the individual, resilience is manifested through shared purpose and interconnectedness, through community solidarity, reciprocity, and collective support. To CHWs, relationships provide emotional support and practical assistance. This aligns with studies demonstrating that interpersonal relationships enhance resilience among CHWs (12,22). For most CHWs, resilience is intrinsically evident in relationships with family, colleagues, and the broader community, serving both as a protective buffer against adversity and a source of strength. CHWs also see their role as a duty to their communities, although this responsibility may be more than altruistic. While they expect their work to improve community health, they remain hopeful that those they help will reciprocate in the future. This is can be explained by what Trivers (1971) describes as human reciprocal altruism**,** where individuals engage in altruistic acts at a small cost to themselves but with a significant benefit to the receiver, with the expectation of future returns (40).

Even so, collective or communal resilience depends on the availability and responsiveness of social resources. When CHWs are unable to access such social supports in times adversity, this creates a social vacuum, which negatively impacts resilience, as some participants expressed. In some circumstances, CHWs felt they had no support or were not appreciated enough by the community. Hence, fostering team cohesion, peer support initiatives, and broader community engagement efforts is essential for CHW resilience (12,46).

In addition to individual coping strategies and social resources, many CHWs drew strength from their faith which shaped their understanding of adversity and guided their responses. Thus, spiritual and faith-based resilience emerged as a foundational layer both a personal coping resource and a reflection of broader cultural values. This aligns with African perspectives on resilience, where spirituality is integrally woven into coping strategies and meaning-making processes (18).

While both female and male CHWs described resilience across all dimensions, their coping strategies revealed subtle but important nuances. Female CHWs sometimes framed their

resilience through caregiving responsibilities and relational support. These gendered nuances in coping may reflect the influence of broader cultural expectations and socially constructed roles, particularly in normative cultural contexts, where norms, values, and beliefs shape individual and collective experiences of resilience (22,41).

It is challenging to disentangle how CHWs perceive and experience resilience, which illustrates how fluid the concept is and how difficult it is to define as a single term, phrase, or even a sentence. CHWs often moved fluidly between describing their reliance on individual, and community supports as well as their spiritual beliefs, highlighting how all processes work in tandem to sustain resilience. Together, these findings highlight that CHW resilience is not confined to individual traits or isolated strategies but emerges from the dynamic interaction between internal capacities, social connections, and cultural belief systems (22,41). Those interested in understanding CHW resilience should adopt a multidimensional and context-sensitive approach, considering the cognitive, emotional, communal, and spiritual processes that influence their daily lives.

Community Health Workers' Understandings and Experiences of Well-being

Well-being was described by CHWs as encompassing environmental, financial, mental and emotional, physical, social, and spiritual dimensions. These dimensions often emerged as precursors and central to the experience of well-being, which aligns with the Afrocentric view of the concept, inherently holistic, rooted in group identity, communal responsibilities, kinship ties, and spiritual harmony (19,47,48). As Idemudia and Adedeji (2023) suggest, in African contexts, the self is not defined in isolation but through relationships with the environment, relationships and spiritual entities, a holistic notion also described by CHWs (19). This integrated perspective can be seen in how CHWs perceive peace of mind, good health, proper nutrition, financial stability, supportive relationships, and spiritual guidance as essential to overall well-being. This is consistent with studies showing that mental and emotional competencies, including the ability to recognize, express, and nurture positive emotions (49,50); physical health, particularly preventive health practices (51); food security and financial stability (16,52); social connectedness in both work, family and community life (16,52); environmental quality (53); and spiritual harmony (17,50) collectively shape how CHWs subjectively experience and describe well-being.

Alternative perspectives of well-being, such as eudaimonic and hedonic models, offer differing interpretations of well-being. For instance, the hedonic model centres well-being around pleasure, happiness, and the avoidance of pain, focusing on subjective emotional experiences (28). This perspective contrasts with our findings, where CHWs experience and describe their well-being in a broader, socially embedded manner. The eudaimonic model, on the other hand, describes well-being as the realization of personal potential, emphasizing self-actualization and mastery over one's environment (29). While CHWs valued professional growth, their well-being was rooted in community belonging, resources and connection to a higher existence, than in individual fulfillment, reflecting a cultural emphasis on holistic functioning. Thus, for individuals interested in CHW well-being in the Ghanaian context, considerations should be made to the sum of these experiences, rather than relying solely on individualistic measures of success or satisfaction.

Our findings reiterate well-being as a multidimensional, relational, and culturally grounded phenomenon. As suggested elsewhere, the development of context-sensitive understanding and experiences of well-being is essential for accurately capturing the lived realities of African populations and informing responsive health policy and social interventions (19,47). For CHWs, supporting well-being requires holistic approaches that recognize and integrate environmental, financial, mental and emotional, physical, social, and spiritual needs rooted in the values and worldviews that define their everyday lives.

Strengths, Limitations and Future Research

By identifying a range of manifestations and meanings of resilience and well-being among CHWs in Ghana, this study contributes to the literature on CHW resilience and well-being within culturally grounded and communally oriented contexts. However, despite these contributions, several limitations should be acknowledged. Despite a diverse sample across two districts, the findings may not reflect CHWs in other regions with different contextual challenges. Well-being and resilience may vary depending on how they are understood across contexts (24,54). Future studies should expand to include more regions to capture wider perspectives and context-specific nuances. Second, the cross-sectional nature of the study limits our ability to examine how resilience and well-being evolve over time. Given that these are dynamic processes influenced by changing life circumstances, work environments, and seasonal patterns, future research should

adopt longitudinal designs to explore how these constructs shift across time, particularly in response to seasonal variations, policy changes, and life events as observed in other studies (55).

Conclusion

This study shows that CHW resilience and well-being are the result of interrelated cognitive, emotional, social, and spiritual processes embedded in local cultural contexts. The findings may interest policymakers and health system stakeholders by highlighting the importance of context-sensitive, culturally, and gender-attuned approaches to understanding the diverse experiences of resilience, well-being, and synergies among CHWs. Consequently, it is imperative to move beyond narrow incentive-based approaches to develop more holistic workforce strategies that emphasize peer support systems, community recognition structures, psychosocial support mechanisms, and culturally sensitive supervision practices. Incorporating these dimensions into CHW program design may improve retention, motivation, and long-term sustainability.

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CHAPTER 5

Objective 2 – Contextual processes and factors that shape resilience and well-being

5.1 Article Preface

This chapter addresses Objective 2 of the thesis, which was to identify the contextual processes and factors that shape resilience and well-being among community health workers within the CHPS setting. This article is currently under review at the Journal of Health Services Research & Policy. It builds directly on Chapter 4 by moving from meaning to explanation: while the first article established how CHWs understand resilience and well-being in their own terms, this article examines the conditions that shape these experiences in everyday practice.

The article shows that resilience and well-being are not produced by individual strength alone, but through the interaction of personal resources and contextual realities across individual, relational, community, structural, and seasonal domains. The findings identify key factors such as motivation, household responsibilities, family and peer support, supervision, community recognition, financial insecurity, lack of formal status, gendered expectations, resource constraints, and seasonal pressures. These factors also informed the longitudinal study in Chapter 6 by helping to clarify which social, occupational, programme, and seasonal conditions needed to be considered when examining resilience and well-being over time.

Thus, Chapter 5 provides the social-ecological and contextual bridge between Chapter 4, which establishes local meanings of resilience and well-being, and Chapter 6, which examines how these experiences vary across seasons and how resilience is associated with well-being over time.

5.1.1 Contribution

I led the development of this article with guidance from my supervisors, Drs. Alison Krentel and Ian Colman, and input from the thesis advisory committee. I contributed to the qualitative study design, development of the interview guide, participant recruitment, and data collection in the Upper East Region of Ghana. I led the analysis with Prosper Asaana, including transcript review, coding, theme development, and interpretation of findings using an interpretative phenomenological approach and a socio-ecological lens. I prepared the first draft of the manuscript and coordinated revisions with co-authors. Co-authors provided methodological guidance, supported interpretation of the findings, and critically reviewed the manuscript for important intellectual content. The findings of this study were also presented at the American Society of Tropical Medicine and Hygiene Annual Meeting – New Orleans 2024. This article is currently under review at the Journal of Health Services Research & Policy.

5.1.2 Ethics approval

This qualitative study received ethical approval from the University of Ottawa Research Ethics Board (H-06-23-9302) and the Navrongo Health Research Centre Institutional Review Board (NHRCIRB534). Additional permissions were obtained from the relevant regional and district health authorities (GHS/UER/ORD/RES/01056). Written informed consent was obtained from all participants before the interviews were conducted

5.1.3 Manuscript status

This chapter presents the manuscript currently under review at the Journal of Health Services Research & Policy. The chapter-specific reference list has been retained to preserve the citation structure and most current references associated with the submitted manuscript.

5.2 Article Content

Processes and contextual factors that shape the resilience and well-being of Community Health Workers within the Community-based Health Planning and Services context in the Upper East Region, Ghana

Abstract

Background: In low-resource settings, Community Health Workers (CHWs) play an important role in providing primary health care, but the contextual conditions shaping their health and well-being are less explored.

Methods: From June to August 2023, a qualitative study was conducted in the Kassena-Nankana Municipality and Kassena-Nankana West Districts in Upper East Region, Ghana. Using a phenomenological design, 20 in-depth interviews were conducted with 16 CHWs and four stakeholders (Nurses and CHPS coordinators). Interviews were conducted in Kasem and Nankani, translated into English, and analysed using interpretive phenomenological analysis and a socio-ecological lens. We identified barriers and facilitators of resilience and well-being operating at individual, relational, community, and system levels and examined how seasonal and climatic factors modified these dynamics.

Results: Resilience and well-being reflected a dynamic interaction between personal resources and contextual experiences. At the individual level, guilt after adverse medical events, tensions between volunteer and farming duties, and financial insecurity undermined coping. Relational stressors included household conflict, bereavement, and supervisory pressure. At the community level, lack of recognition, misconceptions about compensation, and distrust were barriers. Structural threats included a lack of formal status, inconsistent support, resource constraints, and gendered norms limiting opportunities. Seasonal changes amplified or eased pressures: rainy and dry seasons brought increased workloads, extreme heat, travel difficulties, and strained resources, whereas transitional periods offered relief and economic gains. Facilitators such as altruism, faith, pride in impact of work, family support, community solidarity, respectful supervision, recognition, and seasonal relief boosted resilience and sustained motivation.

Conclusion: CHWs' resilience and well-being within the context of CHPS are shaped by multilevel experiences. Aligning personal and contextual resources sustains resilience and well-

being, whereas misalignment creates structural threats. Strengthening CHW resilience and well-being requires multilevel strategies addressing systemic neglect, gendered barriers, and seasonal stressors while reinforcing enabling experiences.

Keywords: Community Health Workers, Resilience, Well-being

Introduction

Community Health Workers (CHWs) contribute immensely to healthcare systems, especially in settings with limited access to formal health care (1,2). In most cases, they are the initial point of contact for underserved populations in their communities, providing essential healthcare services (1,2). Despite this integral role in advancing public healthcare goals, concerns remain about their resilience and well-being, and the long-term sustainability of CHW programs (3–5). These concerns are driven by context-specific challenges related to their work and social environments which may compromise their resilience, well-being and ultimately their ability to perform their duties effectively (1,3).

In recent years, growing attention is paid to the contextual factors that account for CHWs' motivation, performance, and effectiveness. Several studies have explored both individual capacities as well as broader community, social and systemic work environments important in sustaining CHWs' motivation to continue offering services to their communities (5–8). At the individual level, aspects of work-life orientation, including self-efficacy, intrinsic motivation, participation costs, and a sense of calling, have been shown to impact motivation and effectiveness (5–7). Beyond individual factors, broader social and systemic influences have been identified as important. Supportive social relationships (5,9,10), access to community resources (2,5,8), and prevailing cultural and community norms all shape CHWs' experiences and motivation (11). Structural supports provided by the healthcare system, including training, supervision and remuneration, as well as environmental factors such as seasonal and climatic conditions, have also been consistently linked to CHW motivation, performance and effectiveness (2,6,8,12).

Given the demanding nature of CHW work and engagements in Ghana, similar concerns are raised about motivation, effectiveness and long-term sustainability of the CHW program within the Community-based Health Planning and Services (CHPS) initiative (1,3). While existing studies (1,3,13), have identified contextual challenges faced by CHWs, it is unclear whether these same challenges also impact resilience and overall well-being. In other words, are CHWs able to bounce back and cope with adverse work-life conditions and function effectively in their roles?

The first part of this research examined how CHWs in Ghana described resilience and well-being within their social and work contexts (4). From this exploration, we found that CHWs conceptualize resilience and well-being as dynamic, multi-layered processes shaped by the interplay of personal attributes and contextual realities. Dimensions of resilience included cognitive and adaptive resilience, collective or communal resilience, emotional resilience, and spiritual or faith-based resilience. Similarly, well-being encompassed multiple domains; environmental, financial, mental and emotional, physical, social, and spiritual (4).

This conceptualization of resilience and well-being suggests that the factors that shape perception and experience of these concepts are themselves multi-layered, rooted in both individual attributes and contextual realities (4,14). This study thus takes an additional step to explore the socio-ecological factors that underlie CHWs' experiences of resilience and well-being in Ghana. Specifically, the interplay of factors operating at individual, relational, community, and structural or systems levels. Insights in these context-specific factors can inform culturally grounded and sustainable strategies to support CHW resilience and well-being. Secondly, acknowledging that resilience and well-being are shaped by multifaceted experiences, the study draws attention to the individual and contextual elements that are essential for future investigations of resilience and well-being among similar populations.

Methods

Data were collected from the Kassena-Nankana Municipal and Kassena-Nankana West District in Ghana, among a diverse group of CHWs and stakeholders within the CHPS program. Working closely with Community Health Officers (CHOs), CHWs serve as volunteers who support community outreach, monitor household health, provide basic care, health education, and referrals, while also assisting with malaria, vaccine-preventable diseases, and neglected tropical diseases programs (15). A detailed description of the study methods is provided in a separate publication (4).

Study design and data collection

A phenomenological design was used to explore CHWs' resilience and well-being (16). Twenty in-depth interviews (IDIs) were conducted between June and August 2023, with sixteen CHWs and four key stakeholders (SH). Sampling was done purposively to ensure diversity across genders, districts, and service years, and data saturation was achieved when no new perspectives

emerge (16). Stakeholders were identified in consultation with the Regional CHPS Coordinator. The sample pool included District CHPS Coordinators, Community Health Management Committees (CHMCs), CHOs, and District Health Management Teams (DHMTs) due to their engagements with CHW. However, due to scheduling conflicts and limited availability, two District CHPS Coordinators and two CHOs from each District were sampled. Selection of CHWs was described elsewhere (4).

Interviews were scheduled in-person at a time and place that was convenient and private for each participant. Field notes were taken, and interviews were conducted and audio-recorded by JS, JA, and NA in Kasem and Nankani. Participants were informed of the nature of the study, procedures, risks and benefits, the voluntary nature of participation, and the confidentiality procedures. Participants also signed informed consent forms. Interviews with CHWs were guided by two broad questions: (1) In what ways do your relationships, social support networks, or community contribute to your resilience and well-being? (2) Are there any specific cultural, spiritual, or religious beliefs that play a role in your resilience and well-being? Can you provide examples of how they influence your life? Stakeholders were also asked two broad questions: (1) When you think about CHWs, what do you think contributes to their resilience and well-being? (2) Are there any individuals or groups, healthcare systems and within the network of CHW's relationships, social support networks, or community that impact their resilience and well-being? The word resilience was described in lay terms as "picking oneself up after facing difficulties or challenges" and well-being as "to possess good health and happiness." Probes were further used within each broad question for nuanced descriptions. Throughout the study, we maintained a reflexive approach, critically reflecting on our roles and potential biases that might have influenced data collection and interpretation.

Data management and analysis

Interviews were transcribed into English, and analysed using interpretative phenomenological analysis (IPA), with a socio-ecological lens (17). The analysis conducted by JS and PA following a structured, iterative process involving independent coding, clustering of emergent themes, and group-level synthesis. Data were organized using NVivo 14.0. An intersectional and socio-ecological lens was used to explore how CHWs' experiences of resilience and well-being are influenced by different factors (18,19). Detailed data management and analysis, ethical

procedures, and analytic protocols remained the same as those reported in the first part of this study (4).

Results

A total of 20 IDIs were conducted with CHWs, nurses, and CHPS coordinators. Sample composition is presented below (Table 1). Reporting of the study was guided by the 32-item Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist for interviews and focus groups (Supplementary I).

Table 1. Sample Characteristics and Representation

Participants	Characteristics					
	Municipality/District		Gender		Experience	
	KNW Municipal	KNE District	Male	Female	< 5 years	> 5 years
CHWs	8	8	6	10	8	8
% CHWs	50	50	37.5	62.5	50	50
CHPS Coordinator	1	1	2			
CHO	1	1		2		

Contextual processes and factors that shape resilience and well-being

Using the social-ecological framework (Figure 1) as a guide, the results highlight both barriers and facilitators to resilience and well-being at the individual, relational, community, and structural or systems levels, along with climatic and seasonal factors modify or amplify these dynamics.

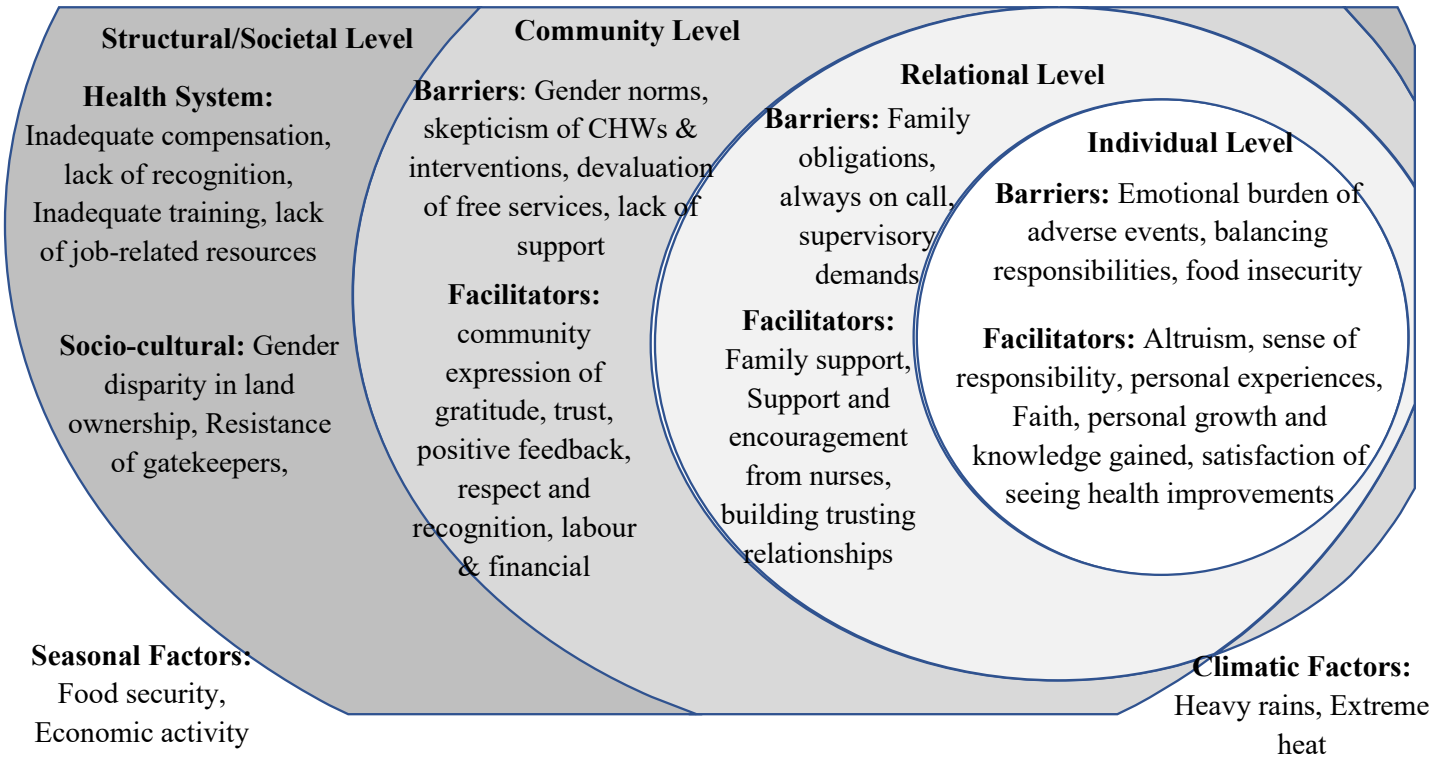
Contextual processes and factors that act as barriers to resilience and well-being.

Individual-level processes and factors

CHWs navigate a range of personal challenges that shape their resilience and well-being. These include **emotional distress** following adverse treatment outcomes, **difficulty balancing**

volunteer duties with livelihood activities such as farming, and limited access to healthcare due to **financial hardship**.

Figure 1: Social-ecological factors that shape the resilience and well-being of CHWs



Seasonal/climatic conditions could act as modifiers, amplifying or buffering socio-ecological factors at all levels

Some CHWs reported **emotional strain and feelings of guilt**, whenever community members experienced **adverse reactions to treatments** they administered. These incidents impact their well-being and confidence:

> *"I gave SMC [seasonal malaria chemotherapy] to a boy and the situation got bad and they referred them to the hospital. I did not feel well about it…the mother initially refused the medicine…but because of my advice and the trust the mother has for me, the boy took the medicine…I felt it was my fault because the woman refused to take the medicine and I insisted and they took it, and that happened..." (Female CHW013)*

Balancing volunteer health work with personal responsibilities also poses a daily challenge. Many CHWs struggle to meet the expectations of both roles, often sacrificing income-generating work to fulfil their volunteer obligations:

> *"It becomes difficult when you have your volunteer work and your own work…it puts pressure on you. When the health work comes, and I have farm work, I will have to do the health work because my community members and my children wouldn't get medicine to take…this affects me! (Male CHW002)*

Financial limitations further affect CHWs personal well-being, especially when they are unable to seek timely healthcare. For some, this compromises both their physical health and ability to continue working:

"I had a problem that led to injury on my leg…I did not have the money to treat it, so I was struggling to work…most times, it's the financial aspect that affects our well-being" (Male CHW004)

Relational-level processes and factors

Resilience and well-being are also linked to how well CHWs relate to family, supervisors, and peers. **Relational strain, particularly at home or in the workplace**, can introduce stress and disrupt coping mechanisms.

Community Health Workers often experience **tension in their households** when they must prioritize volunteer responsibilities over livelihood activities, such as farming. As described by one CHW, this resulted in stress and frustration from his spouse:

> *"I can't farm my usual farm size anymore and my wife is complaining that they gave me work to do for the community and they wouldn't help you in the farmwork…where will we get food to eat? This is a big problem" (Male CHW011)*

Others reported feelings of helplessness and vulnerability resulting from their **inability to obtain essential family support** due to the death of a supportive family member:

> *"My brother in Kumasi [a city] who usually helps me, lost his wife and he told me that this year he can't help anymore…I suffered! I didn't know what to do…I cried to God saying, "how will I provide for these children?" (Female CHW016)*

In some cases, participants reported feeling burdened by **supervisory expectations** that did not consider their workload or time:

"We get pressure from the supervisors…you'll be on home visits at a far location, and they'll call you to come around the health centre…this is stressful. However, because they're leaders you cannot argue with them… they give you work to do for the day, and the day is not over but they're asking for data and I'm still working." (Male CHW004)

Community-level processes and factor

Community dynamics like lack of support from local leaders and community members, misperceptions of CHWs' compensation, exclusion from local opportunities, and doubts about their professional competence were identified as undermining well-being and resilience. Such challenges were often heightened during the rainy season, when workloads increased.

A female CHW for instance, expressed frustration over **inadequate community and leadership support**, noting that they were often undervalued and excluded from local benefits:

> *"The major challenges I have as a volunteer is that there is no support from the community….in rainy season for instance, I spend more of my time doing the voluntary work than my own personal work…and when opportunities come up in the community, they will not give them to us because they think we're already working. The opinion leaders are not helping". (Female CHW013)*

The stakeholders also highlighted how community misconceptions about CHW compensation led to **unrealistic expectations and reduced cooperation**. They noted that quite often, community members wrongly assumed CHWs were paid and, as a result, felt entitled to demand services without accommodating their limitations:

> "*A challenge is that the community members feel CHWs are paid so, sometimes they don't cooperate with them. For instance, when we have activities like SMC, they will have to trace them as far as to their farms. When CHWs ask them to wait at home for their children's medicine, they say they're paid and should serve them wherever they are…that is the challenge…people think we pay the volunteers, but they're not paid…this misconception stresses them" (Female SH002)*

Occasionally, **community scepticism** of interventions and the informal status of CHWs impacted resilience. One CHW recounted an incident where her authority was dismissed, and her service was rejected because she was not a mainstream health professional:

> *"We went to a house, and after mixing the medicine for a child, the father took the medicine from my hands and poured it away although the mother agreed. He said he doesn't like children taking random medications. I felt discouraged but it's part of the work… I called my supervisor and she came, and because she is a nurse, the man then believed the medicines are not harmful…so, he didn't want to give the baby the medicine because I am a volunteer." (Female CHW006).*

Systems or structural-level processes and factors

The **health system** and the broader **socio-cultural context** played a role in shaping CHW resilience and well-being. Systemic barriers, including a lack of formal employment, delayed or inconsistent compensation, diminishing institutional support, resource constraints, and entrenched gender norms were mentioned. Also, disparities in workload and supports between government-led initiatives and those funded by nongovernmental organizations (NGOs) were noted.

Stakeholders noted that **NGOs led intervention have lighter workloads** and a consistent compensation structure, while the **District Health Administration (DHA) often stretched limited resources** across multiple interventions and a broader geographical region, which frustrates CHWs:

"The NGOs have less workload and CHWs are remunerated well, so, no matter the workload, they're willing to work with them (NGOs). But because of the nature of our work (DHA), when we have an intervention, we want to cover so many areas with the same resources. For instance, we train volunteers for interventions, and we're looking at an entire district. We try to include too many activities at once to cover more areas, but it just gives CHWs extra work and leaves them frustrated." (Male SH001)

Some CHWs also expressed frustration over the **lack of formal recognition**.

> *"I started with these nurses thirteen years ago and I haven't been employed, but I'm still here. This worries us…we're not permanent and when the month ends you wouldn't give*

us anything…waiting till three months to give us 200.00 Ghana Cedis (USD $11) is frustrating." (Female CHW016)

Others mentioned **reduced institutional support** leading to diminished motivation. Pointing to discontinuation of monthly reviews, refresher trainings, and reimbursements for travel:

"At the end of the month, they used to come and review the books to see how many patients you have in the month, provide retraining every three months and give us T&T (Transport allowance), but now that is not there…there's no encouragement" (Male CHW008)

Gender norms ingrained within family and community limited the opportunities for some female CHWs. A CHW described her experience of being denied secondary education by her father, who did not **value the education of girls**:

"A major challenge I faced was after completing junior high school. I got admission to senior high, but my father said he wouldn't pay my fees because it was a waste of money educating a girl who would eventually get married and leave. He wanted me to marry so he could take my bride price. What's painful is that he wasn't illiterate. That incident still hurts…whenever I chat with my colleagues, I attribute my current woes to my father's decision about my education." (Female CHW013)

Effects of seasonal climate conditions on resilience and well-being

Seasonal **climate conditions** shaped the resilience and well-being of CHWs through logistical, environmental, and occupational challenges.

As described by this CHW, peak farming periods and heavy rainfall significantly impacted outreach efforts:

"The challenging period which stresses us the most is sowing and weeding season… it is very difficult to go out because of the rains let alone give medicines or invite women for weighing but we still go." (Female CHW002)

Besides poor conditions, the rainy season coincides with intense health campaigns, which **increase CHWs' workloads** and force them to pause personal obligations.

"The rainy season has so many activities. I have farm and volunteer work. We finished the SMC last month and have to do it again next month…it's part of our work…we will have to leave our farm work and volunteer for five to seven days… that is too much." (Male CHW008)

Stakeholders corroborated this, stating that farm work and health duties contributed to **fatigue during the rainy season**. Unfavourable weather conditions often prevented CHWs from carrying out outreach activities, even though they are still tasked to do so:

"Most of them are fatigued during the rainy season…they work on their farms and still come to complete their health campaigns. They have no time to rest or do other things. When it rains like today, they're still expected to go out and distribute the medicines. (SH001)

The dry season presented different sets of challenges. The **extreme heat** and risk of cerebrospinal meningitis made it challenging to deliver services as noted by Female CHW016:

"The dry season is difficult…I must travel a far distance in the sun for this work, and I don't have a bicycle. The extreme heat and CSM (Cerebrospinal meningitis) are a problem in the dry season. The volunteer work requires that we have bicycles because of the sun but we don't. (Female CHW016)

Contextual processes and factors that facilitate and shape resilience and well-being

Individual-level Processes and Factors

Positive motivators such as **altruism**, especially the desire to improve community and child health, encouraged CHWs to volunteer and strengthened their resilience and well-being. **Personal growth through learning** and the **tangible benefits their work brings to the community** also reinforces their resilience. Additionally, **faith, introspection, and a strong sense of responsibility** empower CHWs to overcome challenges, fostering perseverance and overall well-being.

For example, *Male CHW015* described his work as a **personal responsibility and duty**, driven by his values and commitment to the community's well-being:

"I personally felt it's important to support the community…In my opinion, everyone who has the community at heart and wants the community's health improvement can volunteer…that is why I decided to support." (Male CHW015)

For some CHWs, **personal growth in health knowledge** and **visible improvements in community health outcomes** are important sources of resilience and well-being.

"I do this work with happiness…I learned things I didn't know before I became a volunteer…there're health improvements too…in the past, women used to deliver premature babies; they don't deliver premature babies like that anymore…how children used to die, they don't die like that anymore. (Male CHW011)

For some CHWs **altruism** anchored their resilience. They volunteered to contribute their energy toward helping others and ensuring the community received the care it needed:

"I noticed no one from our community supported the nurses and they complained that they can't locate the houses. So, I said if I'm not going anywhere, and I can support, why should I sit down and watch? It does not cost anything but my energy to support the community to improve; that's my reason to keep volunteering." (Male CHW015)

Relational-level processes and factors

Supportive relationships with family, community members, and health system actors influenced daily experiences and coping mechanisms.

For some CHWs, **establishing rapport and relationships** with community members fostered trust and laid the foundation for a less stressful working environment:

"I usually visit this man to administer medicine… he had hydrocele and was afraid to go for an operation (surgery)… I talked to him, and he went for the operation… He's still alive and doesn't forget this. When we're delivering medicines and other CHWs go there, he would tell them (CHWs' name) will bring his, though his house is at the far end of the village…when we're chatting, he would say oh (CHWs' name), you have done well, may God grant you good health, you are the reason I am still alive else I would've died...this makes the work worthwhile" (Male CHW008)

Besides community ties, **family support** was important in maintaining resilience and well-being, especially during challenging financial times. For some, relatives are their reliable source of help:

> *"It is my family that helps me when I have any problem, for example money. No one else supports…the world is difficult that is why I say only my relatives support me." (Female CHW005).*

Moreover, **relational dynamic with health facility staff** also matters. CHWs who described respectful, patient, and clear communication from healthcare providers felt valued and appreciated.

> *"At the health centre, the way the nurses talk to us, especially when they want to explain something to us, they take time to do it for you to understand. They talk to us politely and you feel respected and valued" (Male CHW004)*

Community-level processes and factor

Community support emerged as vital in strengthening the resilience and well-being of CHWs. **Gratitude, respect, and positive feedback** from community members reinforced CHWs' sense of purpose and commitment. For many, these affirmations served as a source of resilience:

> *"They give testimonies about us and the medicines we deliver; they say we do well, and the medicines are very effective in treating malaria, they say the drugs for elephantiasis, bilharzia and polio are also very effective…so, that is very encouraging." (Male CHW002)*

Familiarity between volunteers and the community, knowledge that **volunteers have been trained** to deliver services, fostered trust, encouraged cooperation and enhanced volunteer resilience for some stakeholders:

> *"Because CHWs are the same people staying with them (community), and the communities believe they have received training before they deliver services to them…they accept them (CHWs,), which gives them less stress in the work (Male SH001).*

Additionally, some CHWs reflected on community solidarity as their source of resilience and well-being:

"The community notices your problems and works together to solve them. If there is a funeral in your house, all people from your community always come to support you for the funeral to be successful." (Male CHW008)

"There are also others who appreciate the work you do and sometimes will give you groundnuts and other things" (Female CHW006)

Systems or structural-level processes and factors

Structural and health systems experiences were important for CHWs' resilience and well-being. Tangible material supports like bicycles and certificates, helped sustain their motivation.

For this CHWs, receiving a bicycle, symbolizes appreciation for their dedication and reinforced their commitment:

"There was a time they brought six bicycles, and they called me and said there are not many for everyone, but they asked me to pick the one I liked so that they'll call others to come and pick too…should I not be happy about this? Is it not because of my good works that they have given me a bike? Why won't I be happy to do the work? Now I don't have to walk everywhere" (Male CHW011)

Recognition from higher authorities, through certificates and awards also enhanced morale and affirmed the value of their work:

"One time, they gave us certificates saying that it was because of our good work. They came again with best volunteer award and gave us shirts to encourage us and let us know that they recognize the work we're doing…that is encouraging." (Female CHW005)

Stakeholders noted that **community engagement and communication** promoted cooperation, helping to strengthen resilience and well-being:

"We [DHA] have been able to engage the community well for them to understand the trainings that CHWs have acquired…so, the communities support them when they get there." (Male SH001)

In addition, **capacity building** boosted confidence and pride in CHWs, enabling them to share new knowledge with their communities and reinforced their identity as trusted health workers:

"They also like the information they get because we engage them in trainings and other activities, and they're always proud to go back to share with the community...they believe in them (CHWs)" (Male SH003)

Some CHWs derived resilience from the broader impact of their work on **transforming cultural norms and improving health behaviours** in their communities. These visible changes provided a deep sense of purpose and satisfaction, as noted by Male CHW011:

"Our cultural practices affected us and contributed to a lot of deaths among children. In those days, if the child is sick, they say you can't take the child outside because they fear crowds. These are our cultural beliefs, and as a result we lost our children…but because of our work, these things are no longer there. People no longer say their child would not go to the hospital because it is forbidden…This is very encouraging for us." (Male CHW011)

Effects of seasonal climate variations on resilience and well-being

Seasonal climate conditions have positive implications for CHW resilience and well-being. Some periods of the dry season and post-harvest period were often described as times of relief, economic stability, and improved social interactions. These factors contributed to reduced stress and enhanced motivation among CHWs.

During the **dry season**, food security and **community generosity** improved CHWs' morale and created a more supportive working environment:

"From October onwards, it doesn't rain and people are harvesting their crops…sometimes you get to a compound, and they'll give you roasted corn or fresh groundnuts, and that puts a smile on your face." (Female CHW001).

Post **rainy season** also brought a sense of **freedom and stronger community engagement**. CHWs described this period as more relaxed and fulfilling, allowing them to build positive relationships during their outreach:

"After the rainy season, everybody is free and when you go to a compound and the children see you, they run to you and play with you… some take you as a friend." (Male CHW004)

Similar observations were made by stakeholders:

> *"Somewhere in October- December they would've finished harvesting. So, they [community people] are always free, so you can always reach and engage them at any time" (Male SH003)*

Male CHW015 also noted that the **dry season** has **lighter workload**, reducing the pressure of balancing multiple responsibilities:

> *"From January to May there is less workload…so, I don't have to worry about other personal multiple responsibilities." (Male CHW015)*

Discussion

Employing an exploratory qualitative approach, this study advances knowledge on the resilience and well-being of community health workers, an essential workforce in primary care systems in low-income settings. The study contributes to the literature by emphasizing the multisystem nature of resilience and well-being, conceptualized within social-ecological experiences (4,14,20). Our findings shows that CHWs' resilience and well-being are shaped both positively and negatively by multiple, co-occurring factors emerging from individual experiences and broader cultural, community, structural, and seasonal influences. This is consistent with other studies that have shown that individual capacities and broader social and systemic work environments can either facilitate or hinder CHWs' functioning and ability to continue serving their communities (2,5–8,12,21,22).

Community Health Workers face layered **challenges** spanning individual, relational, community, and structural domains, which undermine their well-being, resilience, and motivation to remain in service. At the individual level, CHWs frequently reported experiences of guilt and emotional distress when communities responded negatively to treatments, along with difficulties balancing volunteer duties with family obligations and persistent financial constraints. Previously, studies have shown that negative community reactions and insults (23), moral dilemmas (5), conflicting responsibilities and time management (24), and inadequate income and out-of-pocket expenses (23) compromise CHW motivation, elevates stress, and undermine both resilience and well-being. Besides personal experiences, broader contextual **challenges** such as strained family relations, community misperceptions, neglect within the healthcare system, and entrenched

gender-based cultural barriers all intersect to undermine resilience and well-being (1,3,12). These contextual stressors weaken coping capacities, reduce positive functioning, and compromise overall well-being, while also diminishing CHWs' motivation to sustain their roles, a pattern consistent with findings reported in multiple studies (1,5,6,9,10,13).

In spite of substantial challenges, CHWs draw **strength** from intrinsic motivations such as altruism and the desire to improve community health, protect children, and support neighbours, as shown in other contexts (3,4,7,22,23). Additionally, learning opportunities, seeing tangible community benefits, and the trust they receive from community members provided meaning and purpose to their work, consistent with evidence reported elsewhere (4,7). These intrinsic motivators were often amplified by contextual facilitators, such as family and community support, health service recognition, and seasonal respite, which strengthen commitment and motivation. This aligns with a broader body of evidence emphasising the role of family support (4,24), community support, ownership, and respect (2,3,5), non-monetary incentives such as trust and recognition (2,22,24), integration into health systems (2) and seasonal benefits (12), that temporarily alleviate strain on CHW commitment, motivation and functioning.

Our study suggests that the resilience and well-being of CHWs are affected by multifaceted socio-ecological influences (4–7,13). A variety of adverse and facilitating conditions across several layers of the social environment interact with a person's vulnerabilities and strengths to produce a variety of coping responses and well-being outcomes. Yet, traditional biomedical models tend to overlook social and environmental determinants, particularly strained interpersonal relations and under-resourced community structures, which are vital for maintaining resilience and well-being (4,25). For instance, CHWs often cited emotional strain, conflict between work and life, and financial hardship as barriers to coping with routine stressors. However, these challenges were rarely isolated; rather, they were deeply influenced by family dynamics, the perceptions of the community, the responsiveness of the health system, and even the season. An example of this is when a CHW internalised hostile community reactions as a personal failure, resulting in guilt and demoralization that undermined both well-being and motivation for service. This illustrates how contextual stressors combined with self-blame can intensify psychological burden to diminish resilience and well-being (26). In the case of CHWs, being held responsible for failure despite external factors beyond their control can place undue psychological strain on them. Over time, this burden can undermine their resilience, compromise

well-being, and decrease motivation to continue supporting their communities. In another instance, financial insecurity, which was a personal vulnerability, was amplified by the community's mistaken belief that CHWs receive formal compensation. This wrong perception not only reduces support and cooperation from some community members, but also intensifies the emotional and social burdens associated with unpaid volunteer work (3,12,22). While such pressures may be expected in resource-constrained settings, their persistence and entrenchment not only transform them from temporary challenges into contextual threats to the resilience and well-being of CHWs but also threaten the sustainability of programs that rely on them.

A notable insight from this study is how seasonal variation illustrates the role of more distal socio-ecological conditions in shaping CHWs' resilience and well-being (4,14,20). In line with findings from other contexts (12,27), participants described rainy season and a substantial part of the dry season as intensely challenging periods marked by increased workloads, extreme heat, difficulties traveling, and strained resources, often compounded by additional responsibilities such as farming. In contrast, transitional or harvest periods and some durations of the dry season were sometimes seen as respite periods, with reduced work demands, improved economic opportunities, and in-kind support from community members. These seasonal fluctuations, especially during the challenging seasons disrupt routines and compound existing vulnerabilities, posing additional stresses that undermine coping mechanisms, motivation, and service delivery (1,4,5,22). Thus, sustaining the well-being and resilience of CHWs depends on recognizing and responding to these cyclical pressures during program and health services planning.

Finally, the extent to which gender norms constrain opportunities and undermine the resilience and well-being of CHWs, particularly those navigating inequities shaped by gender, is also worth pointing out, even if experiences across genders were broadly similar. One CHW recounted her father's refusal to allow her to attend secondary school, a decision that continues to cause her pain and suffering. This demonstrates how discriminatory practices within households can create systemic disadvantages that are reflected throughout the life course of individuals (28). Such gendered inequities not only restrict opportunities but also leave lasting emotional scars, undermining resilience and reinforcing vulnerabilities within both CHWs’ family and work domains (28).

Implications

Our findings resonate with multisystem frameworks that emphasise the dynamic alignment or misalignment between individual capacities and environmental or contextual demands (14,20). Among CHWs, personal vulnerabilities, such as financial insecurity or emotional strain, were often compounded by contextual challenges, such as strained family relations, misperceptions within the community, institutional neglect, and climate stressors. This misalignment may transformed routine pressures into systemic threats that undermined resilience and well-being (4,20,29). At the same time, resilience was also actively reinforced by several factors. Individual-level facilitators, such as altruism, personal growth, and faith were enhanced by enabling contexts such as supportive families, community solidarity, structural recognition, as well as seasonal reprieve. In these circumstances, the synergy between personal resources and environmental supports sustained motivation, strengthened resilience, and preserved well-being.

To bolster CHW resilience and well-being, and to reinforce primary health care systems, it is necessary to implement multilevel strategies (4,14,20). Such strategies should have a seasonal cadence and must not only reduce barriers by addressing systemic and individual stressors, including harmful restrictive gender norms but also strengthen facilitators by fostering conditions that sustain positive experiences, supportive relationships, and intrinsic motivation among CHWs. Policies and programmes that explicitly tackle both individual and structural challenges, while amplifying facilitators of resilience, are essential for sustaining CHWs' well-being, motivation, and long-term contributions to population health.

Study Limitations and Future Research

This study was limited to two districts in the Upper East Region of Ghana. Despite the use of purposeful sampling to ensure diversity, findings might not reflect the perspectives of CHWs working in other regions with different culture, structural organization, and environmental conditions. However, we provided thick descriptions to support transferability of our findings based on contextual similarities rather than representativeness (17). The scope of future research should include additional regions to capture broader perspectives and context-specific details. Secondly, all interviews were conducted in Kasem or Nankani and translated into English for analysis. The process of translation is inherently interpretive, so subtle shifts in meaning or culturally-rooted expressions may occur even when careful procedures have been followed (30). To mitigate this, two native speakers verified translations to reduce distortions and preserve

nuanced meanings, as recommended elsewhere (30). Finally, the cross-sectional design captures CHWs' experiences at a single point in time - during the rainy season when workloads are high. However, resilience and well-being are dynamic and vary across life events, policies, and seasons (31). Findings may therefore overrepresent stressors and understate positive experiences, highlighting the need for longitudinal research to track how resilience and well-being shift with changing conditions.

Conclusion

This study demonstrates that the resilience and well-being of CHWs are shaped by the interplay of personal strength and vulnerabilities and the broader social-ecological contexts in which they live and work. Structural threats ranging from systemic neglect and community misperceptions to entrenched gender inequities intersect with financial and emotional strains, while seasonal and climatic conditions further modify these effects, collectively undermining CHWs' resilience and well-being. Yet, intrinsic motivators like altruism, personal growth, and faith, when reinforced by supportive families, communities, and health systems, sustain CHWs' well-being. Strengthening the resilience and well-being of CHWs, and by extension, primary health care systems in low-resource settings, requires multi-level interventions that address both individual and structural barriers, challenge restrictive gender norms, as well as provide enabling conditions for CHWs to enhance their existing capabilities. Some practical measures could include providing reliable transportation or mobility support during the rainy season to ensure safety and continuity of care; implementing recognition and feedback systems that demonstrate the value of CHWs' contributions; developing communication campaigns to clarify misconceptions regarding CHW compensation and role expectations; and integration into the formal health service by providing recognition, stable support, and inclusion within institutional structures that strengthen their identity, security, and social connectedness. Doing so is critical for sustaining both the health workforce and the broader goal of improving population health.

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CHAPTER 6

Objective 3 – Seasonal variation in resilience and well-being

6.1 Article Preface

This chapter addresses Objective 3 of the thesis, which was to examine seasonal variation in resilience and well-being among community health workers in Ghana and to assess whether resilience is associated with well-being over time. The article presents the longitudinal component of the thesis and ties together the two qualitative chapters. Chapter 4 established how CHWs understand and describe resilience and well-being in their own terms, while Chapter 5 identified the contextual, programme, and seasonal factors that shape these experiences and helped clarify the factors to account for in the longitudinal analysis. Building on both chapters, this article examines whether these meanings and contextual processes are reflected in measurable patterns across dry, rainy, and transition/harvest seasons.

The article focuses on CHWs in the Upper East Region of Ghana, where seasonal changes shape disease burden, mobility, farming demands, household resources, community support, and health system pressures. This is important because the qualitative findings showed that CHW resilience and well-being are not static, but are shaped by changing work-life conditions. The longitudinal study therefore provides a way to examine whether resilience and well-being vary across these seasonal periods, and whether the association between resilience and well-being changes under different seasonal and programme conditions.

By using repeated measures from the same CHWs across three seasons, the article provides the temporal and quantitative complement to the earlier qualitative chapters. It moves the thesis from local meaning and contextual explanation to empirical assessment of seasonal dynamics. In this way, Chapter 6 integrates and extends the first two papers by testing the core argument of the thesis: that CHW resilience and well-being are not fixed individual attributes, but dynamic, context-dependent, and seasonally shaped experiences.

6.1.1 Contribution

I led the development of the longitudinal research question with guidance from my supervisors, Drs. Alison Krentel and Ian Colman, and input from the thesis advisory committee. I coordinated the design and implementation of the longitudinal cohort study, including the seasonal framing, questionnaire refinement, participant follow-up procedures, and data management processes. I also led the statistical analysis, including the derivation of resilience and well-being measures,

classification of seasonal periods, interpretation of mixed-effects models, and assessment of the relationship between resilience and well-being over time.

Dr. Cindy Feng supported the statistical analysis and advised on model building, including the selection and interpretation of the longitudinal modelling approach. I prepared the first draft of the manuscript and coordinated revisions with co-authors. Co-authors contributed to refinement of the study design, methodological guidance, interpretation of findings, contextualization of the seasonal and climatic data, and critical revision of the manuscript for important intellectual content. The findings from this study are expected to be presented at the Canadian Conference on Global Health in Montreal in 2026.

6.1.2 Ethics approval

This study received ethical approval from the University of Ottawa Research Ethics Board [H-04-24-10186] Research Ethics Board and the Navrongo Health Research Centre Review Board [NHRCIITB600]. We also obtained the necessary permissions from the regional and district health administrations of the Ghana Health Service before beginning data collection. Participation was voluntary, and written informed consent was obtained from all participants after a thorough explanation of the study procedures.

6.1.3 Manuscript status

This chapter presents the manuscript that will be submitted for review at BMC Human Resource for Health. The chapter-specific reference list and appendices have been retained to preserve the manuscript's structure, ensure that the most current references are included, and provide the supplementary methodological details and results necessary to support the chapter.

6.2 Article Content

Seasonal Variation in Resilience and Well-being among Community Health Workers in Northern Ghana: A Longitudinal Cohort Study

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Abstract

Background: Community health workers (CHWs) are essential to primary healthcare delivery in low- and middle-income countries, yet they often operate under demanding and seasonally variable conditions. In these contexts, resilience has been proposed as a key adaptive process enabling health workers to maintain psychological functioning and performance under adversity, while well-being reflects broader psychosocial outcomes. However, evidence on how resilience and well-being change over time and across environmental contexts remains limited. This study examined seasonal variation in resilience and well-being among CHWs in Ghana's Upper East Region and assessed whether resilience is associated with well-being across changing climatic and occupational conditions.

Methods: We conducted a prospective cohort study of CHWs across three districts in northern Ghana with data collected during the dry/early rainy (March–June 2024), rainy (July–August 2024), and transition/harvest (October–December 2024) seasons. Resilience was measured using the 28-item Resilience Research Centre–Adult Resilience Measure (RRC-ARM) and well-being using the WHO-5 Well-Being Index (0–100 scale). Linear mixed-effects models with participant-level random intercepts were used to examine seasonal differences in both resilience and well-being, adjusting for sociodemographic, occupational, and environmental factors. Additional models assessed the association between resilience and well-being, with well-being as the outcome and resilience as the primary predictor. To distinguish differences between CHWs from changes within the same CHW over time, resilience was analysed as both each CHW's average resilience across waves and each CHW's seasonal deviation from their own average.

Results: A total of 377 CHWs completed the baseline survey, with retention exceeding 95% across follow-up waves. Mean resilience increased from the dry/early rainy season (122.9, SD 11.2) to the rainy season (128.6, SD 9.5) and remained high during the transition season (127.1, SD 8.1). Mean well-being also increased across seasons, from 62.7 (SD 24.1) in the dry season to 73.2 (SD 24.1) in the rainy season and 76.0 (SD 18.2) in the transition season. In mixed-effects models, higher resilience was associated with higher well-being (adjusted β=0.60, SE 0.08; $p<0.0001$). The strength of this association varied by season, with stronger within-person

resilience–well-being relationships during the rainy and transition seasons compared with the dry season. Seasonal patterns also differed by district and incentive frequency.

Conclusion: Resilience and well-being among CHWs follow identifiable seasonal trajectories shaped by environmental and programme contexts. Strengthening predictable incentives, supportive supervision, and material resources, particularly during high-strain periods, may help sustain CHW well-being and support climate-resilient community health systems.

Introduction

Community health workers (CHWs) are integral to primary healthcare delivery globally (1). Their deep knowledge of local culture and language, as well as their embedded position within communities, uniquely positions them to improve access to care and strengthen community health system linkages (2,3). In low- and middle-income countries in particular, they provide culturally attuned care, deliver health education, support preventive and curative services, and contribute substantially to public health campaigns (4–6). However, this work is often shaped by stressors that disrupt daily routines, increase workloads, limit mobility, and reduce access to communities, with important implications for CHW resilience and well-being (7–10).

Resilience, the capacity to adapt positively to significant stressors, has emerged as a key process enabling health workers to maintain performance under adversity (7,11,12). Contemporary conceptualizations describe resilience as a dynamic process shaped by resources at the individual, relational, community, and system levels, rather than a fixed personal trait (11,13–15). Within CHW programs, studies have shown that community support, sense of purpose, and positive social relationships can strengthen resilience, while stress, inadequate incentives, and challenging work conditions, particularly within different seasons, can undermine it (7,16,17).

Well-being is similarly central to CHW performance and retention (7,11,18–20). Well-being, usually understood as the experience of life satisfaction and the balance of positive and negative emotions, is influenced by social relationships, meaningful work, and personal fulfilment (11,21,22).While volunteerism can foster a sense of purpose and psychosocial benefit over time, evidence indicates that CHWs frequently experience cumulative stress, burnout, and emotional strain arising from unpaid labour, inconsistent incentives, heavy workloads, adverse climatic conditions and competing household responsibilities (7,18–20,23,24).

Although resilience and well-being are central for CHWs functioning, evidence remains limited and is largely cross-sectional, limiting our understanding of how these concepts change over time and how resilience influences well-being in seasonally dynamic community health contexts (11,12,25). As climate-related pressures intensify, seasonality will be an important but underexamined factor shaping the work of CHWs and healthcare providers more broadly. Seasonal changes can affect workloads, mobility and access to communities, with implications for resilience, well-being, retention, and the long-term effectiveness of community-based health

programmes (7,8,10,11). This knowledge gap is especially important in seasonally dynamic settings such as Ghana, where CHWs extend the reach of overstretched health services to rural underserved communities, and where seasonal variation is a defining feature of rural life, livelihoods, and health service delivery (2,4,7).

Earlier qualitative evidence show that seasonal variation represents an important contextual factor that may shape both resilience and well-being among CHWs (7,11). In Ghana, as in many tropical countries, dry, rainy, and transitional seasons produce substantial fluctuations in disease burden, mobility, economic activity, and workload (7,9,17,26–28). The rainy season, in particular, is associated with heightened disease transmission, increased morbidity, flooding, and reduced access to remote communities, which together intensify service demands and create logistical challenges for CHWs (5,7–9,27). These pressures are further intensified by rural households' reliance on subsistence agriculture, as peak farming periods usually overlap with CHW responsibilities, creating competing demands on time, labour and resources (7,26,29). As a result, the rainy season and some periods of the dry season, usually characterized by extreme heat, are often described as especially demanding, with increased workloads, competing livelihood demands, mobility constraints, and limited resources (7). In contrast, transitional or harvest season is often associated with better health outcomes (7,28,30). This period is commonly perceived as a time of relative relief, when workloads ease, household economic conditions improve, and greater in-kind support from community members is available (7,31).

Even with this substantial theoretical rationale, evidence remains limited on how CHW resilience and well-being vary across seasons, as well as how resilience relates to well-being across seasonal contexts. Conceptually, resilience has been described not as an end in itself but as a pathway through which outcomes such as mental health and well-being are achieved (15,32). Within this framing, resilience operates alongside other promotive and protective factors across multiple system levels to buffer individuals from threats to well-being (7,32). Building on this understanding and situating resilience within a social ecological framework, we conducted a longitudinal study among CHWs in Ghana's Upper East Region across three distinct climatic seasons, which are the dry (March–June 2024), rainy (July–August 2024), and transitional seasons (October–December 2024). The study examined temporal variation in resilience and well-being across seasons and assessed whether resilience influenced well-being differently across these seasonal periods. Addressing this gaps is increasingly important as climate change is

projected to intensify seasonal extremes and increase the frequency of severe weather events (33,34). This has implications for establishing of healthcare priorities, service planning and implementation of both preventive and therapeutic initiatives, and the resilience and well-being of healthcare personnel.

We tested two hypotheses. First, we hypothesized that CHW resilience and well-being differ across seasons, with the highest levels observed during the transition season. Second, we hypothesized that resilience would be positively associated with well-being, with the strength of this association varying by season.

Methods

Study setting and geoclimatic and seasonal conditions

The study was conducted in Ghana's Upper East Region. The region is situated in northeastern Ghana, bordered by Burkina Faso to the north, Togo to the east, the Northern Region to the south and the Upper West Region to the west (35,36). The region's climate is described as tropical continental or interior savannah and is strongly influenced by the tropical continental air mass (9,35,36). Unlike southern Ghana, which has two rainy seasons, the Upper East Region has a single rainy season from July to October, followed by a prolonged dry season from October to early June, characterized by dry harmattan winds, reduced humidity, and cooler nighttime temperatures. Rainfall here ranges from 645 mm and 1250 mm, and temperatures fluctuate between 15°C (December to February) and 45°C (March to June) (9,35,36). For this research, we identify the period from late September to December as transitional months. These months bridge the gap between heavy rainfall and extreme dryness, coinciding with the harvest season.

Study design

This study employed a prospective cohort design in which the same CHWs were followed across three data-collection waves: March-June, July -August, and October - December. These periods correspond to the dry, rainy, and transitional (9,27).

Study population, sampling and variables

Participants were sampled from three administrative districts in the Upper East Region of Ghana. Active CHWs were randomly selected from an administrative list of approximately 700 CHWs provided by the Ghana Health Service (GHS). Selected CHWs were first informed about the study and then contacted by the research team to assess eligibility and invite participation. Eligible participants were required to be actively engaged in CHW duties and to have access to a phone. Once enrolled, CHWs were informed that they would be contacted on two further occasions for follow-up surveys. Data were collected through phone-based surveys at each study wave.

The sample size for the study was determined using power analysis in Webpower (37). Power calculations were conducted for a linear mixed-effects model with three repeated measures per participants, assuming an autoregressive [AR (1)] correlation structure. The expected within-person correlation was set at 0.6, with a two-sided alpha of 0.05 and a power of least 80%. The anticipated relationship between resilience and well-being was expected to be modest; therefore the effect size was set at 0.2 to detect small changes or differences between groups (38), assuming a standard deviation of 1 and anticipated retention rates of 100%, 80% and 75% across the dry, rainy and transition seasons, respectively. Based on this, a total of 420 CHWs were sampled.

The same questionnaire was administered at the three seasonal time points. Resilience was measured using the 28-item Resilience Research Centre–Adult Resilience Measure (RRC-ARM), which uses a five-point Likert scale ranging from 1 (not at all) to 5 (all the time), with total scores ranging from 28 to 140 (39). Example items include "I have people I can respect in my life," "spiritual beliefs are a source of strength for me," and "I feel I belong in my community." Well-being was measured using the World Health Organization 5-Item Well-Being Index (WHO-5), a unidimensional measure scored from 0 (never) to 5 (always) and transformed to a 0–100 scale, with higher scores indicating better well-being (21). Examples include *"I have felt cheerful and in good spirits"* and *"My daily life has been filled with things that interest me."*

Independent variables were selected a priori based on findings from a qualitative exploratory study and guided by the social-ecological framework to capture multilevel factors influencing resilience and well-being (7). These included individual characteristics, nodal life events, relational factors such as supervision and social support, community-level factors such as trust and relationships with communities, and health system factors such as training, remuneration, integration and institutional support. Environmental exposures were limited to daily temperature and rainfall obtained from the Ghana Meteorological Agency. These were assigned to CHWs by date of interview to capture climatic conditions at each survey wave. Additional work-related indicators included campaign participation, incentive frequency, transportation access, availability of work equipment and protective gear, training received and supervision intensity.

Statistical analysis

We first assessed completeness and retention across waves and examined patterns of missing data. Resilience (RRC-ARM; range 28–140) and well-being (WHO-5; transformed to a 0–100 scale) were summarized by season using observed means, standard deviations and ranges.

All primary longitudinal analyses used linear mixed-effects models with participant-level random intercepts to account for repeated measurements within CHWs. Models were estimated using restricted maximum likelihood (REML), with Kenward–Roger degrees of freedom. Random-effects structures were evaluated using restricted maximum likelihood (REML) and likelihood ratio tests to compare nested models (random intercept vs. random intercept and slope). Alternative covariance structures for the repeated measures (e.g., AR(1), ARH(1), unstructured) were compared using Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC), and the structure with the best fit and stable convergence was selected. Within-person correlation was modelled using a heterogeneous autoregressive covariance structure of order 1 [ARH (1)] to allow residual variances to differ across seasons. Model assumptions were assessed after fitting the models by visually examining histograms, quantile–quantile plots, and residual diagnostics to evaluate linearity, normality, and variance structure (40,41).

Hypothesis 1: Seasonal variation in resilience and well-being

To examine whether resilience and well-being differed across seasons, we fitted separate mixed-effects models for each outcome with season modelled as a categorical time-varying variable and transition season as the reference. The transition season was selected as the reference because it represented a period of relative environmental and workload stability. We first estimated unadjusted models including season only, followed by covariate-adjusted models including district and prespecified individual, relational, structural and environmental covariates selected a priori based on the socio-ecological framework. We then tested *season*×*district* and *season*×*incentive-frequency* interactions to assess contextual variations in seasonal patterns. When interactions were statistically significant, interpretation focused on adjusted marginal means and simple effects within strata, with Tukey–Kramer adjustments for multiple comparisons.

Hypothesis 2: Resilience as a determinant of well-being with seasonal moderation

To examine whether resilience was associated with well-being and whether this association varied by season, we fitted mixed-effects models with well-being as the outcome and resilience as the primary exploratory variable. We estimated three sequential models: (1) an unadjusted model including resilience and season, (2) a covariate-adjusted model, and (3) a covariate-adjusted model including the resilience×season interaction. Resilience was centered at the sample mean before creating interaction terms to improve interpretability, so that the season coefficients represented differences in well-being at the average level of resilience rather than at a resilience score of zero, which lies outside the observed scale.

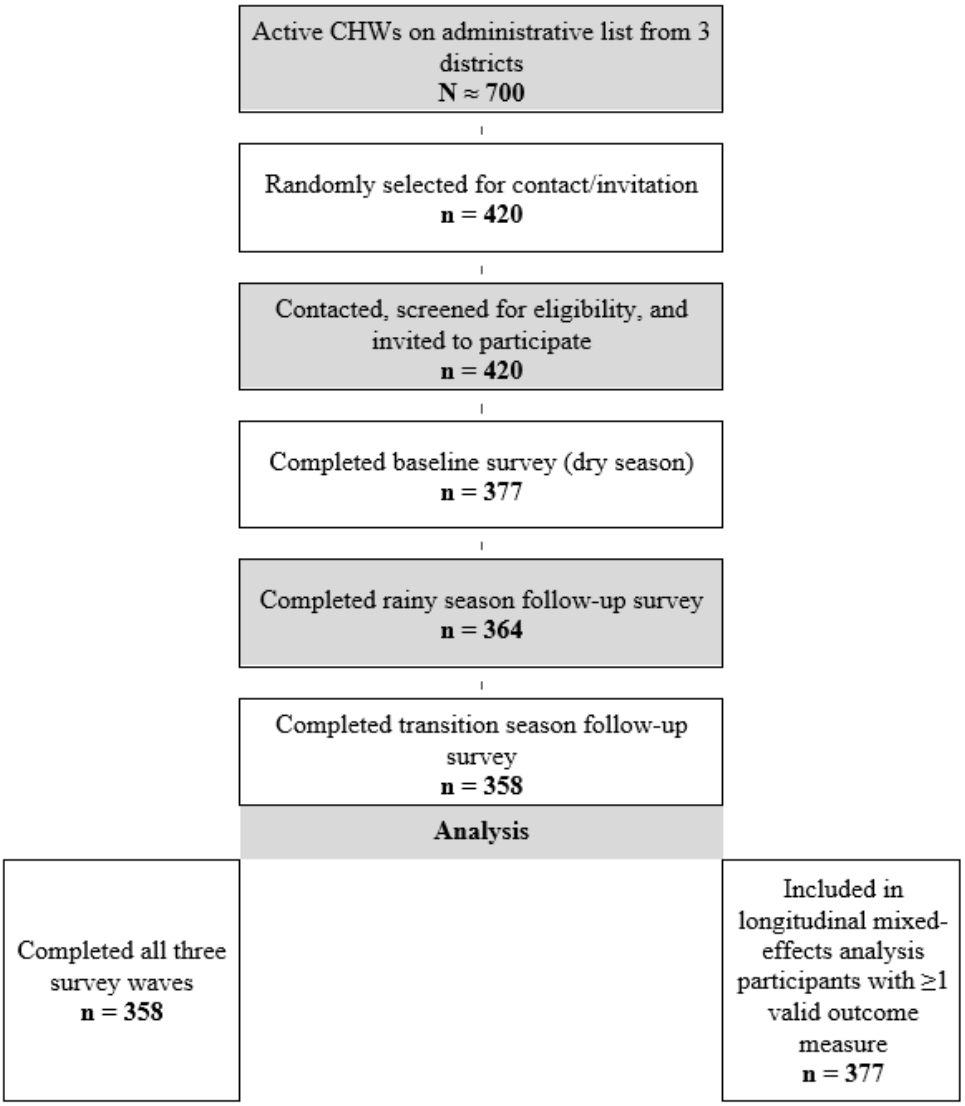
To distinguish stable between-person differences from within-person change over time, resilience was decomposed analytically into two components. The between-person component was each CHW's mean resilience across waves, capturing differences in average resilience between CHWs. The within-person component was each CHW's deviation from their own mean at each wave, capturing seasonal changes relative to their usual resilience level. Seasonal moderation was tested using interactions between within-person resilience deviation and season, with season-specific slopes and pairwise contrasts derived from model-based estimates.

All analyses were conducted in SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). Statistical tests were two-sided with $p<0.05$.

Results

Results are reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (42). Of the 420 randomly selected CHWs contacted for baseline assessment, 377 completed the baseline dry-season survey across three districts in Ghana's Upper East Region. Follow-up surveys included 364 CHWs in the rainy season and 358 CHWs in the transition season, corresponding to retention rates of 96.6% and 95.0%, respectively. Participants with at least one valid outcome measure (n = 377) were included in longitudinal mixed-effects analyses (Figure 1).

Figure 1. Participant Recruitment and Follow-up Across Survey Seasons



Flow diagram showing baseline sample and retention at rainy and transition-season follow-up

Baseline characteristics are summarized in Table 1. Participants were predominantly female (53.0%), and most had worked as CHWs for more than five years (69.9%). Most participants reported low household income, receiving inconsistent or no incentives, and limited access to work-related resources.

Table 1. Characteristics of community health workers at dry-season assessment

SEM Level	Characteristic	Category	N (%)
Individual level	Sex	Female	197 (53.0%)
	Age group	1st Quartile (18-30)	94 (25.3%)
		2nd Quartile (31-36)	87 (23.4%)
		3rd Quartile (37-44)	101 (27.2%)
		4th Quartile (45-77)	90 (24.2%)
	Years as CHW	<1 year	15 (4.0%)
		1–2 years	49 (13.2%)
		3–5 years	48 (12.9%)
		>5 years	260 (69.9%)
	Time Varying Variables (Collected at each wave of Surveys)		
	Annual Household income (GHC)	<10K	261 (70.2%)
		10K–29,999K	75 (20.2%)
		30K – 49,999K	22 (5.9%)
		50K – 69,999K	13 (3.5%)
		≥ 70K	1 (0.3%)
Relational Level (Nodal Events)	Marriage event	Yes	161 (43.3%)
	Birth of child	Yes	199 (53.5%)
	Divorce	Yes	9 (2.4%)
	Death of household member	Yes	195 (52.4%)
	Loss of household income	Yes	58 (15.6%)
Structural/Systems level	District	KNM	96 (25.8%)
		KNWD	174 (46.8%)
		BND	102 (27.4%)
	Incentive frequency	Consistently	22 (5.9%)
		Not consistently	232 (62.4%)
		No incentives	118 (31.7%)
	Resources received	Raincoat	17 (4.6%)
		Wellington boots	6 (1.6%)
		T-shirt	10 (2.7%)
		Stationery	14 (3.8%)
		Promotional material	1 (0.3%)
		None	324 (87.1%)

Environmental	Extreme weather challenges	Increased workload	74 (19.9%)
		Limited access	281 (75.5%)
		Supply shortages	15 (4.0%)
		Communication difficulties	2 (0.5%)
	Climate change effects	Worsened	300 (80.7%)
		Somewhat worsened	65 (17.5%)
		No noticeable change	6 (1.6%)
		Not sure	1 (0.3%)
	Minimum Temperature (°C)	Summary	Value
		N, Mean (SD), Median (IQR), Range	365, 26.38 (1.5), 26.5 (25.5–27), 22.5–29.5
	Maximum Temperature (°C)	N, Mean (SD), Median (IQR), Range	365, 36.94 (2.96), 37.5 (35.5–39.0), 29.0–42.3

SEM=socio-ecological model; SD=standard deviation; IQR=interquartile range; GHC=Ghanaian cedi. Values are n (%) unless otherwise indicated. ***Sex, age, years as a CHW, and district*** *were treated as time-fixed variables; all other covariates were treated as time-varying and collected at each survey wave. Continuous temperature data are presented as mean (SD), median (IQR), and range*

Measurement reliability

Before examining seasonal changes, internal consistency was assessed for both outcome measures. Reliability was acceptable across districts and seasons (RRC-ARM Cronbach's α 0.78–0.94; WHO-5 Cronbach's α 0.71–0.89), supporting use of total scores in longitudinal models (21,39).

Observed seasonal patterns in resilience and well-being

Observed mean resilience increased from the dry season (mean 122.9, SD 11.2) to the rainy season (mean 128.6, SD 9.5) and remained elevated in the transition season (mean 127.1, SD 8.1) (Table 2). Observed well-being increased across seasons from 62.7 (SD 24.1) in the dry season to 73.2 (SD 24.1) in the rainy season and 76.0 (SD 18.2) in the transition season (Table 2). No floor effect was observed, while ceiling scores occurred in 7.8%, 7.1%, and 2.8% of observations in the dry, rainy, and transition seasons, respectively (Supplementary Table S7).

Table 2. Observed resilience and well-being scores by season

Season	N	Resilience (RRC-ARM), Mean (SD)	Well-being (WHO-5), Mean (SD)	Observed Range
Dry	377	122.9 (11.2)	62.7 (24.1)	Res: 78–140; WB: 12–100
Rainy	364	128.6 (9.5)	73.2 (24.1)	Res: 73–140; WB: 16–100
Transition	358	127.1 (8.1)	76.0 (18.2)	Res: 105–138; WB: 20–100

*RRC-ARM=Resilience Research Centre–Adult Resilience Measure, theoretical range **28–140**; WHO-5=World Health Organization 5-Item Well-Being Index, transformed range **0–100**; SD=standard deviation. Values are observed means (SD); observed ranges indicate minimum–maximum values within each season*

Hypothesis 1: Seasonal differences in resilience and well-being

In unadjusted mixed-effects models with transition season as the reference, there was strong evidence of seasonal differences in both resilience and well-being (Table 3). Well-being was lower in both the dry and rainy seasons than in the transition season, whereas resilience was lower in the dry season but higher in the rainy season compared with the transition season.

In covariate-adjusted models including season×district and season×incentive-frequency interactions, season remained associated with both outcomes (Table 3). Because interaction terms were statistically significant, adjusted season coefficients should be interpreted as conditional contrasts; therefore, the main adjusted seasonal patterns are presented using marginal means and within-stratum contrasts in Tables 4–5 and Figures 2–3.

Table 3. Seasonal differences in resilience and well-being from mixed-effects models (unadjusted and adjusted)

	Resilience				Well-being			
Season vs Transition	**β (SE)**	**p-value**	**Adj β (SE)**	**p-value**	**β (SE)**	**p-value**	**Adj β (SE)**	**p-value**
Dry vs Transition	−4.14 (0.55)	<0.0001	−11.64 (3.06)	0.0002	−13.31 (1.26)	<0.0001	−34.18 (7.38)	<0.0001
Rainy vs Transition	1.55 (0.29)	<0.0001	−13.46 (2.35)	<0.0001	−2.92 (1.03)	0.0048	−38.37 (7.73)	<0.0001
Transition (ref)	0.00	—	0.00	—	0.00	—	0.00	—

β=regression coefficient; SE=standard error. Unadjusted models include season only. Adjusted models include district and prespecified covariates and additionally include season×district and season×incentive-frequency interaction terms. Therefore, adjusted season coefficients represent contrasts conditional on the reference district and reference incentive category (and reference levels of other covariates), rather than population-average seasonal effects. Adjusted marginal means and simple effects are presented in Tables 4–5 and Figures 2–3.

Seasonal variation in resilience and well-being by district/municipality

Seasonal patterns differed by district for both resilience (season×district: $F(4,532) = 15.21$; $p<0.0001$) and well-being ($F(4,586) = 6.45$; $p<0.0001$) (Table 4; Figure 2). In Builsa North District (BND), adjusted resilience was relatively similar in the dry and rainy seasons and declined in the transition season, whereas Kassena-Nankana West District (KNWD) and Kassena-Nankana Municipality (KNM) showed marked transition-season increases. Within-season contrasts indicated that transition-season resilience in Builsa North District was substantially lower than in the other two districts (Supplementary Table S1).

Table 4. Adjusted marginal means of resilience and well-being by season and district

Season	BND LS-mean (SE) [95% CI]	KNWD LS-mean (SE) [95% CI]	KNM LS-mean (SE) [95% CI]
	Resilience		
Dry	119.08 (1.63) [115.87, 122.28]	124.72 (1.51) [121.75, 127.69]	124.34 (1.64) [121.11, 127.56]
Rainy	119.50 (1.27) [117.01, 122.00]	124.17 (1.53) [121.17, 127.17]	123.98 (1.50) [121.03, 126.93]
Transition	114.21 (1.23) [111.81, 116.62]	132.07 (1.44) [129.25, 134.89]	131.60 (1.49) [128.68, 134.51]

	Well-being		
Dry	81.10 (4.53) [72.20, 90.01]	55.03 (4.44) [46.32, 63.75]	52.56 (4.41) [43.90, 61.22]
Rainy	76.01 (4.57) [67.03, 84.99]	49.54 (5.18) [39.37, 59.72]	47.88 (5.38) [37.31, 58.44]
Transition	77.63 (4.46) [68.87, 86.39]	76.99 (5.22) [66.74, 87.24]	74.99 (5.39) [64.41, 85.57]

LS-mean=least-squares mean; SE=standard error; CI=confidence interval. BND=Builsa North District; KNWD=Kassena-Nankana West District; KNM=Kassena-Nankana Municipality Values are adjusted marginal means from mixed-effects models including covariates and season×district interaction terms

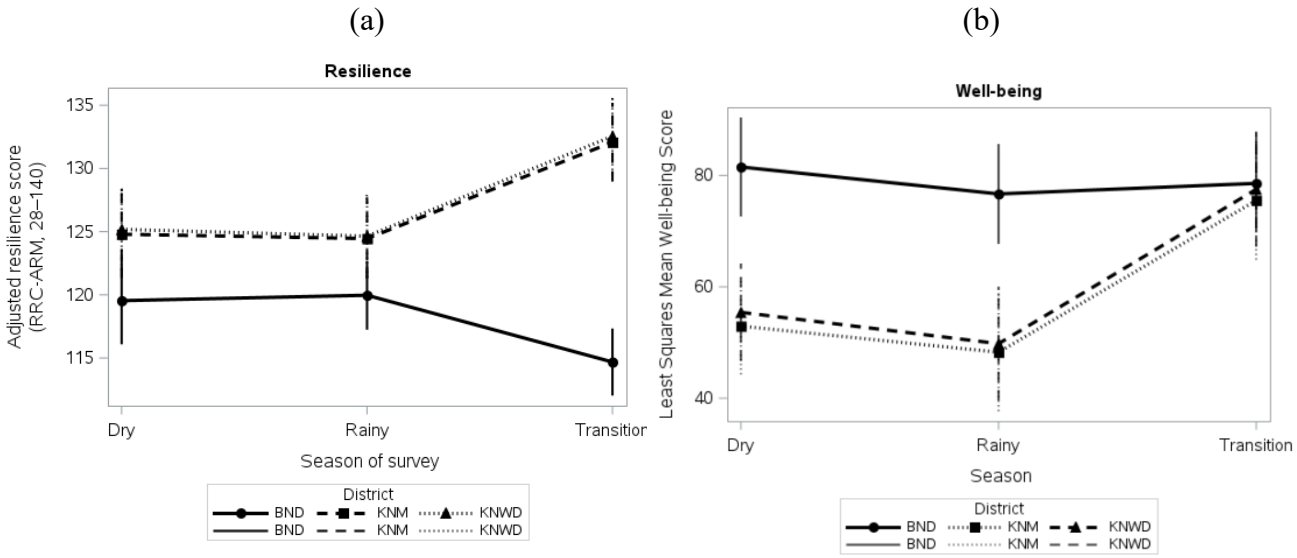


Figure 2. Adjusted mean resilience and well-being by season and district. Panel A: resilience (RRC-ARM). Panel B: well-being (WHO-5). Points show adjusted least-squares means; error bars show 95% CIs. Estimates are from mixed-effects models including covariates and season×district interaction terms.

For well-being, BND had relatively high adjusted well-being across seasons (dry 81.10; rainy 76.01; transition 77.63), while KNWD and KNM exhibited substantially lower well-being in the dry and rainy seasons followed by marked increases in the transition season, approaching BND levels (Table 4; Figure 2b). Within-season contrasts showed large district differences in the dry and rainy seasons, which were attenuated in the transition season (Supplementary Table S1).

Seasonal variation in resilience and well-being by frequency of incentives

Seasonal patterns also differed by incentive consistency for resilience (season×incentive: F (4,640) =13.49; p<0.0001) and well-being (F (4,659) =4.88; p=0.0007) (Table 5; Figure 3). Community health workers receiving incentives consistently showed their strongest outcomes during the transition season, while those receiving no incentives had their lowest resilience and well-being during the rainy season. Within-season contrasts indicated significantly lower rainy-season resilience among CHWs receiving no incentives compared with those receiving incentives inconsistently or consistently (Supplementary Table S2).

Table 5. Adjusted marginal means of resilience and well-being by season and incentive frequency

Season	No incentives LS-mean (SE) [95% CI]	Not consistently LS-mean (SE) [95% CI]	Consistently LS-mean (SE) [95% CI]
		Resilience	
Dry	120.21 (1.55) [117.16, 123.26]	122.59 (1.36) [119.93, 125.26]	126.71 (2.59) [121.62, 131.80]
Rainy	115.76 (1.78) [112.26, 119.26]	128.00 (1.28) [125.49, 130.51]	125.29 (1.93) [121.50, 129.09]
Transition	122.85 (1.64) [119.64, 126.06]	122.18 (1.37) [119.48, 124.88]	134.28 (1.61) [131.12, 137.43]
		Well-being	
Dry	61.14 (4.24) [52.81, 69.48]	62.29 (3.98) [54.48, 70.11]	65.26 (5.82) [53.81, 76.72]
Rainy	49.37 (5.44) [38.70, 60.05]	63.39 (4.22) [55.09, 71.68]	60.67 (6.25) [48.40, 72.95]
Transition	72.65 (5.29) [62.27, 83.03]	66.31 (4.32) [57.82, 74.80]	90.65 (5.63) [79.60, 101.71]

LS-mean=least-squares mean; SE=standard error; CI=confidence interval. Values are adjusted marginal means from mixed-effects models including covariates and season×incentive-frequency interaction terms.

For well-being, CHWs receiving incentives consistently showed a pronounced transition-season advantage (90.65), substantially higher than their dry- and rainy-season well-being and higher than transition-season well-being among other incentive groups (Table 5; Figure 3b; Supplementary Table S2). CHWs receiving no incentives reported the lowest well-being in the

rainy season (49.37), whereas those receiving incentives inconsistently showed more modest seasonal variation.

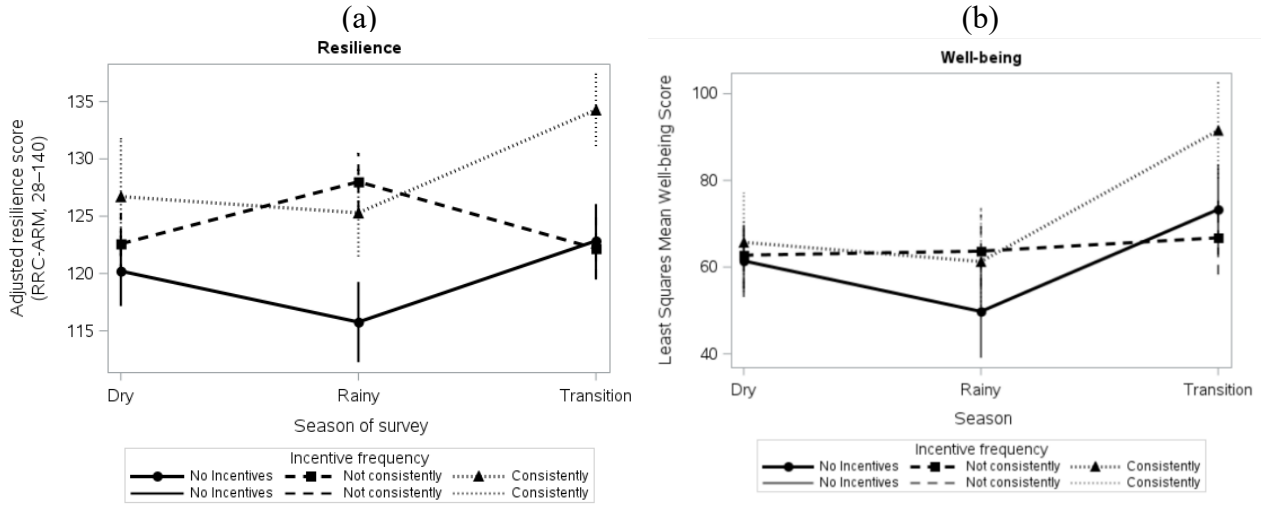


Figure 3. Adjusted mean resilience and well-being by season and incentive frequency. Panel A: resilience (RRC-ARM). Panel B: well-being (WHO-5). Points show adjusted least-squares means; error bars show 95% CIs. Estimates are from mixed-effects models including covariates and season×incentive-frequency interaction terms.

Hypothesis 2: Association between resilience and well-being and seasonal moderation

In mixed-effects models predicting well-being, higher resilience was consistently associated with higher well-being. In unadjusted analyses (Model 1), each one-unit increase in resilience was associated with a 0.37-point increase in well-being ($\beta = 0.37$, SE 0.07; $p<0.0001$). This association remained statistically significant after adjustment for sociodemographic, occupational, contextual, and environmental covariates (Model 2: $\beta = 0.60$, SE 0.08; $p<0.0001$) (Figure 4; full model estimates in Supplementary Table S3a)**.**

In the fully adjusted interaction model (Model 3) the main effect of resilience represented its association with well-being during the transition season, the reference category ($\beta = 0.97$, SE 0.11; $p<0.0001$). There was evidence that this relationship varied by season. Specifically, the resilience×dry season interaction was negative and statistically significant ($\beta = -0.72$, SE 0.14; $p<0.0001$), indicating that the association between resilience and well-being was weaker during the dry season compared with the transition season. The resilience×rainy interaction was not statistically significant (Supplementary Table S3a). Season-specific conditional slopes from the

fully adjusted interaction model are presented in Supplementary Table S3b and indicate that resilience was positively associated with well-being in all seasons, with the weakest association in the dry season and stronger associations in the rainy and transition seasons. Independent of resilience, well-being was lower in both the dry and rainy seasons relative to the transition season in the interaction model (dry vs. transition: $\beta = -6.69$, SE 1.50; $p<0.0001$; rainy vs. transition: $\beta = -10.35$, SE 1.87; $p<0.0001$) (Figure 4). Several covariates were also associated with well-being in adjusted models.

Fixed effect	Adjusted β (95% CI)	P value
Intercept	107.0 (87.0 to 127.1) ***	<0.0001
Resilience	0.97 (0.75 to 1.19) ***	<0.0001
District: BND (vs KNM)	30.4 (26.1 to 34.8) ***	<0.0001
Season: Dry (vs Transition)	-6.69 (-9.63 to -3.75) ***	<0.0001
Season: Rainy (vs Transition)	-10.3 (-14.0 to -6.68) ***	<0.0001
Supervision: As needed (vs Daily)	-2.62 (-5.01 to -0.23) *	0.0329
Income: Low (< GHC10,000)	-5.65 (-9.47 to -1.83) **	0.0038
Age: 3rd quartile	-3.80 (-7.50 to -0.10) *	0.0448
Age: 4th quartile	-7.51 (-11.5 to -3.47) ***	0.0003
Nodal event — Divorced	-21.1 (-35.3 to -6.87) **	0.0039
Resources: Basic materials	6.37 (3.14 to 9.60) ***	0.0001
Resources: None	-4.39 (-7.57 to -1.21) **	0.0071
Maximum temperature	-0.95 (-1.48 to -0.42) ***	0.0004
Resilience × Season: Dry	-0.72 (-0.99 to -0.45) ***	<0.0001
Resilience × Season: Rainy	0.06 (-0.18 to 0.30)	0.6533

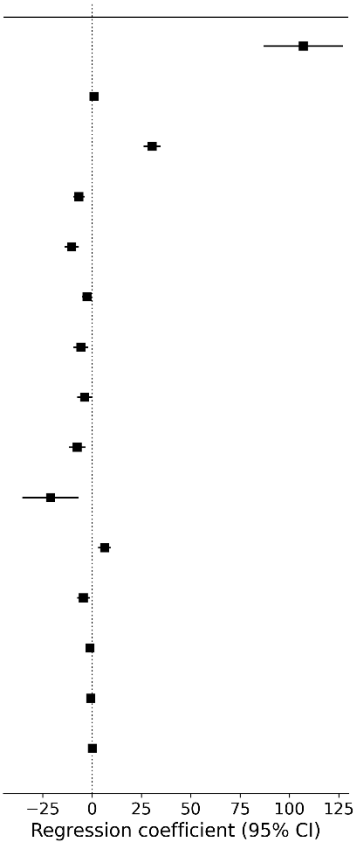


Figure 4. Adjusted associations between resilience and well-being from the final mixed-effects model. Forest plot showing regression coefficients and 95% confidence intervals for statistically significant predictors of well-being from the fully adjusted mixed-effects model. Positive coefficients indicate higher well-being, whereas negative coefficients indicate lower well-being. Full model estimates are provided in Supplementary Table S3.

In adjusted models, lower well-being was associated with lower household income, older age, divorce and higher maximum temperature, whereas access to basic work materials was

associated with higher well-being (Figure 4; Supplementary Table S3a). Residual diagnostics showed residuals centred near zero, with no major residual pattern after accounting for within-person correlation and season-specific variance using the ARH(1) structure. Although formal normality tests indicated some departure from normality, visual diagnostics did not suggest this materially affected model interpretation (Supplementary Table S6).

Estimated well-being across resilience levels and season-specific slopes

Model-based estimated well-being varied by season and resilience level (Table 6; Figure 5). Estimated well-being increased with resilience in all seasons, but the difference between low and high resilience was smallest in the dry season and larger in the rainy and transition seasons. Figure 6 further illustrates this interaction, showing a flatter dry-season slope and steeper rainy and transition-season slopes.

Table 6. Adjusted estimated well-being by season at low (P25), mid (P50), and high (P75) resilience

Season	Low resilience (P25)	Mid resilience (P50)	High resilience (P75)
Dry	94.83 (SE 10.66); 95% CI 73.91 to 115.75	97.06 (SE 10.62); 95% CI 76.22 to 117.90	98.05 (SE 10.62); 95% CI 77.20 to 118.90
Rainy	86.37 (SE 9.26); 95% CI 68.19 to 104.55	95.59 (SE 9.24); 95% CI 77.45 to 113.74	99.69 (SE 9.27); 95% CI 81.49 to 117.89
Transition	97.07 (SE 10.48); 95% CI 76.50 to 117.63	105.78 (SE 10.47); 95% CI 85.22 to 126.34	109.65 (SE 10.50); 95% CI 89.03 to 130.28

LS-means=least-squares means; CI=confidence interval. Values are adjusted marginal means of well-being estimated at resilience percentiles (P25, P50, P75) from the final mixed-effects model, adjusted for district, season, sociodemographic factors, nodal events, resource availability, and climate variables. Because these are model-based least-squares means from a linear mixed-effects model, estimated values and confidence intervals may extend beyond the observed 0–100 WHO-5 scale (Supplementary Table S7).

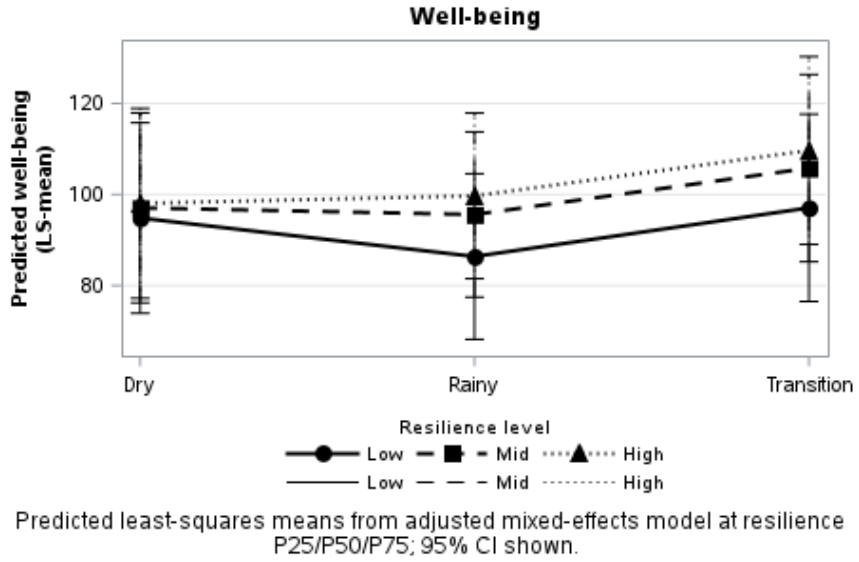


Figure 5. ***Model-estimated well-being by season at low, mid, and high resilience levels.*** *estimated WHO-5 well-being from the final interaction model at resilience percentiles (P25=120; P50=129; P75=133). Points show estimated marginal means; error bars show 95% Cis.*

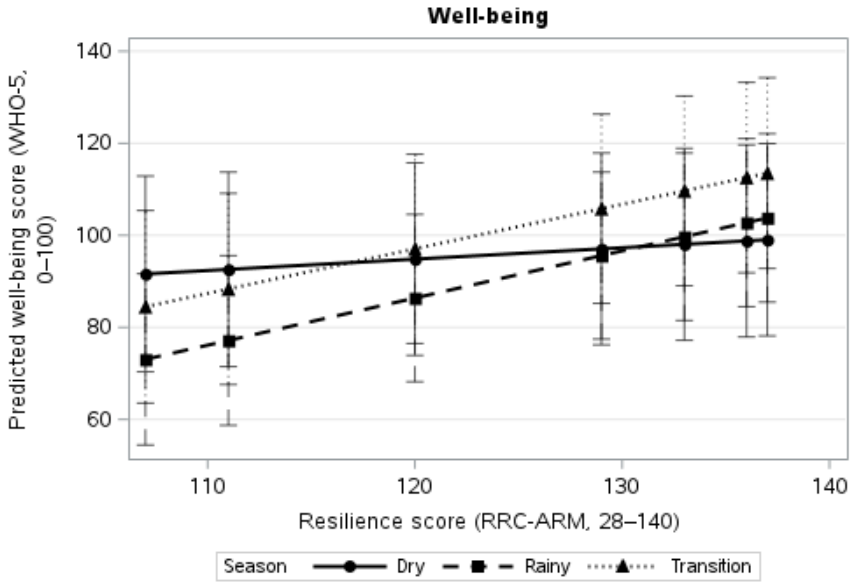


Figure 6. ***Model-estimated well-being across resilience scores, stratified by season****. Estimated WHO-5 well-being scores were estimated from the final fully adjusted mixed-effects interaction model. Lines show season-specific slopes; error bars show 95% CIs. Estimates are adjusted for covariates. Values above 100 reflect linear model-based predictions and should not be interpreted as attainable WHO-5 scores.*

Within-season contrasts comparing high versus low resilience (P75–P25) showed the smallest difference in the dry season and substantially larger differences in the rainy and transition seasons (Table 7), consistent with stronger resilience-related differences in well-being outside the dry season.

Table 7. Adjusted differences comparing estimated well-being at high (P75) versus low (P25) resilience within each season from the final mixed-effects model

Season	Difference (SE)	95% CI	p-value
Dry	3.22 (1.26)	0.74 - 5.70	0.0110
Rainy	13.32 (1.47)	10.44 - 16.20	<0.0001
Transition	12.59 (1.49)	9.67 - 15.51	<0.0001

SE=standard error; CI=confidence interval.

Within-person change in resilience and well-being across seasons

In the within-person/between-person decomposition model (Supplementary Table S5), higher average resilience between CHWs was associated with higher well-being. Within-person increases in resilience were associated with higher well-being in the transition (β = 0.56, SE 0.17; p=0.0013) and most strongly in the rainy season (β = 1.42, SE 0.23; p<0.0001), but not in the dry season (Table 8). The within-person association was significantly stronger in the rainy than in the dry season (Δβ 1.72, SE 0.31; p<0.0001) (Table 9).

Table 8. Season-specific within-person associations between resilience and well-being

Season	Within-person slope (β)	SE	df	t	p-value	95% CI
Transition	0.56	0.17	421	3.24	0.0013	0.22 - 0.91
Dry	-0.30	0.17	396	-1.74	0.0818	-0.64 - 0.04
Rainy	1.42	0.23	370	6.29	<0.0001	0.98 - 1.87
Rainy vs Dry (difference in slopes)	1.72	0.31	615	5.62	<0.0001	1.12 -2.33

Slopes represent the expected change in WHO-5 well-being associated with a 1-unit increase in resilience relative to each CHW's individual mean across waves (within-person change). The Rainy versus Dry comparison tests differences in the within-person resilience–well-being association between seasons.

Discussion

We observed seasonal variation in resilience and well-being in a prospective cohort of CHWs in Ghana's Upper East Region across dry, rainy and transition seasons. Unadjusted longitudinal models indicated that resilience was lower during the dry season and higher during the rainy season, while well-being was lower during the dry season and remained lower during the rainy season relative to the transition season. Adjusted analyses however, showed considerable contextual heterogeneity: seasonal patterns differed by district and by incentive frequency, with CHWs receiving incentives consistently demonstrating a greater advantage in terms of resilience and well-being. Observably, district-level differences in well-being were large even after covariate adjustment. For example, CHWs in the Builsa North District scored approximately 27-30 points higher than those in the Kassena-Nankana Municipality, indicating that local programs and contextual factors may have a greater impact on CHWs' well-being than may be perceived.

Resilience was positively associated with well-being across all models, although the strength of this association varied in accordance with the season. n models distinguishing between-person differences from within-person variation, within-person resilience, defined as a CHW's season-specific resilience relative to their own average level, was most strongly associated with well-being during the rainy season, weaker during the transition season, and not statistically significant during the dry season. Gathered from these findings and in alignment with previous research, resilience is a context-dependent and seasonally contingent resource for well-being, and that programmatic and contextual factors can shape seasonal trajectories (11,14,15,17,32). This seasonal moderation was also reflected in the model-based contrasts, which showed that differences in well-being between CHWs with higher and lower resilience were smaller in the dry season but more pronounced during the rainy and transition seasons. Importantly, even at comparable resilience levels, adjusted models still showed a residual seasonal disadvantage for well-being in dry and rainy seasons compared to the transition season, suggesting that broader seasonal stressors may negatively impact well-being beyond what individual resilience resources alone can compensate for.

Seasonal dynamics and the socioecology of CHW resilience and well-being

The findings of this study are consistent with social-ecological conceptualizations of resilience as a dynamic process supported by resources and constraints at the individual, relational, community and system levels (13–15). From this perspective, CHWs' capacity to adapt is shaped not only by personal coping but also by the social, economic, organizational and environmental contexts in which they live and work (7,14,15,17,43,44). Thus, to some extent, CHWs' ability to adapt to recurring occupational and environmental stressors is dependent on the way in which these contextual factors interact over time or seasons. Within this broader social-ecological system, seasonal variation represents an important contextual influence. Consequently, changes in climatic conditions, livelihood demands, mobility, and disease burden are likely to modify both exposure to stressors and access to protective resources (7,9,26,28,35).

In tropical settings such as northern Ghana, the rainy season often brings increased disease transmission, higher service demand, peak agricultural labour, and mobility barriers caused by flooding and poor road access (7,31,45). The dry season presents other types of stressors, including extreme heat and prolonged environmental stress, which may intensify physical strain and affect CHWs' ability to deliver community-based services (7,9,17,35,44). By contrast, the transition or harvest period is often assumed to provide temporary relief due to improved food availability, reduced workload pressures and increased community reciprocity, including in-kind appreciation for CHWs' work, strengthening psychosocial resources and motivation as suggested elsewhere (7,16,31,46).

However, the district-specific analyses suggest that these seasonal pressures and buffers were not experienced uniformly. Rather than reflecting simple geographic variation, differences in resilience and well-being appeared to reflect the local contexts in which CHWs lived and worked, including social, environmental, and institutional conditions (7,11,14,15,32). In this sense, seasonal change should be understood not only as a climatic phenomenon, but also as a structural stressor whose effects are shaped by district-level programme conditions and environmental exposures. Programme supports should therefore be tailored to local seasonal realities rather than implemented uniformly across districts.

Incentives, recognition, and seasonal vulnerability

A key contribution of this study is the demonstration that seasonal trajectories in resilience and well-being differed according to incentive frequency. CHWs who reported receiving incentives consistently had the highest resilience during the transition season and a pronounced transition-season advantage in well-being. In contrast, CHWs who received no incentives experienced their lowest resilience and well-being during the rainy season. These findings are supported by multi-country evidence showing that incentives and remuneration are central to CHW programme functioning and worker outcomes, and that gaps between expected and delivered support can undermine motivation, retention, performance and overall functioning (16,29,45–47). Based on our findings, the influence of incentives cannot be understood in isolation but rather in interaction with seasonal conditions that shape CHWs' psychological functioning. In particular, the rainy season appears to represent a period of heightened vulnerability. It is a period of peak agricultural activity, which is central to the subsistence livelihoods of many CHWs, forcing them to balance farming responsibilities with volunteer health work. At the same time, programme demands often intensify during the rainy season due to increased disease transmission and the implementation of major health campaigns such as vaccine-preventable diseases, malaria, and neglected tropical diseases (2,7,26,45). For CHWs without consistent incentives, these overlapping livelihood and occupational demands may be difficult to absorb, especially when household financial and labour demands are also high. The absence of predictable financial or material support may therefore compound seasonal stressors and help explain the lower resilience and well-being observed among CHWs without incentives during the rainy season.

A more favourable period for CHWs appears to be the transition or harvest season, as they report receiving consistent incentives. During this period, reduced workload pressures, improved food availability, and a greater sense of community reciprocity may reinforce the material and psychosocial benefits already provided through the programme (7,26,45,48). This convergence of seasonal and institutional supports may strengthen motivation and contribute to the elevated resilience and well-being observed during the transition season. More broadly, the consistency of incentives appears to act as a contextual modifier that can buffer or amplify seasonal pressures. Therefore, predictable and reliable incentives may help sustain motivation during demanding periods and enable CHWs to benefit more fully from seasonal periods of relative relief. Similar findings are reported in research emphasizing that incentives and remuneration must be aligned

with CHW roles and workloads, and that weak or inconsistent support can contribute to attrition, underperformance and potential psychosocial strain (16,46,48). At the same time, studies suggest that incentive structures can shape how CHWs allocate effort across tasks. For instance, systematic reviews of performance-based incentives show that while incentives can improve measurable service outputs, they may also shift attention away from activities that are not incentivized, showing the importance of careful programme design and monitoring (49). Evidence from Ghana similarly indicates that financial incentives can improve CHW and Community-based Health Planning and Services delivery indicators, although the magnitude of these effects depends on implementation fidelity and contextual conditions (16). Viewed within this broader context, our findings point to an additional seasonal dimension. Interestingly, CHWs receiving incentives inconsistently showed their highest resilience in the rainy season rather than the transition season. This pattern may reflect seasonally timed incentive distribution, for example, linked to campaigns or the mobilization of social and organizational supports during peak-demand periods. The findings highlight the importance of predictable incentive structures in supporting CHW resilience and well-being across seasons.

Our seasonal findings suggest that incentives may be particularly consequential within seasonally dynamic work environments. Incentives may play an important buffering role during high-strain periods, such as the rainy season when livelihood pressures, service demand, and mobility constraints intensify, while also amplifying benefits during periods of relative relief, such as the transition season. Viewed this way, the role of incentives cannot be separated from broader discussions about labour conditions within CHW programmes. These results intersect with emerging concerns regarding labour arrangements in CHW systems, where substantial service expectations are sometimes placed on volunteer workers who receive limited compensation or labour protections, creating conditions that may increase the risk of exploitative arrangements when workloads are high but remuneration and institutional support remain inadequate (50). In settings characterized by strong seasonal fluctuations in workload, these concerns become even more pronounced. Periods of intensified service demands, such as during the rainy season, may place a disproportionate pressure on CHWs who already operate with limited materials and institutional support.

Resilience as a pathway to well-being, with seasonal moderation

Conceptually, resilience has been described as a pathway through which individuals maintain mental health and well-being under adversity (15,32). Our findings provide longitudinal support to this framing by demonstrating a consistent positive association between resilience and well-being and by showing that the strength of this association varied across seasons. Importantly, the within-person results indicate that when CHWs experienced increases in resilience relative to their own average levels, their well-being also improved particularly during the rainy season. A plausible interpretation is that when stressors increase, such as mobility barriers, higher service demand, and competing livelihood responsibilities, incremental increases in resilience-related capacities may yield larger gains in well-being (7,11,51,52). This seasonal pattern is consistent with perspectives that emphasize the role of resilience as a dynamic process activated under conditions of strain rather than as a static individual trait (14,15,32). Under such conditions, resilience processes may play a more prominent role in sustaining psychological functioning and effectively buffering the negative effects of environmental and occupational stressors.

The dry season, on the other hand, may involve stressors, particularly extreme heat exposure and livelihood competition, that may be less amenable to buffering through the psychosocial resources captured in the resilience scale or that require structural protections beyond individual adaptive capacities. Periods of relative environmental relief, such as the transition or harvest season, may also reduce reliance on individual resilience pathways because of improvements in contextual conditions, such as food security, community reciprocity and reduced mobility constraints, that naturally support well-being. This is consistent with evidence from CHW programmes indicating that when structural and contextual conditions improve, such as during harvest or transition periods marked by greater food security, community reciprocity, and easier mobility, the burden on individual coping mechanisms is reduced (7,8,31). However, during periods characterized by livelihood pressures, life-stage demands, and limited work resources, psychosocial resilience alone may not be sufficient to sustain well-being without broader structural supports (7,18,20,23). More recent evidence similarly documents substantial psychological distress and burnout among CHWs in low- and middle-income countries, often driven by resource scarcity, role strain, and heightened service demands (19,24). These findings therefore point to the importance of integrating psychosocial support and seasonally responsive workload management into CHW programme design.

Climate and environmental stressors: implications for climate-resilient CHW programmes

The observed negative association between maximum temperature and well-being confirms climate-related exposures may directly affect CHW health and performance (10,27). As climate change intensifies extreme heat and weather variability, frontline and community-based health workers will face rising occupational risks that threaten both service continuity and workforce sustainability. Recent work highlights that occupational heat is an under-recognized threat to community-based health workers and can constrain daily functioning, service delivery, and coping capacity (10,17,33). Evidence syntheses further suggest that CHWs are increasingly relied upon during extreme weather events for service delivery, surveillance, education, referrals, and psychosocial support, roles that may expand as climate shocks intensify but which require commensurate training, equipment, and health-system support (34). In the context of this study, these findings imply that climate adaptation strategies for primary health care should explicitly include CHWs. Practical measures may include heat protection strategies such as water access, schedule adjustments, heat-appropriate gear and reliable means of transportation. Improved mobility support during the rainy season such as transport allowances, protective gear and reliable supply chains to prevent seasonal resource bottlenecks are critical.

Occupational and life-course influences on CHW well-being

Beyond season and resilience, several occupational and life-course factors were independently associated with well-being in adjusted models. CHWs reporting supervision “as needed” had lower well-being than those supervised daily, suggesting that predictable, supportive supervision may serve as a protective resource, especially when seasonal workload and mobility constraints intensify as reported in other studies (7,34,44,53). Supervision that is regular, mentoring-oriented, and supportive, rather than punitive or purely administrative, can strengthen the confidence, problem-solving capacity, and motivation of CHWs (44,47,53), whereas irregular supervision may leave workers feeling isolated and unsupported, increasing the risk of stress and burnout (7,24,46). Furthermore, life-course factors such as family responsibilities and major life events can shape CHWs’ capacity to sustain their roles and maintain well-being, particularly for women who often face a dual burden of health work and domestic responsibilities (7,12,24,46).

Consistent and context-sensitive supervisory engagement may play an important buffering role help CHWs navigate cyclical environmental and occupational pressures while maintaining their psychological well-being. Older CHWs (highest age quartile) and those reporting divorce showed substantially lower well-being, pointing to the importance of considering life-stage demands and acute social stressors alongside programme factors (8,19,44).

Community health workers who reported no access to basic work resources and materials had lower well-being than those reporting adequate resources, reinforcing the importance of reliable equipment and logistical support. These findings reiterate what has already been reported in previous studies: that the availability of essential materials and tools such as protective equipment, uniforms, transport, and communication supplies not only facilitates service delivery but also acts as a psychological and practical support that strengthens workers' sense of effectiveness and belonging within the health system (5,24,46,47). This finding also aligns with previous research showing that inadequate material support can undermine CHW motivation, increase strain, and weaken engagement with programme roles (5,7,29,47).

Implications for CHW programming

The findings of this study have several programmatic implications for the design and management of CHW programmes. First, seasonality should be recognized and incorporated into programme planning as an operational reality. Predictable seasonal fluctuations in workload, mobility, and disease burden suggest that staffing arrangements, supervision schedules, outreach activities, and supply distribution systems should be structured to anticipate periods of intensified service demand and logistical barriers (7,10,34). Integrating seasonal planning into programme operations may help prevent service disruptions while reducing avoidable strain on frontline workers. At the same time, seasonal planning should be contextual rather than uniform, taking into account the differences in supervision, incentive delivery, material resources, transportation infrastructure, community support, and exposure to the environment at the district level. This aligns with social-ecological perspectives and CHW programme literature showing that resilience and well-being are shaped by interactions between individual, community, environmental, and health-system conditions (7,14,17,34)

Second, the results highlight the importance of stabilizing incentives and essential work resources. These patterns reinforce policy recommendations emphasizing fair and reliable compensation aligned with CHW roles and workload expectations (16,46–48,53). Ensuring predictable incentives and adequate material resources may help buffer seasonal stressors and sustain motivation across the annual cycle.

Third, the findings underscore the importance of predictable and supportive supervision. Approaches such as peer-support groups, mentorship, recognition, and structured problem-solving support could help CHWs navigate seasonal pressures while maintaining psychological well-being (7,34,44,53).

Fourth, CHW programmes should consider life-stage demands and social stressors that may influence worker well-being and retention. This research highlights the importance of programme flexibility and supportive policies that acknowledge the broader social contexts in which CHWs live and work. Tailoring supervision, workload expectations, and support mechanisms to accommodate these realities may help strengthen workforce sustainability (8,19,44)

Finally, the findings raise broader considerations regarding the ethical design of CHW roles in contexts where volunteer-based models persist. Seasonal surges in workload may place substantial demands on workers who often operate with limited compensation and institutional protections. Programme strategies should therefore explicitly account for seasonal workload variability and ensure that expectations placed on CHWs are matched with adequate incentives, labour protections, and formalized system support to promote workforce sustainability (50).

Strengths and Limitations

Strengths of this study include its prospective design across three distinct seasons in a setting with climatic variability, the use of validated measures of resilience and well-being, high participant retention across survey waves, and analytic approaches that accounted for repeated measurements and seasonal heteroscedasticity while distinguishing between-person differences and within-person change over time. This design allowed the study to capture seasonal dynamics in CHW psychological functioning that are rarely examined in cross-sectional research.

Several limitations should be considered. First, outcomes were self-reported and collected through phone-based surveys, which may introduce social desirability or reporting bias (54). However, standardized instruments were used, interviews were conducted by trained research staff, and participants were assured of confidentiality and that their responses would not affect their position within the programme. These steps intended to reduce this risk of bias. Second, although models adjusted for a wide set of covariates, unmeasured confounding remains possible, including unmeasured programme differences between districts such as staffing norms, supervision quality, or supply chain reliability (55). Third, the WHO-5 well-being index is bounded (0–100). Although no floor effect and only modest ceiling effects were observed across seasons, linear mixed-effects models do not constrain estimated values to this range. Consequently, some model-based estimates and confidence intervals extended beyond 100 and should be interpreted as model-based expectations rather than attainable WHO-5 scores. Acceptable residual diagnostics and the limited ceiling effects nevertheless supported the use of linear mixed-effects models for the primary analyses. Fourth, the study covered three districts within a single region of Ghana, which may limit generalizability to other ecological zones or CHW programme models. Finally, although climate variables were incorporated, future studies could strengthen exposure assessment through more granular geospatial climate measures and explicit measurement of extreme weather events.

Conclusion

CHW resilience and well-being varied across seasons in Ghana's Upper East Region, with patterns that differed meaningfully by district and by incentive frequency. Resilience was positively associated with well-being, but this association was seasonally contingent, strongest during the rainy season and weakest during the dry season. Beyond seasonal effects, occupational supports, including predictable supervision, reliable incentives, and access to essential work resources, as well as life-course stressors, were also associated with CHW well-being. The district-level differences further suggest that seasonal pressures are shaped by local programme conditions, community resources and infrastructure, underscoring the need for context-specific responses. These findings show the importance of designing CHW programmes that are both season-responsive and climate-resilient. Strategies such as stable incentives,

adequate logistical support, reliable supervisory structures, and targeted psychosocial support during high-strain periods may help protect CHW well-being while sustaining the capacity of community health systems to deliver essential services in resource-constrained and climate-vulnerable settings.

Supplementary Materials for Chapter 6

Supplementary Table S1. Within-season district contrasts

Season	Comparison (A − B)	Δ LS-mean	95% CI (adjusted)	Adjusted p-value
		Resilience		
Dry	BND − KNM	-5.26	[-10.62, 0.11]	0.0599
	BND − KNWD	-5.64*	[-10.67, -0.61]	0.0151
	KNM − KNWD	-0.38	[-4.75, 3.98]	1.0000
Rainy	BND − KNM	-4.48*	[-8.42, -0.54]	0.0127
	BND − KNWD	-4.67*	[-8.50, -0.85]	0.0048
	KNM − KNWD	-0.19	[-2.95, 2.56]	1.0000
Transition	BND − KNM	-17.39**	[-21.88, -12.91]	<0.0001
	BND − KNWD	-17.86**	[-22.19, -13.55]	<0.0001
	KNM − KNWD	-0.47	[-2.25, 1.31]	0.9960
		Well-being		
Dry	BND − KNM	+28.54**	[18.24, 38.85]	<0.0001
	BND − KNWD	+26.07**	[16.83, 35.30]	<0.0001
	KNM − KNWD	-2.47	[-10.82, 5.87]	0.9916
Rainy	BND − KNM	+28.13**	[14.92, 41.35]	<0.0001
	BND − KNWD	+26.47**	[13.62, 39.31]	<0.0001
	KNM − KNWD	-1.66	[-9.58, 6.24]	0.9992
Transition	BND − KNM	+2.64	[-12.93, 18.21]	0.9998
	BND − KNWD	+0.64	[-14.22, 15.51]	1.0000
	KNM − KNWD	-2.00	[-7.75, 3.75]	0.9765

*Δ LS-mean values represent Tukey–Kramer–adjusted pairwise differences in adjusted least-squares means within each season (A − B). Adjusted p-values: * $p < 0.05$; ** $p < 0.0001$.*

Supplementary Table S2. Within-season incentive contrasts

Season	Comparison (A − B)	Δ LS-mean	95% CI (adjusted)	Adjusted p-value
		Resilience		
Dry	No incentives − Not consistently	-2.38	[-5.49, 0.74]	0.2792
	No incentives − Consistently	-6.50	[-13.43, 0.44]	0.0658
	Not consistently − Consistently	-4.12	[-10.55, 2.31]	0.2386
Rainy	No incentives − Not consistently	**-12.24****	[-16.72, -7.76]	<0.0001
	No incentives − Consistently	**-9.53****	[-14.83, -4.24]	<0.0001
	Not consistently − Consistently	+2.71	[-2.03, 7.45]	0.3617
Transition	No incentives − Not consistently	+0.67	[-3.36, 4.70]	0.9505
	No incentives − Consistently	**-11.43****	[-14.68, -8.18]	<0.0001
	Not consistently − Consistently	**-12.10****	[-17.08, -7.12]	<0.0001
		Well-being		
Dry	No incentives − Not consistently	-1.15	[-8.25, 5.95]	0.9999
	No incentives − Consistently	-4.12	[-19.43, 11.19]	0.9957
	Not consistently − Consistently	-2.97	[-17.53, 11.59]	0.9994
Rainy	No incentives − Not consistently	**-14.01***	[-27.07, -0.95]	0.0248
	No incentives − Consistently	-11.30	[-27.36, 4.77]	0.4143
	Not consistently − Consistently	+2.71	[-13.28, 18.70]	0.9998
Transition	No incentives − Not consistently	+6.34	[-8.49, 21.18]	0.9218
	No incentives − Consistently	**-18.00****	[-27.64, -8.36]	<0.0001
	Not consistently − Consistently	**-24.35****	[-40.05, -8.64]	<0.0001

*Δ LS-mean values represent Tukey-Kramer-adjusted pairwise differences in adjusted least-squares means within each season (A − B). Adjusted p-values: * $p < 0.05$ ** $p < 0.0001$*

Supplementary Table S3a. Full fixed-effects output

Model component	Model 1: Unadjusted β (SE) / estimate	p value	Model 2: Adjusted β (SE) / estimate	p value	Model 3: Adjusted β (SE) / estimate	p value
Fixed effects						
Intercept	29.17 (9.50) **	0.0022	27.01 (14.53)	0.0634	107.03 (10.24) ***	<0.0001
Resilience	0.37 (0.07) ***	<0.0001	0.64 (0.08) ***	<0.0001	0.97 (0.11) ***	<0.0001
Season: Dry vs transition	−11.79 (1.29) ***	<0.0001	−5.14 (1.50) ***	0.0007	−6.69 (1.50) ***	<0.0001
Season: Rainy vs transition	−3.49 (1.01) ***	0.0006	−9.57 (1.88) ***	<0.0001	−10.35 (1.87) ***	<0.0001
District: BND vs KNM	—	—	28.21 (2.23) ***	<0.0001	30.45 (2.24) ***	<0.0001
District: KNWD vs KNM	—	—	2.97 (1.50) *	0.0478	2.82 (1.46)	0.0544
Female vs male	—	—	0.37 (1.25)	0.7678	0.25 (1.22)	0.8387
Supervision: As needed vs daily	—	—	−2.48 (1.22) *	0.0424	−2.62 (1.22) *	0.0329
Supervision: Monthly vs daily	—	—	−1.31 (5.74)	0.8196	−0.99 (5.61)	0.8599
Supervision: Weekly vs daily	—	—	3.68	0.3005	2.32	0.5068

Model component	Model 1: Unadjusted β (SE) / estimate	p value	Model 2: Adjusted β (SE) / estimate	p value	Model 3: Adjusted β (SE) / estimate	p value
			(3.55)		(3.49)	
Income: Low (<GHC10,000) vs high income	—	—	−6.72 (1.96) ***	0.0006	−5.65 (1.95) **	0.0038
Income: Medium (GHC10,000–29,999) vs high income	—	—	−3.49 (1.88)	0.0640	−2.83 (1.89)	0.1343
Age: 2nd quartile vs 1st quartile	—	—	−2.78 (1.81)	0.1255	−2.89 (1.78)	0.1045
Age: 3rd quartile vs 1st quartile	—	—	−3.57 (1.92)	0.0641	−3.80 (1.89) *	0.0448
Age: 4th quartile vs 1st quartile	—	—	−7.41 (2.10) ***	0.0004	−7.51 (2.06) ***	0.0003
Children: 2nd quartile vs 1st quartile	—	—	−1.26 (1.77)	0.4756	−0.85 (1.74)	0.6241
Children: 3rd quartile vs 1st quartile	—	—	0.30 (2.22)	0.8917	0.79 (2.18)	0.7170
Children: 4th quartile vs 1st quartile	—	—	−2.28 (2.25)	0.3111	−1.60 (2.21)	0.4700
Incentives: No incentives vs consistently	—	—	0.78 (2.58)	0.7626	3.42 (2.65)	0.1975
Incentives: Not consistently vs consistently	—	—	1.11 (2.39)	0.6432	1.96 (2.41)	0.4152

Model component	Model 1: Unadjusted β (SE) / estimate	p value	Model 2: Adjusted β (SE) / estimate	p value	Model 3: Adjusted β (SE) / estimate	p value
Nodal event: Divorced vs no	—	—	−24.20 (7.40) **	0.0012	−21.08 (7.25) **	0.0039
Resources: Basic materials vs adequate resources	—	—	7.15 (1.67) ***	<0.0001	6.37 (1.65) ***	0.0001
Resources: None vs adequate resources	—	—	−4.48 (1.64) **	0.0065	−4.39 (1.62) **	0.0071
Maximum temperature	—	—	−0.88 (0.27) **	0.0011	−0.95 (0.27) ***	0.0004
Rainfall	—	—	−0.00049 (0.00190)	0.7977	−0.00093 (0.00188)	0.6220
Resilience × dry season	—	—	—	—	−0.72 (0.14) ***	<0.0001
Resilience × rainy season	—	—	—	—	0.06 (0.12)	0.6533
Covariance parameters						
Random intercept variance	182.89	—	0.00†	—	3.56	—
Residual variance: dry season	474.85	—	441.91	—	410.79	—
Residual variance: rainy season	341.39	—	356.09	—	337.28	—
Residual variance: transition season	128.60	—	175.61	—	170.03	—
ARH(1) within-person correlation	0.2647	—	0.2675	—	0.2393	—

Model component	Model 1: Unadjusted β (SE) / estimate	p value	Model 2: Adjusted β (SE) / estimate	p value	Model 3: Adjusted β (SE) / estimate	p value
Model fit statistics						
−2 restricted log likelihood	9577.5	—	9087.8	—	9055.6	—
AIC	9587.5	—	9095.8	—	9065.6	—
AICC	9587.6	—	9095.9	—	9065.6	—
BIC	9607.2	—	9111.5	—	9085.2	—

*Notes: β=regression coefficient; SE=standard error; AIC=Akaike information criterion; AICC=corrected Akaike information criterion; BIC=Bayesian information criterion; ARH(1)=heterogeneous autoregressive covariance structure of order 1; KNM=Kassena-Nankana Municipality; BND=Builsa North District; KNWD=Kassena-Nankana West District. Model 1 included resilience and season. Model 2 was adjusted for district, season, sex, supervision frequency, income, age group, child group, incentive frequency, divorce, resource availability, maximum temperature, and rainfall. Model 3 included centred resilience, dry and rainy season indicators, covariates from Model 2, and resilience×season interaction terms. For Model 3, the resilience coefficient represents the resilience slope in the transition season, and season coefficients represent differences at average resilience. Reference categories were transition season, KNM, male sex, daily supervision, high income, first age quartile, first child-number quartile, consistent incentives, no divorce, and adequate resources. †The Model 2 random intercept variance was estimated at the boundary (0.00), producing a non-positive definite G-matrix warning. The model converged; this estimate is reported as negligible between-participant variance after adjustment for fixed effects and the ARH(1) repeated covariance structure. Significance levels: *p<0.05; **p<0.01; ***p<0.001.*

Supplementary Table S3b: Season-specific conditional associations between resilience and well-being from the fully adjusted interaction model

Season	Conditional resilience slope β (SE)	95% CI	p value
Dry	0.25 (0.10)	0.06 to 0.44	0.0110
Rainy	1.02 (0.11)	0.80 to 1.25	<0.0001
Transition	0.97 (0.11)	0.74 to 1.19	<0.0001

β=regression coefficient; SE=standard error; CI=confidence interval. Slopes represent the expected change in WHO-5 well-being score associated with a one-unit increase in resilience within each season. Transition was the reference season; dry and rainy slopes were derived from the fitted resilience × season interaction model

Supplementary Table S4. Full LSMeans output (resilience percentiles)

Resilience level	Resilience value	Season	LSMean	SE	95% CI
P25 (Low)	120	Dry	94.83	10.66	73.91 to 115.75
P25 (Low)	120	Rainy	86.37	9.26	68.19 to 104.55
P25 (Low)	120	Transition	97.07	10.48	76.50 to 117.63
P50 (Mid)	129	Dry	97.06	10.62	76.22 to 117.90
P50 (Mid)	129	Rainy	95.59	9.24	77.45 to 113.74
P50 (Mid)	129	Transition	105.78	10.47	85.22 to 126.34
P75 (High)	133	Dry	98.05	10.62	77.20 to 118.90
P75 (High)	133	Rainy	99.69	9.27	81.49 to 117.89
P75 (High)	133	Transition	109.65	10.50	89.03 to 130.28

Values are adjusted marginal means (LSMeans) of well-being estimated at resilience percentiles (P25=120; P50=129; P75=133). All estimates are from the final mixed-effects model and are adjusted for district, season, resilience, resilience×season, sex, age group, supervision frequency, income, number of children, nodal events (divorce/death/income loss), resource availability, and climate variables (max temperature, rainfall).

Supplementary Table S5: Final WP/BP mixed-effects model

Predictor	Estimate (β)	SE	df	t	p-value
Between-person resilience (res_bp)	0.9646	0.1031	557	9.35	<0.0001
Within-person resilience (res_wp) in Transition season	0.5643	0.1741	421	3.24	0.0013
Dry season (vs Transition)	-8.0008	1.5487	524	-5.17	<0.0001
Rainy season (vs Transition)	-12.4143	1.9532	845	-6.36	<0.0001
Interaction: res_wp × Dry (vs Transition)	-0.8640	0.2560	577	-3.37	0.0008
Interaction: res_wp × Rainy (vs Transition)	0.8591	0.2741	577	3.13	0.0018
District: BND (vs KNM)	34.4272	2.4224	616	14.21	<0.0001
District: KNWD (vs KNM)	2.9163	1.4490	337	2.01	0.0449
Age group: 4th quartile (vs 1st)	-7.5873	2.0479	563	-3.70	0.0002
Nodal event: divorced (Yes vs No)	-23.1109	7.2584	344	-3.18	0.0016
Work resources: basic materials (vs adequate)	7.7010	1.6410	707	4.69	<0.0001
Work resources: none (vs adequate)	-4.8962	1.6179	774	-3.03	0.0026
Maximum temperature (per unit)	-0.9637	0.2660	828	-3.62	0.0003
Rainfall (per unit)	-0.00038	0.001880	531	-0.20	0.8392

Between-person differences (res_bp) = Each CHW's mean resilience across all survey waves; within-person change (res_wp) = Deviations from each CHW's individual mean at a given wave. Season main effects reflect adjusted differences in well-being when within-person resilience is at an individual's average level (res_wp=0).

Supplementary Table S6. Residual diagnostics from final mixed-effects models

Outcome	Residual type	N	Mean	SD	Skewness	Kurtosis	Range	Shapiro-Wilk p-value
Resilience	Conditional residuals	1085	0.004	7.06	-1.06	4.01	-42.26 to 18.64	<0.0001
Resilience	Marginal residuals	1085	0.005	7.64	-1.01	3.13	-42.59 to 19.71	<0.0001
Well-being	Conditional residuals	1085	0.035	18.96	-0.73	0.09	-67.25 to 45.97	<0.0001
Well-being	Marginal residuals	1085	0.036	19.11	-0.73	0.09	-67.41 to 46.35	<0.0001

Note. The models converged and used an ARH(1) covariance structure to account for within-person correlation and season-specific residual variances.

Supplementary Table S7. Floor and ceiling effects in observed WHO-5 well-being scores by season

Season	Observations, n	Floor (WHO-5 = 0), n (%)	Ceiling (WHO-5 = 100), n (%)
Dry	372	0 (0.0)	29 (7.8)
Rainy	364	0 (0.0)	26 (7.1)
Transition	358	0 (0.0)	10 (2.8)
Overall	**1,094**	**0 (0.0)**	**65 (5.9)**

WHO-5=World Health Organization Five-Item Well-Being Index. Scores range from 0 to 100. Floor and ceiling effects represent observations at the theoretical minimum (0) and maximum (100), respectively. Percentages are based on non-missing WHO-5 observations within each season. The overall row represents pooled observations across survey waves rather than unique participants

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CHAPTER 7

Discussion

7.1 Chapter Overview

This thesis examines resilience and well-being among CHWs in Ghana through three related studies which explored meaning, context, and seasonal dynamics. Accordingly, the first study examined how CHWs themselves understand and describe resilience and well-being in their social and work contexts. The second study examined the contextual processes and factors that shape these experiences within the context of Community-based Health Planning and Services. The third study examined whether resilience and well-being differed across dry, rainy, and transition/harvest seasons, and whether resilience remained associated with well-being over time.

The main argument emerging from the thesis is that CHW resilience and well-being are not fixed individual attributes. They are dynamic, social-ecological and seasonally shaped, resulting from the interaction of personal resources, relationships, community expectations, health system arrangements, material circumstances, and environmental realities. These findings align with broader resilience theory, which views resilience as a dynamic process of adaptation supported by resources within individuals and their environments rather than as a stable personal trait (19,21,56,130,133,134). Beyond that, they also reflects the realities of CHW programmes, where performance, motivation, retention, and sustainability are closely tied to contextual realities like supervision, incentives, community trust, workload, recognition, and programme support (7,37,38).

This chapter synthesizes the findings across the three studies and discusses their conceptual, methodological, programmatic, and policy implications. It also reflects on the strengths and limitations of the thesis and identifies directions for future research.

7.2 Summary of Key Findings

The first study showed that CHWs in the Upper East Region of Ghana understand resilience and well-being from a broad, culturally grounded, and multidimensional perspective. Resilience was described as a dynamic process that involves cognitive and adaptive strategies, emotional regulation, communal solidarity, and spiritual coping mechanisms. Community health workers did not describe resilience solely in terms of endurance or toughness, rather, they described it as the ability to think through challenges, regulate emotions, draw strength from others, rely on faith, and continue functioning in the face of difficult work-life situations. Well-being was

similarly described as holistic, including environmental, financial, mental and emotional, physical, social, and spiritual dimensions (21).

This finding is important because resilience and well-being are often examined using standardized measures that do not fully represent how they are understood in local sociocultural settings (25,54,61,135,136). While standardized tools remain useful, the first study revealed that CHWs' own interpretations provide a deeper understanding of what resilience and well-being mean in practice. In this thesis, resilience and well-being are therefore not treated only as abstract concepts or measurable outcomes, but also as lived experiences shaped by local language, values, relationships, and expectations.

The second study extended this conceptual foundation by using the socio-ecological framework as an analytic lens to identify the processes and contextual factors that shaped resilience and well-being in CHPS settings (12). This framework guided the organization and interpretation of barriers and facilitators across individual, relational, community, structural, and seasonal/environmental levels. At the individual level, CHWs described psychological and emotional burden following adverse medical events, difficulty balancing volunteer responsibilities with farming and other livelihood activities, and financial insecurity. At the relational level, household conflict, family responsibilities, bereavement, and supervisory pressure shaped their ability to cope and maintain well-being. At the community level, lack of recognition, distrust, misconceptions about compensation, and unrealistic expectations undermined resilience and well-being. At the structural level, lack of formal status, inconsistent support, limited resources, and gendered norms created additional strain. Seasonal and climatic conditions further amplified or eased these pressures, with rainy and dry seasons bringing increased workload, extreme heat, travel difficulties, and strained resources, while transition/harvest periods sometimes provided relief through improved food availability, economic activity, and community reciprocity (12).

The third study provided a temporal and quantitative complement to the qualitative findings. In a longitudinal cohort of CHWs followed across three seasons, resilience and well-being showed clear seasonal patterns. Mean resilience increased from the dry season to the rainy season and remained high during the transition/harvest season. Mean well-being also increased across the three periods. There was a consistent association between higher resilience and higher well-being

in adjusted models, although the strength of the relationship varied by season. The within-person resilience–well-being relationship was stronger during the rainy and transition/harvest seasons than during the dry season. The analysis also accounted for personal circumstances that could shape CHWs' resilience and well-being, including household income, livelihood pressures, family responsibilities, and stressful or nodal life events such as illness, bereavement, or other major disruptions. Furthermore, seasonal patterns varied by district and incentive frequency, suggesting that resilience and well-being are not only shaped by environmental and programmatic conditions, but also by the personal and household circumstances within which CHWs carry out their work (137).

In summary, the three studies show that CHW resilience and well-being are meaningful, contextual, and temporal. Table 7.2.1 integrates the findings across the three studies, highlighting where key factors and domains converged, differed, or were examined using complementary qualitative and quantitative approaches.

Table 7.2.1. Identification of factors shaping resilience and well-being across the three thesis studies

This table summarizes the extent to which key factors and domains were identified across the three empirical studies. Study 1 focused on how CHWs understood and described resilience and well-being; Study 2 examined contextual barriers and facilitators across social-ecological levels; and Study 3 examined selected individual, programme, environmental, and seasonal factors longitudinally. The table is intended to illustrate areas of convergence across the studies as well as qualitative findings that were not directly captured or statistically significant in the longitudinal analysis.

Factor / domain	Study 1: Meaning of resilience and well-being	Study 2: Contextual barriers and facilitators	Study 3: Longitudinal study	Cross-study interpretation
Resilience	✓	✓	✓	Central across all three studies; conceptualized qualitatively and measured longitudinally
Well-being	✓	✓	✓	Described as multidimensional, contextually shaped, and measured longitudinally
Cognitive/adaptive coping and personal agency	✓	✓	X	Important qualitative process but not measured as a distinct longitudinal variable
Emotional and mental well-being/burden	✓	✓	✓*	Identified qualitatively; Study 3 assessed overall psychological well-being using the WHO-5
Faith and spirituality	✓	✓	X	Important source of coping and resilience qualitatively but not directly measured longitudinally
Financial security/household income	✓	✓	✓	Financial well-being and insecurity emerged qualitatively; lower household income was significantly associated with lower well-being
Livelihood demands and work-livelihood conflict	✓	✓	X*	Farming and livelihood pressures emerged qualitatively; related circumstances were considered but were not significant predictor in the final model

Family/household support and responsibilities	✓	✓	✓*	Family and social support were important qualitatively; major household and life circumstances were considered quantitatively
Bereavement and major life events	X	✓	✓*	Major life events emerged in Study 2; nodal events were measured in Study 3 and divorce was significantly associated with lower well-being
Community support and solidarity	✓	✓	X	Communal support was central qualitatively but was not a significant longitudinal predictor reported in Study 3
Community recognition and appreciation	✓*	✓	X	Recognition and social value were reflected qualitatively, particularly in Study 2
Community trust and relationships	✓	✓	X	Relational and communal dimensions were important qualitatively but were not directly significant in Study 3
Supervision	X*	✓	✓	Supportive supervision emerged as a facilitator in Study 2; supervision frequency was significantly associated with well-being in Study 3
Incentives and compensation	X*	✓	✓	Compensation and inconsistent support emerged in Study 2; seasonal patterns differed significantly by incentive frequency in Study 3
Material resources and equipment	X*	✓	✓	Resource constraints were a structural barrier in Study 2; work-resource availability was significantly associated with well-being in Study 3
Formal status and institutional recognition	X	✓	X	Lack of formal status was an important structural barrier but was not directly tested longitudinally
Gender and gendered expectations	✓	✓	X	Gender-related nuances emerged in Studies 1 and 2; sex was included as a covariate in Study 3 but was not statistically significant

Workload and competing work demands	✓*	✓	X*	Work-life demands appeared qualitatively; workload was not a distinct significant predictor in the final longitudinal model
Seasonality	X*	✓	✓	Seasonality emerged as an important contextual influence in Study 2 and was quantitatively demonstrated in Study 3
Heat and temperature	✓*	✓	✓	Environmental well-being was identified in Study 1, heat was a seasonal stressor in Study 2, and higher maximum temperature was significantly associated with lower well-being in Study 3
Rainfall	✓	✓*	X	Rainy-season conditions were qualitatively important, but rainfall itself was not statistically significant in the final longitudinal model
Mobility, travel and transportation challenges	✓*	✓	X	Environmental and mobility challenges emerged qualitatively; transportation was not a significant final predictor
District/local context	✓*	✓	✓	Context shaped qualitative experiences and longitudinal patterns differed significantly across districts
Resilience-well-being relationship	✓*	✓*	✓	Conceptually linked in Studies 1 and 2 and quantitatively demonstrated in Study 3, with the strength of the association varying by season

Notes: *✓indicates that the factor was identified as a substantive finding in a qualitative study or was statistically significant in the longitudinal study.* ***X*** *indicates that the factor was not identified as a substantive finding, was not directly measured, or was not statistically significant in that study. An asterisk* ***(*)*** *indicates that the factor was represented indirectly, captured within a broader construct, considered in the analysis without being a distinct significant predictor, or reflected conceptually rather than measured directly. The absence of a statistically significant association in Study 3 should not be interpreted as evidence that a qualitative finding was disproven, because several factors identified in Studies 1 and 2 were not measured using equivalent quantitative constructs.*

7.3 Conceptualizing resilience and well-being in context

The thesis makes an important contribution to the conceptualization of resilience and well-being. The findings challenge narrow framings of resilience as an individual capacity that CHWs either possess or lack. This interpretation is consistent with wider resilience scholarship beyond the CHW literature, which increasingly conceptualizes resilience as a dynamic and multisystemic process rather than a fixed personal trait. Across this broader literature, resilience is understood as a process of adaptation shaped by resources within individuals, families, relationships, communities, institutions, cultures, and wider social and ecological environments (19,51,56,57). Masten's concept of "ordinary magic" is useful here because it describes resilience as emerging from ordinary everyday adaptive systems, such as supportive families, relationships, communities and opportunities to cope effectively, rather than in exceptional individual qualities alone (51). Similarly, multisystemic resilience scholarship emphasizes that resilience emerges through interactions across psychological, social, cultural, ecological, and institutional systems (18,19). These ideas align with the social-ecological understanding used in this thesis, where resilience is influenced by the resources available to individuals, families, communities, and systems (20,56,92,94). This distinction is necessary because an individualised understanding of resilience can unintentionally shift responsibility onto CHWs without addressing the underlying conditions that make adaptation possible.

This wider framing is important because CHWs' work cannot be separated from household, livelihood, social, and spiritual realities. Personal strain may reduce the resources available for CHW work, while family support, faith, peer solidarity, community recognition, and supportive supervision may strengthen their capacity to function across domains (12). This reinforces the argument that CHW resilience is not compartmentalized, but is produced through the interaction of personal life, community life, and programmatic conditions.

For CHWs in this study, resilience was not simply about continuing to work despite hardship. It was expressed in a variety of ways, including practical problem-solving, emotional control, faith, social support, and the ability to remain useful to the community, reflecting both personal agency and contextual support (21). A CHW may be highly motivated, but that motivation may be difficult to sustain when there is inadequate supervision, lack of recognition, limited resources, and pressure from household and livelihood responsibilities (22,80,95). In this sense, resilience is

not only something CHWs bring to their work; it is also something that is produced or constrained by the conditions under which they work.

Similarly, CHWs did not describe well-being only as the absence of distress or illness. They linked well-being to physical strength, emotional stability, financial capability, social respect, spiritual grounding, environmental conditions, and the ability to fulfill both household and community responsibilities (21). This broader understanding is consistent with literature that views well-being as multidimensional and shaped by social relationships, meaningful work, and material circumstances (130,138). Thus, for CHWs, their well-being is not separate from the conditions of their work. It is tied to whether their labour is recognized, whether they can support their households, whether communities respect their role, and whether the health care system provides them with adequate resources needed to function effectively and in a dignified manner.

This conceptual contribution is important for CHW policy and research. If resilience and well-being are treated as individual psychological outcomes alone, interventions may focus too narrowly on motivation, coping skills, or training, which may be useful, but are insufficient. The findings of this thesis demonstrate that CHWs' resilience and well-being depend on whether individual capacity is matched with relational, community, institutional, and seasonal supports. In other words, resilience should not become a way of asking CHWs to absorb structural neglect and inefficiencies. It should instead guide programmes to identify the conditions that allow CHWs to adapt, remain well, and continue contributing to primary health care within their communities.

7.4 Contextual Processes, Structural Conditions, and Programme Realities

The second major contribution of this thesis is the identification of contextual factors that influence CHW resilience and well-being within the CHPS setting. Community health workers occupy a dual position in the sense that they are embedded community members who draw legitimacy from their closeness to households, local culture, language, and community relationships. At the same time, they function within a broader health system that may not always provide the support, recognition, or material resources needed for the responsibilities expected of them (7,11,37). Therefore, the value and vulnerability of CHW work are best

understood by recognizing their position at the intersection of community life and the formal health system.

The thesis shows that CHW resilience and well-being are shaped by alignment or misalignment between personal commitment and contextual support (12). When CHWs experience family encouragement, peer solidarity, supportive supervision, community appreciation, and visible positive outcomes from their work, their motivation, resilience and well-being are strengthened (6,12,28,38,60,80,89,139). The contribution of this thesis is therefore not simply that it identifies these factors, since they are already part of wider conversations about CHWs. Rather, it pushes the discussion further by showing how these factors operate together as conditions that produce, support, or constrain CHW resilience and well-being. In this way, the thesis moves beyond treating supervision, incentives, recognition, workload, and resources only as programme inputs or retention factors. It shows how they interact with household responsibilities, livelihood pressures, gendered expectations, community relationships, and seasonal conditions to shape whether CHWs are able to remain well while carrying out community health work.

This is important because CHWs may be expected to perform essential health system functions while remaining insufficiently compensated, inadequately resourced, and only partially integrated into formal structures (15,40). The resulting tension is not only a labour or programme-design issue; it is also a well-being issue. When CHWs are asked to absorb gaps in resources, recognition, supervision, or compensation, the burden is carried not only in their work performance, but also in their emotional, social, financial, and household lives.

The findings also highlight the importance of gendered expectations. In the second qualitative study, gender norms shaped who had opportunities and who faced constraints in the cultural context, how CHWs balanced household and community roles, and how volunteer work was interpreted within families and communities (12). This suggests that CHW support strategies should not assume that all CHWs experience the role in the same way. Gender-sensitive approaches are needed, particularly where household responsibilities, livelihood demands, and community expectations interact differently for men and women.

This thesis therefore reframes CHW resilience and well-being as more than individual attributes or secondary outcomes of programme participation. It positions them as indicators of the quality of the social, material, institutional, and seasonal environments in which CHWs work. From this

perspective, resilience is not simply a characteristic that enables CHWs to continue delivering services; it is also a signal of whether the programme environment is enabling or constraining their ability to function with dignity.

Programme sustainability cannot be separated from the conditions under which CHWs live and work. What this thesis adds is that workload, incentives, supervision, recognition, material resources, and community accountability should be understood not only as determinants of CHW performance or retention, but also as determinants of CHW resilience and well-being. This shifts the question from how programmes can keep CHWs motivated enough to deliver services, to what forms of relational, material, institutional, and seasonal supports are needed for CHWs themselves to remain well while sustaining community-based primary health care.

7.5 Seasonality, incentives, and programme design

The longitudinal study adds an important temporal dimension to the thesis by showing that CHW resilience and well-being are not static across time. They vary across seasons and are influenced by programmatic conditions such as incentive frequency. This finding is critical because much of the CHW literature treats the work environment as relatively stable (28,31,38,89). In settings such as northern Ghana, however, seasonal variation is a defining feature of everyday life. Dry, rainy, and transition/harvest periods shape disease burden, mobility, farming demands, household resources, access to communities, and the feasibility of CHW work (30,98,103,140).

The qualitative findings suggested that the rainy season can intensify workload, mobility constraints, and competing farming responsibilities, while the dry season can bring heat stress and environmental strain. In contrast, the transition/harvest season may offer some relief through improved household resources, food availability, and community reciprocity (12). The longitudinal findings confirmed that resilience and well-being follow seasonal patterns, but also showed that these patterns are not uniform across districts or incentive groups (137). This reinforces the need to understand seasonality not as background context, but as an operational condition that shapes CHW work and well-being.

One of the important findings from the longitudinal study was that resilience was consistently associated with well-being, but the strength of this association varied by season. The resilience–well-being relationship was stronger in the rainy and transition/harvest seasons compared with the dry season (137). This suggests that resilience may matter most when contextual demands are

high or when seasonal conditions make social and material resources more or less available. It also supports the broader argument by Ungar and Theron (2020) that resilience is not the final outcome; rather, it is a pathway through which well-being and mental health may be supported under adversity (19).

The role of incentives deserves particular attention given that incentive frequency modified seasonal trajectories of resilience and well-being. Community health workers receiving more consistent incentives showed more favourable patterns, especially during periods where household and programmatic conditions were more supportive (137). It should be stated clearly that this does not mean incentives are a simple solution. Rather, incentives operate as part of a broader ecosystem of recognition, labour value, and institutional support. Their influence depends on predictability, fairness, and whether they align with the actual workload expected of CHWs. Inconsistent and unreliable incentives may undermine resilience and well-being not only because they reduce financial support, but also because they introduce stress and uncertainty while signalling weak recognition of CHW labour (38,39,141). This is especially important in contexts where CHWs may live close to the margins and depend on even modest payments to manage household expenses, transport costs, farming needs, or family responsibilities. When expected payments are delayed, irregular, or absent, the effect is not merely symbolic; it can affect daily survival, household planning, and the ability to continue volunteering without sacrificing other responsibilities.

The opportunity costs of CHW work are therefore high. Time spent on household visits, community mobilization, campaigns, meetings, or follow-up activities is time taken away from farming, trading, caregiving, paid work, rest, and other family obligations. For CHWs whose livelihoods are already shaped by seasonal uncertainty, unpaid or inconsistently compensated work can deepen strain rather than simply test commitment. Programme design must therefore treat incentives not as optional tokens of appreciation, but as part of the material conditions that make CHW participation sustainable, predictable, and fair.

These findings provide the empirical basis for a season-sensitive approach to CHW programme design. Across the qualitative studies, community health workers described seasonal changes in workload, mobility, farming demands, heat exposure, food security and community support, while the cohort study demonstrated corresponding seasonal variations in resilience and well-

being. This suggests that CHW programmes in seasonally dynamic settings should not assume that workload, mobility, and household capacity remain constant throughout the year.

Programme activities such as campaign scheduling, supervision, transport support, incentive delivery, and distribution of work materials should be planned with seasonal realities in mind. For example, rainy seasons may require additional transport support, protective equipment, flexible scheduling, and closer supervision. Dry seasons may require attention to heat exposure, hydration, and workload distribution. Transition/harvest periods may provide opportunities for training, recognition activities, and community engagement, but should still account for agricultural demands.

A season-sensitive approach does not require creating entirely new programmes rather it calls for making existing CHW support more responsive to when and where strain is likely to intensify. This is particularly important as climate change increases the frequency and severity of extreme weather events, with likely implications for health service delivery and frontline health workers (142). Community health workers are often described as essential to resilient health systems, but their own resilience and well-being must be supported if they are expected to sustain community-based care under changing environmental conditions.

7.6 Methodological contributions

This thesis also makes a methodological contribution by linking qualitative and quantitative longitudinal evidence. The first two studies provided conceptual and contextual grounding before the longitudinal analysis was conducted. The qualitative findings made it possible to interpret the scores in the cohort study in relation to CHWs' lived experiences, values, work demands, community relationships, and programme realities.

The use of interpretative phenomenological analysis allowed the first study to remain close to CHWs' own accounts while also interpreting how resilience and well-being were made meaningful in context (21,127,143). The second qualitative study extended this by using a social-ecological lens to examine how barriers and facilitators operated across levels (12). The longitudinal study then used repeated measures to examine whether resilience and well-being varied over time and whether the resilience–well-being association changed by season (137).

A major methodological contribution of this thesis is that it is the only study to our knowledge that follow the same CHWs over time rather than relying on a single cross-sectional assessment. Longitudinal studies of CHWs are difficult to conduct because they require repeated participant contact, tracking across time, sustained field coordination, and strategies to minimize loss to follow-up. These challenges are intensified in rural and seasonal settings where mobility, road access, farming calendars, workload, and communication barriers can affect both participants and research teams. By following CHWs across dry, rainy, and transition/harvest seasons, this thesis provides temporal evidence on how resilience and well-being change within the same individuals under shifting social, programme, and environmental conditions. This responds to wider calls for longitudinal CHW research that can assess change over time rather than infer dynamic processes from cross-sectional data alone (144,145).

The use of phone-based surveys is another important methodological contribution. Rather than relying only on repeated face-to-face surveys, the longitudinal study used telephone interviews to reach CHWs across three seasonal waves. This approach was well suited to the study population because CHWs are community-based actors who are geographically dispersed and often balancing health-related duties with farming, household, and livelihood responsibilities. Telephone follow-up reduced the need for repeated travel to dispersed communities, made seasonal data collection more feasible, and allowed the study team to maintain contact with participants during periods when mobility and road access could be difficult.

This has important implications for less expensive research and routine programme monitoring. Evidence from LMICs suggests that mobile phone surveys can provide a practical alternative to face-to-face data collection in hard-to-reach settings, particularly for monitoring general programme indicators when phone coverage, network reliability, and up-to-date contact lists are available (146,147). In this thesis, remote data collection demonstrated that repeated monitoring of CHW resilience, well-being, incentive frequency, supervision, workload, and resource constraints is feasible without requiring a full in-person field visit at each time point. This approach could be useful for district health teams and CHW programmes seeking to monitor CHW conditions more regularly and at lower cost, especially in settings where seasonal barriers make frequent in-person data collection difficult.

It is, however, worth stressing that the use of phone surveys should not be treated as a simple replacement for in-person engagement. Phone monitoring depends on functional phone access, reliable network coverage, accurate contact information, language-matched interviewers, and careful attention to confidentiality. It may also exclude CHWs without phones or those in areas with poor connectivity. The methodological contribution of this thesis therefore lies not in claiming that phone surveys are universally superior, but in showing how they can be used pragmatically and ethically as part of a broader mixed-methods approach to CHW research and programme monitoring.

The within-person and between-person decomposition of resilience in the longitudinal study was especially useful, given that it helped distinguish whether CHWs who were generally more resilient also had higher well-being, and whether a CHW's seasonal increase in resilience above their own average was associated with higher well-being. This distinction matters because resilience may differ across CHWs, but it is also a dynamic process that can shift within the same CHW over time in response to changing conditions (18,21,56). By distinguishing and modeling these two sources of variation separately, the analysis was better aligned with the conceptual framing of resilience in the thesis as both personally experienced and contextually shaped.

This methodological order strengthens the thesis because the findings do not rely on one type of evidence alone. The qualitative studies explain meaning and context, while the longitudinal study provides evidence of temporal patterning. The sequential qualitative-to-longitudinal design, telephone seasonal follow-up, and within-person/between-person modelling provide a methodological template for studying CHWs as a dynamic workforce whose experiences change over time and across programme and environmental conditions. The synergy among all the studies produced a more coherent understanding than any one design could have provided independently.

7.7 Strengths and Limitations

The thesis has several strengths. First, it addresses an important gap in CHW literature by paying special attention to resilience and well-being beyond the more commonly studied outcomes of motivation, performance, and retention alone. Much of the existing literature has focused on motivation, performance, retention, or programme effectiveness. While these outcomes remain important, they do not fully capture the lived experiences of CHWs or the personal, relational,

community, and health system conditions that shape their ability to continue working in difficult settings. By giving specific attention to resilience and well-being, this thesis shifts attention away from what CHWs produce for the health system to how they experience, interpret, and sustain their work over time.

Second, the thesis focuses on the voices and interpretations of CHWs before conducting the longitudinal analysis. This is important because resilience and well-being can easily be defined from the outside in ways that may not accurately reflect local realities (56,148). The qualitative studies allowed CHWs to define these concepts in their own words and explain how family, community, programme conditions, and seasonal pressures shaped their experiences. The longitudinal study then tested whether these locally grounded accounts were reflected in measurable seasonal patterns.

A third strength is the use of a social-ecological framework. The framework is appropriate for the work of CHWs, since they serve as a link between households, communities, and the health care system. Their resilience and well-being are not shaped by individual coping alone, but also by family responsibilities, peer relationships, community recognition, supervision, incentives, work resources, and broader programme structures. Thus, the framework allowed for the examination of resilience and well-being as experiences shaped by multiple interacting levels.

Fourth, the longitudinal component provides rare evidence on how resilience and well-being differ across seasonal conditions. Much of the existing literature on CHWs is cross-sectional or focuses on general experiences of motivation, satisfaction, retention, or performance at one point in time (60,61). This thesis adds value by examining how CHWs' resilience and well-being change across dry, rainy, and transition seasons. This is reasonable because CHW work does not typically take place in a stable and controlled environment but in dynamic community settings. Thus, seasonal changes can affect transportation, access to households, farming responsibilities, income, food security, disease patterns, and the emotional and physical demands placed on CHW.

The thesis also benefits from its setting. The Upper East Region is highly relevant for this work because of its long history with CHPS implementation and its strong seasonal variation (10,35,140). Studying CHWs in this setting made it possible to examine resilience and well-being in relation to both programme realities and environmental conditions. This was important

because CHW work in this context is shaped not only by formal health system expectations, but also by farming, mobility, household responsibilities, climate, and community relationships.

That said, several limitations should be acknowledged. The qualitative studies were conducted in selected districts in one region of Ghana and will not capture the full diversity of CHW experiences across the country or beyond Ghana. Although purposive sampling helped ensure variation by gender, district, and years of experience, the findings should be interpreted as contextually grounded rather than statistically generalizable. This limitation was partly mitigated by providing detailed description of the study setting, participant selection, data collection procedures, and analytic approach, allowing readers to assess the transferability of the findings to other CHW settings. The use of a social-ecological framework also supported transferability by linking CHW experiences to broader individual, relational, community, health system, and seasonal conditions that are relevant beyond the specific study districts.

Interpretation of the qualitative findings was also informed by my positionality and familiarity with Ghanaian community health research and the CHPS context. While this familiarity supported rapport and contextual understanding, it also created the possibility of assuming shared meanings. Reflexive notes, team debriefing, and collaborative interpretation were therefore used throughout the analysis to identify and challenge these assumptions.

It is also useful to note that the findings are unlikely to be entirely unique to these districts or to Ghana alone. The wider CHW literature across Ghana and other African settings shows that CHWs often share similar programme realities, including volunteer or low-paid labour, limited resources, inconsistent incentives, supervision challenges, community expectations, competing household and livelihood responsibilities, and questions of recognition, motivation, and retention (21–24) . These similarities suggest that the findings may have analytic relevance for other settings where CHWs occupy comparable positions between communities and formal health systems. However, the specific expression of resilience and well-being may differ depending on national CHW policy, remuneration models, health system integration, gender norms, disease burden, livelihood patterns, and rural or urban context.

The inclusion of stakeholders in the second qualitative study strengthened contextual interpretation, but the stakeholder sample was small. Their perspectives should therefore be seen as complementary to the CHW accounts, rather than a complete representation of programme-

level views. This limitation was mitigated by using stakeholder interviews to contextualize, rather than replace, CHWs' own accounts. The primary analytic emphasis remained on CHWs' lived experiences, while stakeholder perspectives helped clarify how programme structures, supervision, and health system expectations shaped those experiences. Future research could include a larger and more diverse stakeholder sample across multiple regions of Ghana, as well as comparative studies across African countries with different CHW policy and remuneration models.

The longitudinal study also has limitations. Resilience and well-being were measured using self-reported instruments, which may be influenced by social desirability, recall, or seasonal mood (149,150). However, this limitation should be interpreted alongside the strength of the selected measures. Both instruments used in this study are well-established and psychometrically supported. The RRC-ARM was developed as a social-ecological measure of adult resilience and has demonstrated good internal reliability and convergent validity globally, including in Ghana (129,151–153). The WHO-5 is also widely used across clinical, public health, and population studies, with systematic review evidence supporting its high validity and sensitivity as a measure of subjective well-being (130,154).

The main measurement limitation, therefore, is not that the instruments were weak, but that standardized self-report tools cannot fully capture all the culturally specific, relational, and situational dimensions of resilience and well-being that emerged in the qualitative studies. This was partly mitigated by using validated instruments, administering the same measures across all three waves, translating and back-translating the questionnaire, and submitting the back-translated RRC-ARM to Dr. Liebenberg for verification and approval. Additional mitigation strategies included training interviewers to administer questions consistently and interpreting the quantitative findings alongside the qualitative evidence. Self-reported data can still be affected by social desirability and recall bias, so the findings should be interpreted as participants' self-reported resilience and well-being rather than as direct clinical or behavioural assessments (150).

Although the repeated-measures design made it possible to examine change over time, the study was not designed to estimate causal effects. This should be understood as a boundary of the study rather than a methodological weakness. The purpose was to examine seasonal patterns and associations within the same CHWs over time, not to determine whether seasonality, incentives,

or resilience caused changes in well-being. Unmeasured confounding may also remain, especially for complex social and programme factors that are difficult to capture in survey data (149,155). These may include supervision quality, household dynamics, community recognition, informal support, or local programme differences. This was partly mitigated by adjusting for theoretically relevant covariates, using repeated observations from the same CHWs, examining within-person and between-person variation, and grounding the interpretation in the qualitative findings.

In addition, while the study incorporated seasonal and climate-related variables, seasonality is broad. It includes environmental, agricultural, economic, social, and health system processes, and these may not be fully captured through survey measures or available climate data. This is an important limitation because seasonality in rural African settings is not only a matter of rainfall or temperature. It can shape agricultural labour, food availability, household income, mobility, disease burden, social obligations, and access to services. Wider literature on rural livelihoods and seasonality shows that seasonal change affects agriculture, employment, food supply, poverty, hunger, disease patterns, and household vulnerability, particularly in tropical and agrarian settings (156,157).

The study mitigated this limitation by combining climate data with survey measures of perceived climate-related challenges and by interpreting seasonal findings in relation to qualitative accounts of farming demands, travel difficulty, heat stress, workload, food availability, and community reciprocity. Even so, the seasonal categories used in the analysis should be understood as approximations of broader social and ecological periods rather than complete measures of all seasonal processes affecting CHWs. Future studies could strengthen this approach by combining repeated CHW surveys with more detailed agricultural calendars, household economic data, community-level programme indicators, and finer-grained environmental measures.

Finally, the thesis is written in an article-based format. This format allows each study to stand as a distinct contribution, but it also means that some repetition across chapters is unavoidable, especially in relation to the study context, CHW programme background, and conceptual framing. That notwithstanding, the article-based structure is also a strength because it preserves the integrity of each study while allowing the final chapter to bring the evidence together. Taken

together, the thesis provides a more complete understanding of the meanings, contextual processes, and seasonal dynamics of CHW resilience and well-being in Ghana

7.8 Implications for policy and practice

The findings of this thesis have several implications for CHW policy, practice and health care system planning. Overall, the thesis shows that supporting CHWs requires more than simply acknowledging their importance to the delivery of primary health care. It requires attention to the social, material, programmatic, and seasonal conditions under which they work. Community health workers are often expected to remain committed, available, and resilient, but resilience goes beyond commitment alone. It is shaped by the resources, relationships, recognition, and the institutional supports that are available to them.

These implications should also be understood within the wider global policy context for CHW programmes. Global guidance now frames CHWs as part of primary health care and health workforce strengthening, rather than as temporary or narrowly disease-specific project actors (158). The WHO guideline on CHW programmes emphasizes education, deployment, management, remuneration, supervision, career progression, community embeddedness, and health system integration as part of optimizing CHW programmes within stronger primary health care systems (158,159). At the continental level, the African Union and UNAIDS have also positioned CHWs as central to sustainable health for all in Africa, while recent Africa-focused scholarship reinforces their importance for universal health coverage and health security (160,161).

This wider framing is especially important at a time when external health financing for LMICs is less secure. In 2025, WHO projected that external health aid would be 30% to 40% lower than 2023 levels and reported disruptions to services including maternal care, vaccination, emergency preparedness, and disease surveillance (162). Recent evidence from sub-Saharan Africa also shows that CHW financing remains donor-dominant and vertically oriented, with most donor funds directed toward single-disease or emergency-focused programmes rather than broader, horizontal CHW systems (163). In this context, the findings of this thesis strengthen the case for Ghana and other LMICs to invest in integrated, nationally owned CHW systems that support CHWs as a workforce, rather than limited to delivery channels for vertical programmes. This

thesis shows that such system strengthening must include CHW resilience and well-being as part of workforce sustainability, especially in rural and seasonally dynamic settings.

CHW resilience and well-being should be considered as concerns of the health care system, ebeyond merely the personal attributes of individual workers. This is important for public health and family health programmes where CHWs support many community-based activities, including health education, household follow-up, referrals, disease prevention, immunization support, malaria activities, neglected tropical disease interventions, and community mobilization (6,8,80,158). There is evidence that the conditions affecting CHWs can also affect their programme delivery. Jaskiewicz and Tulenko (2012) argue that work overload and reduced organizational support can negatively affect CHW productivity, service quality, and the effectiveness of community-based programmes (164). Similarly, Kok et al.'s systematic review shows that CHW performance is shaped by intervention-design factors such as workload, incentives, supervision, training, and community support (64). Therefore, when CHWs are strained by seasonal workload, inconsistent incentives, weak supervision, limited supplies, or inadequate work resources, the effects are not confined to individual well-being. They can also disrupt continuity, reduce the quality of household follow-up and community mobilization, weaken community trust, and limit the effectiveness of programmes that rely on CHWs, especially in rural and underserved communities. To support CHWs, the WHO guidance identifies supportive supervision, remuneration and non-monetary incentives, community trust, and regular logistical support and supplies as important for CHW motivation, performance, retention, productivity, programme effectiveness, and community uptake of CHW services (158).

Second, CHW programmes should provide predictable, fair, and integrated support that goes beyond material incentives alone. Throughout the thesis, inconsistent incentives, limited work resources, and competing livelihood responsibilities emerged as important sources of strain. This demonstrates that incentives alone are not sufficient to solve all the challenges faced by CHWs. The wider literature shows that CHW motivation is shaped by a combination of material and non-material factors, including supervision, role clarity, community respect, recognition, training, supplies, relationships with health workers, opportunities for growth, and whether CHWs feel valued within the health system (12,21,38,80,165). What it does suggest is that irregular or unreliable support can weaken resilience, well-being, and the ability of CHWs to remain in their roles over time. When incentives are delayed, supplies are unavailable,

supervision is weak, or expectations are unclear, these conditions can signal that CHW labour is not prioritized at higher structural levels of the health system. This matters because CHWs are expected to support campaigns, household visits, surveillance, referrals, health education, and other community-based activities, often while managing household, farming, caregiving, and income-generating responsibilities. Programme support should therefore reflect not only the scale and frequency of CHW activities, but also the value of their time, the opportunity costs of participation, and their need for clear, respectful, and reliable institutional backing.

A more appropriate policy response is therefore not simply to "pay CHWs," but to build a coherent support package that includes predictable remuneration or allowances where appropriate, adequate supplies, supportive supervision, clear role expectations, public recognition, and stronger integration of CHWs into health system planning and resource allocation. This aligns with WHO guidance, which recommends remuneration packages that correspond to CHW roles, hours, training, and workload, as well as written agreements specifying responsibilities, working conditions, remuneration, and rights (165)

Third, supervision should be viewed as a protective resource. Supportive supervision can provide CHWs with the tools they need to manage difficult work situations, solve problems and feel connected to the health system (6,158,166). This is consistent with wider CHW evidence showing that performance is shaped by intervention-design factors such as supervision, training, incentives, workload, role clarity, and community support (64). The WHO guidance similarly emphasizes that effective CHW programmes require evidence-informed education, deployment, management, supportive supervision, and integration into both health systems and community structures (165). Supervision should therefore not be limited to administrative monitoring or occasional contact when problems arise. It should be regular, respectful, and mentoring-oriented. This also points to the need for more holistic and responsive CHW training. Evidence suggests that CHW programmes are often affected by unclear roles, poorly defined education pathways, multiple uncoordinated actors, and fragmented disease-specific training, which can limit the contribution of CHWs to integrated primary health care (159,165). Similarly, a scoping review of ongoing CHW training in low- and middle-income countries found wide variation in how continuing training is designed, delivered, monitored, and sustained, and called for greater attention to ongoing training from a health systems strengthening perspective (167).

Training should therefore move beyond narrow task-specific instruction toward an integrated approach that prepares CHWs for the broader realities they face in practice. This includes communication, problem-solving, boundary-setting, referral navigation, emotional preparedness, community engagement, and strategies for managing competing programme, household, livelihood, and seasonal demands. Evidence from CHW psychosocial-support literature also shows that CHWs may need training in assessment, communication, problem solving, professional responsibilities and boundaries, stress and emotion management, and referral navigation, supported by supervision that improves skills rather than only monitors performance (168).

Supervisors should also pay attention to the broader lives of CHWs, including household responsibilities, livelihood pressures, seasonal constraints, and life events that may affect their resilience, well-being and capacity to work. When supervision is linked with more intelligent and holistic training, it becomes a form of continuing support rather than a narrow accountability mechanism. This would make training more valuable for CHWs and more useful for programmes because it would prepare CHWs not only to deliver specific interventions, but also to sustain their role within complex community and health system environments.

As a fourth recommendation, CHW planning should be more responsive to the seasonal elements and events. The findings demonstrate that resilience and well-being are not static throughout the year, given that seasonal changes in disease burden, farming responsibilities, mobility, heat, rainfall, and community support can all affect CHW experiences. This recommendation is consistent with wider evidence showing that seasonal conditions can alter health needs, physical access to services, workload, and the opportunity costs of community-based health work. For example, studies of geographical access in sub-Saharan Africa show that travel times to health facilities can increase substantially during the wet season, with implications for service planning, referral pathways, and outreach delivery (12,100,100,103). Similarly, climate and weather studies in East Africa have shown that hospital admissions and health service demand can vary with season, temperature, and rainfall, reinforcing the need for health systems to incorporate seasonal and meteorological information into planning (95,160). For CHW programmes, seasonality should therefore be treated as an operational planning issue, not only as background context. CHWs often work at the point where seasonal disease burden, road conditions, household livelihood pressures, and community demand converge. This means that seasonal

increases in workload should be matched with seasonal adjustments in supervision, transport support, supplies, communication, and expectations. Without this alignment, programmes may unintentionally intensify CHW strain during periods when CHWs are also managing farming demands, household food insecurity, travel barriers, or increased community health needs.

This has practical implications in terms of policy planning, monitoring and evaluation. Programme managers and planning units should identify the periods when CHWs are most strained, what supports are most needed during those periods, and how supervision, transportation, supplies, and campaign timing can be adapted across seasons. This could include developing seasonal CHW support calendars that anticipate rainy-season mobility constraints, dry-season heat stress, peak farming periods, seasonal malaria activities, harvest-related availability, and periods of increased household financial pressure. Such calendars could guide when to intensify supervision, pre-position supplies, provide transport or phone credit, schedule campaigns, adjust reporting expectations, and avoid overloading CHWs during peak livelihood periods.

When planning does not take into account seasonality, it may underestimate the pressures CHWs experience and miss opportunities to provide support when it is most needed. A more responsive approach would use routine monitoring data, CHW feedback, local agricultural calendars, climate information, and district-level disease trends to guide programme decisions. This would allow public health programmes to plan not only for what services need to be delivered, but also for when and under what conditions CHWs are expected to deliver them.

The fifth recommendation is that policy and practice should be context-specific rather than uniform. The district-level differences observed in this thesis demonstrate that CHWs do not experience the same seasonal pressures in the same way, even in districts that appear homogenous on the surface. Local programmatic conditions, infrastructure, relationships with the community, supervision practices, and environmental exposure may affect how CHWs experience their work. This means that national CHW policies should be flexible enough to allow for local adaptation. District and regional health directorates are especially important because they are closest to the settings where transport barriers, farming demands, community expectations, and seasonal workload changes are felt most directly.

A sixth recommendation is that climate-resilient primary health care should include the CHW workforce. The impact of climate change and seasonal extremes are often discussed in relation to disease burdens, infrastructure, and service delivery, but less attention is given to the frontline workers who are expected to respond to these pressures on a daily basis. Community health workers are exposed to heat, flooding, difficult terrain, and mobility constraints in a volunteer capacity while also managing their own household and livelihood demands. Although evidence specifically focused on CHWs and climate-related occupational risk remains limited, emerging CHW literature shows that extreme weather events can increase demands on CHWs for community surveillance, health education, referrals, psychosocial support, and continuity of care, while also creating barriers related to mobility, safety, communication, and access to supplies (170). Evidence from Ghana and other African settings also shows that extreme weather and seasonal flooding can disrupt access to health services and affect the delivery of care, particularly where communities face poor roads, flooding, long travel times, and limited transport options (100,108,171).

Practical protections such as transport support, heat protection, protective equipment, flexible scheduling, reliable communication, and timely supply distribution should therefore be considered part of climate-resilient community health programming. These supports are important because climate and seasonal pressures can affect not only whether communities receive services, but also whether CHWs can safely and consistently carry out their roles. For CHWs, heat, flooding, difficult terrain, and disrupted mobility may reduce work capacity, increase strain, delay household visits or referrals, and affect the continuity of community-based activities. Climate-resilient CHW programming should therefore extend beyond facility preparedness to include the practical conditions that allow CHWs to work safely during heat, rainfall, flooding, and other seasonal disruptions. This includes anticipating high-risk periods, adjusting expectations and campaign timing, pre-positioning supplies, strengthening communication, and providing transport or other supports when mobility is constrained.

Finally, the findings raise broader questions about the ethical and sustainable design of volunteer-based CHW arrangements within Ghana's health system. Ghana's policy architecture already positions CHWs and community health volunteers as part of CHPS implementation and community-based primary health care, working through relationships with CHOs, CHMCs, district health teams, and Ghana Health Service structures. However, the literature also shows

continuing variation in how CHWs are selected, supervised, supported, incentivized, and integrated into service delivery(1,11,42,172) . These findings therefore matter to Ghana Health Service because they point to an implementation and workforce sustainability issue, not only an individual well-being issue. If CHWs are expected to support household follow-up, campaigns, surveillance, referrals, health education, and community mobilization, then those expectations should be matched with clear role definitions, fair support, reliable tools, and practical protection during high-demand seasonal periods. CHW resilience and well-being are therefore part of the conditions that determine whether CHPS and broader community-based primary health care can be sustained in rural and seasonally dynamic settings. These findings are relevant for workforce development, research, and health system learning. Even where CHWs are volunteers or partially compensated, they function as part of the health workforce. Their well-being should therefore be considered a workforce sustainability issue, not only a community participation issue.

7.9 Implications for Future Research

Future research should build on this thesis in several ways. First, intervention studies are needed to test whether season-sensitive programme adaptations improve CHW well-being, motivation, retention, and performance. These could include season-sensitive transport or mobility support, predictable incentives, supportive supervision models, peer support groups, or seasonal workload planning, especially during periods when rainfall and road conditions make community access more difficult. Future studies should also define CHW performance carefully, including both activity-based indicators such as household visits, referrals, reporting, and campaign participation, and quality-oriented indicators such as timeliness, community trust, responsiveness, and sustainability without compromising CHW well-being.

Second, comparative studies are needed to examine how common the phenomena documented in this thesis are across Ghana and in other CHW settings. Rather than focusing only on whether the findings apply to other regions, future research should examine which experiences are shared across CHW programmes and which are shaped by local context. For example, issues such as limited incentives, supervision challenges, workload, community expectations, role ambiguity, livelihood pressures, and questions of recognition are widely reported in CHW literature. However, the drivers of these experiences may differ depending on national CHW policy,

remuneration models, degree of integration into the health system, rural or urban setting, gender norms, livelihood patterns, climate exposure, and the extent to which CHWs are linked to vertical programmes or broader primary health care systems. Comparative studies across Ghana and other African settings would therefore help determine not only whether CHW resilience and well-being are shaped by similar pressures, but also how those pressures operate differently across policy, programme, social, and environmental contexts.

Third, future research should continue to examine the relationship between resilience and well-being over time. This thesis showed that resilience is associated with well-being, but further work is needed to understand whether changes in specific resilience domains predict later well-being, burnout, retention, performance, or community trust.

Fourth, psychometric work may be useful to assess whether existing resilience and well-being instruments fully capture the domains that CHWs themselves consider important. The qualitative findings suggest that communal, spiritual, environmental, and financial dimensions may be especially important in this setting. Measurement tools that ignore these dimensions may miss important parts of CHW experience. The content of the two instruments overlapped with the qualitative findings to different degrees. The RRC-ARM captutred several domains that CHWs identified as important to resilience, including personal agency, family and peer support, community belonging, cultural identity, spirituality, and access to social and material resources. However, it did not directly capture all program specific and seasonal conditions that CHWs linked to resilience, including supervision, incentive reliability, recognition, transport constraints, workload, and changing environmental pressures. The WHO-5 primarily captures positive mood, calmness, vitality, rest, and interest in daily life and therefore represents only part of the broader conception of well-being described qualitatively, which also included financial, social, spiritual, and environmental dimensions. Consequently, the longitudinal findings should be interpreted as reflecting standardized measures of resilience resources and subjective well-being rather than the full locally defined constructs identified in the qualitative studies. This measurement gap may have attenuated or obscured seasonal and programme-related changes if important changes occurred in dimensions that were not directly represented in the scales. Future psychometric work should therefore examine the content validity of existing measures against CHWs' locally defined domains and assess whether incorporating programme-specific, financial, spiritual, and

environmental dimensions improves sensitivity to contextual and seasonal change while retaining comparability across settings.

Finally, future research should examine the ethics and sustainability of relying heavily on volunteer CHW labour. CHWs contribute to essential health system functions yet often do so under conditions of limited or uneven compensation and recognition. Research should therefore move beyond asking how to motivate CHWs and also ask what forms of labour recognition, protection, and support are required for community health systems to be fair and sustainable.

7.10 Conclusion

This thesis shows that resilience and well-being among CHWs in Ghana are dynamic, social-ecological, and seasonally shaped experiences. Through two qualitative studies and a longitudinal cohort study, it demonstrates that CHWs understand resilience and well-being in multidimensional and culturally grounded ways. Their experiences are shaped by interacting individual, relational, community, structural, and seasonal factors, and that they vary meaningfully across time and programme conditions.

The findings argue against narrow individual-level interpretations of resilience and well-being. Community health workers should not be expected to simply endure difficult conditions in the name of commitment or community service. It is important to consider the conditions that enable CHWs to cope, function, and remain well in order to support their resilience and well-being. Among these are reliable incentives, supportive supervision, adequate resources, community recognition, gender-sensitive support, and seasonally responsive programme design.

By linking meanings, contextual processes, and seasonal trajectories, this thesis contributes a coherent framework for understanding and supporting CHW resilience and well-being in Ghana. This contribution is particularly important in the context of climate change, because seasonal pressures are likely to become more variable, intense, and disruptive for rural communities and the community-based workers who serve them. The central message is clear: the resilience and well-being of CHWs are not produced by individual strength alone. Supporting CHWs therefore requires programmatic conditions that make sustained, safe, and dignified community health work possible. As climate-related pressures increasingly affect disease burden, mobility, livelihoods, household resources, and access to care, CHW programmes must be designed not

only to rely on CHWs during periods of stress, but also to protect and support them as part of climate-resilient primary health care.

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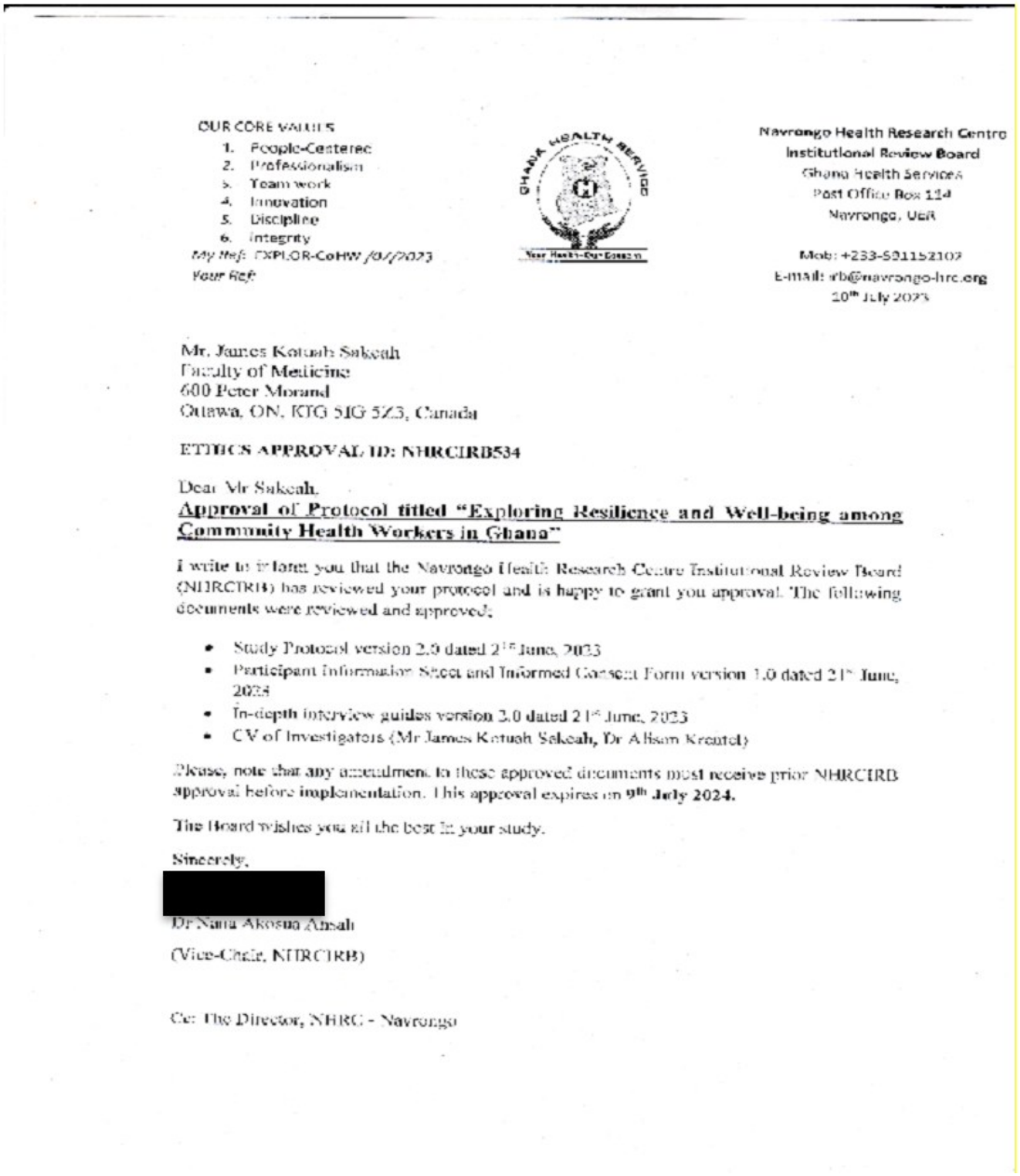
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APPENDICES

Appendix 1 Ethics Approvals and Permissions

Appendix 1.1 Ethics Approval for Qualitative Study-Navrongo Health Research Centre (Objectives 1 and 2)



OUR CORE VALUES
1. People-Centered
2. Professionalism
3. Teamwork
4. Innovation
5. Discipline
6. Integrity

My Ref: EXPLOR-CoHW /07/2023
Your Ref:

Navrongo Health Research Centre
Institutional Review Board
Ghana Health Service
Post Office Box 114
Navrongo, UER

Mob: +233-501152107
E-mail: irb@navrongo-hrc.org
20th July 2023

Mr. James Kotuah Sakeah
Faculty of Medicine
600 Peter Morand
Ottawa, ON, KTG 5IG 5Z3, Canada

ETHICS APPROVAL ID: NHRCIRB534

Dear Mr Sakeah,

Approval of Protocol titled "Exploring Resilience and Well-being among Community Health Workers in Ghana"

I write to inform you that the Navrongo Health Research Centre Institutional Review Board (NHRCIRB) has reviewed your protocol and is happy to grant you approval. The following documents were reviewed and approved:

- Study Protocol version 2.0 dated 21st June, 2023
- Participant Information Sheet and Informed Consent Form version 1.0 dated 21st June, 2023
- In-depth interview guides version 3.0 dated 21st June, 2023
- CV of Investigators (Mr James Kotuah Sakeah, Dr Alison Krentel)

Please, note that any amendment to these approved documents must receive prior NHRCIRB approval before implementation. This approval expires on **9th July 2024.**

The Board wishes you all the best in your study.

Sincerely,

[redacted]

Dr Nana Akosua Ansah
(Vice-Chair, NHRCIRB)

Cc: The Director, NHRC - Navrongo

Appendix 1.2 Ethics Approval for Qualitative Study-Univerdity of Ottawa (Objectives 1 and 2)

04/07/2023

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	H-06-23-9302
Titre du projet / Project Title	Exploring resilience and well-being among community health workers in Ghana
Type de projet / Project Type	Thèse de doctorat / Doctoral thesis
Statut du projet / Project Status	Approuvé / Approved
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	04/07/2023
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	03/07/2024

Équipe de recherche / Research Team

Chercheur / Researcher	Affiliation	Role
James SAKEAH	Département d'épidémiologie et santé publique / Department of Epidemiology and Public Health	Chercheur Principal / Principal Investigator
Alison KRENTEL	Département d'épidémiologie et santé publique / Department of Epidemiology and Public Health	Superviseur / Supervisor
Ian COLMAN	Département d'épidémiologie et santé publique / Department of Epidemiology and Public Health	Co-superviseur / Co-supervisor

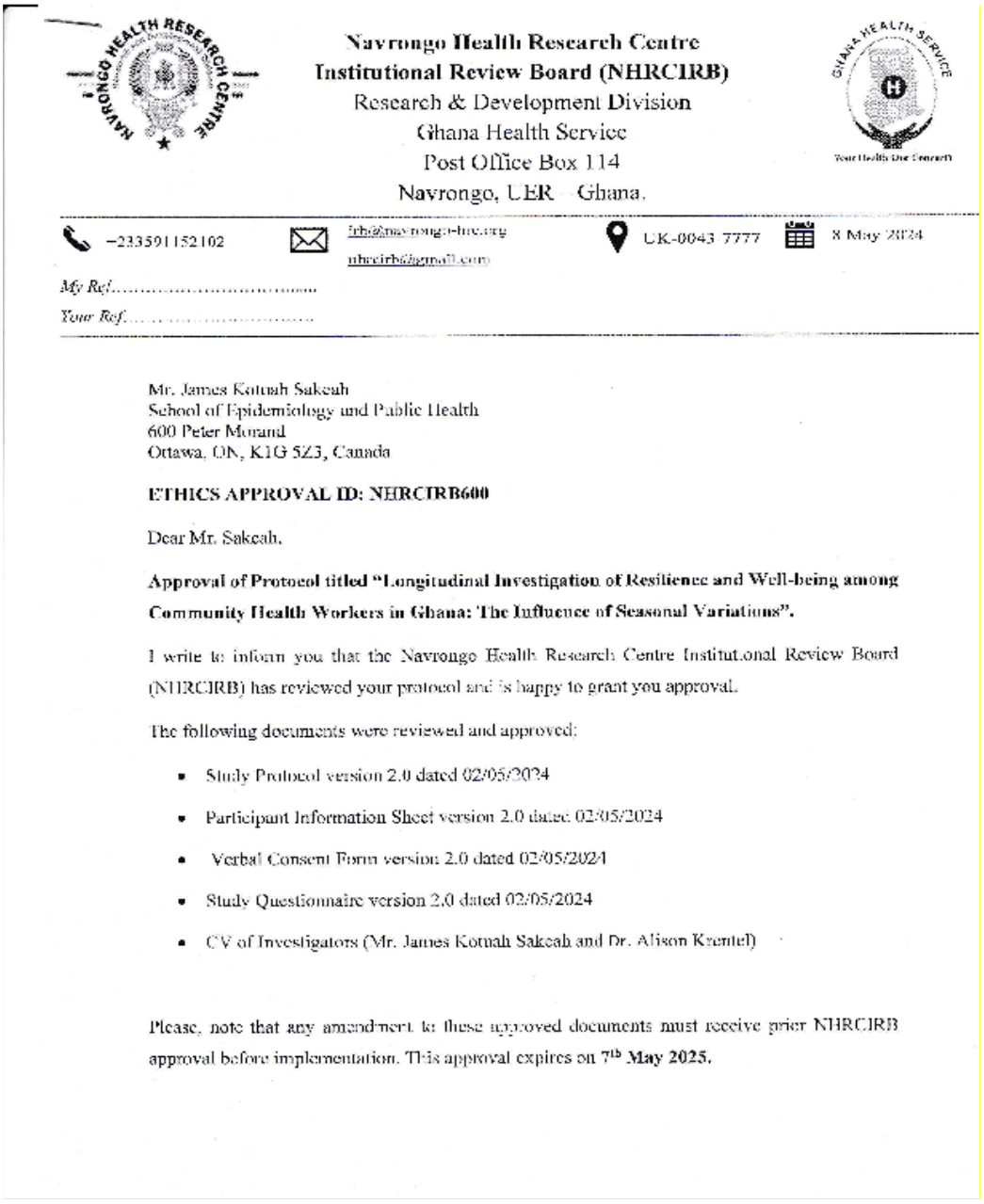
Conditions spéciales ou commentaires / Special conditions or comments

550, rue Cumberland, pièce 154
Ottawa (Ontario) K1N 6N5 Canada

550 Cumberland Street, Room 154
Ottawa, Ontario K1N 6N5 Canada

613-562-5387 • 613-562-5338 • ethique@uOttawa.ca / ethics@uOttawa.ca
www.recherche.uottawa.ca/deontologie | www.recherche.uottawa.ca/ethics

Appendix 1.3 Ethics Approval for Quantitative Study- Navrongo Health Research Centre (Objectives 3)



Navrongo Health Research Centre
Institutional Review Board (NHRCIRB)
Research & Development Division
Ghana Health Service
Post Office Box 114
Navrongo, UER Ghana.

+233591152102 | irb@navrongo-hrc.org | nhrcirb@gmail.com | UK-0043 7777 | 8 May 2024

My Ref.....
Your Ref.....

Mr. James Kotnah Sakeah
School of Epidemiology and Public Health
600 Peter Morand
Ottawa, ON, K1G 5Z3, Canada

ETHICS APPROVAL ID: NHRCIRB600

Dear Mr. Sakeah,

Approval of Protocol titled "Longitudinal Investigation of Resilience and Well-being among Community Health Workers in Ghana: The Influence of Seasonal Variations".

I write to inform you that the Navrongo Health Research Centre Institutional Review Board (NHRCIRB) has reviewed your protocol and is happy to grant you approval.

The following documents were reviewed and approved:

- Study Protocol version 2.0 dated 02/05/2024
- Participant Information Sheet version 2.0 dated 02/05/2024
- Verbal Consent Form version 2.0 dated 02/05/2024
- Study Questionnaire version 2.0 dated 02/05/2024
- CV of Investigators (Mr. James Kotnah Sakeah and Dr. Alison Krentel)

Please, note that any amendment to these approved documents must receive prior NHRCIRB approval before implementation. This approval expires on 7th **May 2025.**

Appendix 1.4 Ethics Approval for Quantitative Study- University of Ottawa (Objectives 3)

29/04/2024

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	H-04-24-10186
Titre du projet / Project Title	Longitudinal Investigation of Resilience and Well-being among Community Health Workers in Ghana: The Influence of Seasonal Variations
Type de projet / Project Type	Thèse de doctorat / Doctoral thesis
Statut du projet / Project Status	Approuvé / Approved
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	29/04/2024
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	28/04/2025

Équipe de recherche / Research Team

Chercheur / Researcher	Affiliation	Role
James SAKEAH	Département d'épidémiologie et santé publique / Department of Epidemiology and Public Health	Chercheur Principal / Principal Investigator
Alison KRENTEL	Département d'épidémiologie et santé publique / Department of Epidemiology and Public Health	Superviseur / Supervisor
Ian COLMAN	Département d'épidémiologie et santé publique / Department of Epidemiology and Public Health	Co-superviseur / Co-supervisor

Conditions spéciales ou commentaires / Special conditions or comments

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Appendix 1.5 Permissions letter from Regional of Ghana Health Service

OUR CORE VALUES
- People-Centered
- Professionalism
- Teamwork
- Innovation
- Discipline
- Integrity

GHANA HEALTH SERVICE
Your Health · Our Concern

Regional Health Directorate
Ghana Health Services
Private Mail Bag
Bolgatanga, UER
GHANA.
10th May, 2024
Tel: (03820) 22335
Fax: (03820) 24390
E-mail: uerrdhs@gmail.com

Ref: GHS/UER/ORD/RES/01056
My Ref. No:

UNIVERSITY OF OTTAWA,
FACULTY OF MEDICINE, SCHOOL
OF EDPIDEMIOLOGY AND PUBLIC HEALTH
600 PETER MORAND (101),
OTTAWA ON K1G 5Z3
CANADA.

Dear Mr. James Sakeah,

RE: LETTER OF SUPPORT FOR JAMES SAKEAH'S DISSERTATION RESEARCH.

The purpose of this letter is to inform you that, you have been permitted to conduct the research titled: *"**Longitudinal Investigation of Resilience and Well-Being among Community Health Workers in Ghana: The Influence of Seasonal Variations**"*.

By a copy of this letter, All Municipal and District Directors are entreated to support you make your study a successful one.

Counting on your usual cooperation

Thank You [redacted]

REGIONAL DIRECTOR OF HEALTH SERVICE
GHANA HEALTH SERVICE
UPPER EAST REGION
BOLGATANGA

DR.(Med.) SAMUEL K. BOAKYE-BOATENG.
REGIONAL DIRECTOR OF HEALTH SERVICES (UER).

Cc: The Regional Research Officer (UER).
All Municipal and District Directors.

Appendix 2 Data collection Documentation for Qualitative Studies (Obejectives 1 and 2)

Appendix 2.1 CHW Informed Consent Form (English)

Title of Study: Exploring Resilience and Well-being among Community Health Workers in Ghana

Funded By: International and Global Health Office, Faculty of Medicine, University of Ottawa

Version Date: June 28, 2023

Introduction:

My name is _____ and I am from_____. As part of the study "Exploring Resilience and Well-being among Community Health Workers in Ghana" we are asking some community health workers (CHWs) in your District to take part in a verbal discussion to understand more about how CHWs go about their work in the community and what challenges and opportunities they have. It is important that you understand why we are doing this study, so please read this (I will read) information sheet carefully. If you have any more questions, ask the interviewer and they will try to answer them for you.

We are interested in the experiences of CHWs as they go about their duties during public health campaigns and other duties related to the health of their communities. We want to understand their experiences of well-being as CHWs and the factors that play a role in how they recover from challenges or setbacks. This will help us better understand what kinds of interventions can be provided to support community health workers.

Your participation is completely voluntary, and you are under no obligation to participate. Whether or not you choose to participate, your status and position as a CHW will not be affected in any way. There are no expected risks or benefits to participation in this study

If you do choose to help with this study, we will only need about one hour of your time to ask you some questions and to discuss informally. At any time during this discussion, you are free to stop and withdraw from the study. You may refuse to answer any of the questions. You do not have to give the interviewer a reason.

The information that you provide during our discussion will be completely anonymous and we will not even write down your name or address. We will take some written notes during our discussion and if you agree, we will also audio record the interview using a digital recorder and later write down the full conversation. This will help us to capture what you are saying.

All written and digital files will be password-protected and stored by the main investigator on www.sync.com and a uOttawa R drive for ten years and your name and address will not be recorded. Other researchers may ask to look at our discussion together, and we may share it with

them, provided that they respect the same rules of confidentiality. Study files may be accessed by the institutional Review Board at the Navrongo Health Research Centre, Navrongo, Ghana and The Faculty of Medicine, University of Ottawa ethics board.

I have read the information sheet provided or it has been read to me concerning this study and I understand what will be required of me if I participate in this study, which will be a verbal interview and discussion.

Contact Information for Primary Investigator and Primary supervisor

If you have any further question about the study, feel free to contact the Principal Investigator: **James Kotuah Sakeah**: Tel: +1 **** Email: ******; **Dr Alison Krentel**: Tel: +1 ***** ext., **Email:** ******;

Contact for Additional Information (Ghana)

If you have any questions about your rights as a research participant in this study you may contact the Administrator of the Navrongo Health Research Centre Institutional Review Board P.O Box 114, Navrongo U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org.

Ethics review – University of Ottawa

This project has been reviewed and approved by the University of Ottawa Research Ethics Board as study #*****. If you have any ethical concerns about the study, or the way it is conducted, please contact the University of Ottawa office of Research Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1613-562-5387.

My questions regarding this study have been answered by: _____.

I understand that at any time I may withdraw from this study without giving a reason and without having any effect on my access to health care.

I voluntarily agree to take part in this study ___Yes ___No

I agree to be audio-recorded ___Yes ___No

Signature/Thumbprint (if no signature) of the respondent:

_____

Signature of the enumerator to indicate that the informed consent has been read and the information sheet given to the respondent:

_____

Appendix 2.2 CHW Informed Consent Form (Kasem)

Ottawa University kom
Sɛɛm Tɔnɔ

Kasem consent translation *(Sɛɛm tɔnɔ konto ye balo na Katere Yizura Tontoŋena tɔnɔ mo)*

Zamsem dem: "Ka lilage ka ni kolo na pae ba wae noŋe ba chana yam wone de ba wopolo katera Yizura Tontoŋena wone Ghana wone"

Boboa:

Amo yire mo _____ ye' amo ye skuuli bu mo "University of Ottawa" ne na wo Canada ne to. "Ka lilage ka ni kolo na pae ba wae noŋe ba chana yam wone de ba wopolo katera Yizura Tontoŋena wone Ghana wone" zamsem dem ŋwaane, de wora de bwe katera yizura tontoŋena abam katere dem wone se ba toge ba ke laara se de nii ko kuri ba boboŋa na ye tei de ba yenno wontelo na pa se ba wora dane a na wora a toŋa ba totoŋa yam mo ye CHW to. Ko fii mo se'n ni ko kuri kolo ŋwaane de na wora de ke zamsem dento, konto ŋwaane jan,jan zuri yira'n ga (amo wo ga) labaare tɔnɔ konto. Mo na jege bwea yalo mama, bwe balo na ke bwea yanto se ba wo kwane ba lere bwea yam ba pa mo.

Bɛ ŋwaane mo zasem dento wora de ke?

Debam laga CHWs bam yenno ba na jega ba mae ba ke ba totoŋa yam pone yiga yizura totoŋa maŋa ne dedane totoŋa yadonna na jege woŋo ya ke dedane ba katera yam yizura to. De laga se de nii ko kuri kolo banto na ye CHWs ye ba nɛ pa se ko pae ba wopolo to dedane wontelo de na toge te pae se ba noŋe chana wone naa kolo na chu pa se ko dane to. Konto wo wole debam se de ni ko kuri lanyirane wola yalo di ba na wo wane pa ese ko zem katera yizura totoŋena.

Ko ke tɛi tɛi mo?

Mo na sɛ se'n toge'n ke zamsem dento, de wo jem dedane laara wone na wo yi nene mita finna yanu –mita fiseredo. De wo pupune wonno de laara yam maŋa ye mo na sɛ, debam ta wo mae woŋo kom bwe wo "digital recorder" to de kwe laara yam ye ko kwoga sene de pupune laara yam mama de tiŋe. Konto wo wole debam se de jaa kolo mama mo na ŋwɔɔne to se de wane de pupune ko de tiŋe ko kwoga sene.

Bɛ nyɔɔre naa fune mo toge ko wo zamsem dento wone?

Mo na toge' n ke zamsem dento ba ja nyɔɔre ko ba mo tete tene. Se kolo ba na nɛa zamsem dento wone to wo wole debam se de ni ko kuri de na wo ke wola yalo se ya zem katera yizura totoŋena wopolo ye se ba totoŋa taa lama.

Fune delo na wora de pae mo ka toge ka ke zamsem dento ba daga. Maŋa kam mo na kwe 'n ke laara yam to ye kolo mo ya wo ke se ko pae mo sabu naa n' tam wo 'n yudwonna wone to mo

mo ba nɛ. Mo na toge' n ke zamsem dem to ye mo tete bubuŋa mo, konto to, ko dae fifio se'n lere bwea yalo mo na ba laga to.

Wo mo wo wane o nɛ amo labaare dem?

Labaare dem mo na pɛ de laara yam maŋa ne to baa taa jege yire fase ye de maŋe de ba pupune mo yire de tiŋe naa mo na zure mɛ to. Ba wo chi tɔnno mama ba na pupune de telo ba bwe wo "digital'les de kem dedoŋe ba na bwe wo "password" ye zamsem dem yuu tu na wo www.sync.com wo tiŋe ko bena fuga mo ye ba ba pupune mo yire de mo na zure mɛ to. Lilagem tina badwonna wae ba bwe se gware dane de ni de laara yam, ye de wae de pae ba, nene ba na sɛ wadɛ sem konto na wo ko ba noŋe poone to. Lilagem tina na wo Navɔro Yizura Lilagem Jega kam Ghana ne to dedane University of Ottawa, naga kalo ba bwe wo "Faculty of Medicine" deba tigisina yalo na ni lilagem totoŋa to.

Se' amo na jege bwea zamsem dem ŋwaane?

Maŋa kalo mama wone laara yanto kwoga mo na jege bwea ko maŋe de on ethical issues naa mo laga se'n ŋwɔɔne de nɔɔno na toge o wora zamsem dem to ne, jan jan ye kɔɔre fune se'n nɛ.

1. **Dr. Patrick Ansah** (*****) na wo Navɔro Yizura Lilagem Jega kam ne, P. O. Box 114, Navɔro ne, Upper East Region naa **James Sakeah** (Email: *****; Cell: +1*****).
2. Mo na jege woŋo mo se'n ta k maŋe de mo chiga choŋa zamsem dem ŋwaane, naa ba na ke de tei tei to, jan jan nɛ Navɔro Yizura Lilagem Jega kam tigisem delo na ni lilagem totoŋa yam se danem ye taa wora ya wone pa se ba bwe wo "Institutional Review Board" to karichi on, P.O Box 114, Navɔro ne U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org naa University of Ottawa office of Research Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1613-562-5387.

SƐ SE N TOGE N LILAGEM ZAMSEM

LILAGEM NƆƆNO SƐƐM TƆNƆ

Zamsem dem yire: **Ka lilage ka ni kolo na pae ba wae noŋe ba chana yam wone de ba wopolo katera Yizura Tontoŋena wone Ghana wone**

Amo gaga labaare dem ba na pɛ ne to, naa ba gaga de ba bere ne. Amo nɛ choŋa se'a bwe bwea de ŋwaane ye bwea yalo amo na bwe to ba lere ya pa se amo jege wopolo. Amo mo tete mo sɛ se'a taa ye lilagem nɔɔno zamsem dento wone.

Yire: _____

Wolo na o toge'o ke to jeŋa titigem/ jeŋa ziim (ne jeŋa ziim na tera):

_____

Dɛ dem: _____

Dɛ/chana/bem

Wolo na bwe bwea yam to:

“Amo sɛ wo amo ŋwɔɔne a bere konto tu (tina) baŋa ne zamsem dem na nyi tei dedane de kolo ŋwaane zamsem dem wora de ke, nyɔɔre de cham delo na wae ya wora ko maŋe de zamsem dento kem. Amo lere bwea yalo mama ba na bwe to ye’ a nɛ jeŋa ziim dem baŋa ne dɛ delo ba na bere tiga kuri ne to”

Yire: _____

Jeŋa ziim: _____

Dɛ dem: _____

Dɛ/chana/bem

Appendix 2.3 CHW Informed Consent Form (Nankani)

University of Ottawa
Sakere Gɔnŋɔ

Nankani consent translation *(Gɔnŋɔ wa dela sakere gɔnŋɔ bɔra Yizuo Ima'assum Tuntuniba sosega)*

Zamsegɔ la yuurɛ: Ka viisi bisɛ sem en base te ba ta'am yɛsera danŋɔ puan lae pupeilum Yizuo Ima'assum Tuntuniba puan Ghana puan"

Pɔsega puan:

Mam yuure dela _____ de mam dela sikuuli bia bɔna "University of Ottawa" en boe Canada puan. "Ka viise bisɛ bisɛ sem en base te ba ta'am yɛsera danŋɔ puan lae pupeilum Yizuo Ima'assum Tuntuniba puan Ghana puan" lan po bɔna zamsegɔ puan la inŋa, te bo bi yeta yizuo ima'assum tuntuniba yama solem la puan te ba poe inŋɛ nore puan sosega te te bɔkɛ ba putirɛ puan lae ba milim puan sem en guri ba sonŋa sonŋa dee te ya ita ba tuma fom en de yizuo ima'assum tuntuna la. La dela pakerɛ fo te fo bɔkɛ sem inŋa te te bɔna bi ita zamsegɔ wa, bala inŋa la, zam, zam maa inŋa kaalem (mam kaalem ya) labaare gɔŋɔ wa. Fo san tara sokere woo, soke sɛba en iti sosega wa de ba inŋe paŋa de lere sokere duma wa bɔ fo.

Bem enŋa te zamsegɔ wa yete de enŋɛ?

Te mam tare putirɛ CHWs duma milum puan bama en bo bi tuna ba yinŋa ima'assum tuma sanŋa lae tuma aseya en tare sɛla ita lae ba yizuto la ima'assum. Te mam bote te te bɔkɛ bama en mii sem te la dena pupeilum bama en de CHWs duma lae yelseya en poe tara sɛla ita lae bama en iti sem yɛsera danŋɔ bei yelseya en guti ba nenŋa la. Ɔwana wan sunŋɛ te te bɔkɛ sonŋa sonŋa tum seya taba te ba wan ta'am bɔ te la sunŋɛ yizuo ima'assum tuntuniba.

Itigo la dela bem?

Fo san sakɛ te fo poe bɔna zamsegɔ wa puan, te wan enŋe sosega en wan yue paa miti pinaase lae anum- miti piyobe. Te wan gulsɛ yɛla binŋɛ te sosega la sanŋa puan de fo san sakɛ, te wan dikɛ sɛla te ba wira te "digital recorder" dikɛ sosega la de gulsɛ sosega wula binŋɛ. Ɔwana wan sunŋɛ te mam te tara sem te fo yeta la te te ta'am gulsɛ ko pore enŋa.

Bem sunŋrɛ bei pɔsese en lagem bɔna zamsegɔ wa puan?

Fo san poe paasɛ zamsegɔ wa puan kan sunŋɛ fo tintɔ. Nabala mɛ, sem te ba viise nyɛ zamsegɔ la puan wan sunŋɛ to te te bɔkɛ sem te ba wan ta'am enŋɛ tuma sunŋɛ yizuto ima'assum tuntuniba pupeilem puan lae de ba tuma ana sonŋa.

Pɔsese en boe fo san poe enŋɛ dela pika pika. Sanŋa la te fo dikɛ inŋɛ sosega la dela te fo ta'am inŋɛ nyɛ lagifɔ bei fo poe bɔna lae fo taba te fo ka nyɛ. Fo san poe pa'asɛ dela fo menŋa putirɛ, bala enŋa la, peregede ka boe te fo lerege sokere yɛla wula te fo ka bota.

Ane'n wan ta'am nyɛ mam labaare la?

Labaare la te fo bɔ la sosega la sanŋa puan na yuurɛ kan makɛ bɔna bi dee te pum kan gulsɛ fo yuure binŋe bei fom en kiiri zia la. Ba wan guu gɔnno wula te ba gulsɛ lae seto te ba wiira te "digital files" la lae sɛla te ba wiira te "password" la dee te zamsegɔ zuo dana en boe www.sync.com puan na wan binŋe to yuma de kan gulsɛ fo yuurɛ bei fom en kiiri zia la. Viisiriba bataba ta'am yele te ba te lagem taba bisɛ te mam sosega la, dee te ta'am dike ko puan bɔ ba, wui ba san sakɛ bɔ tuba ayii kan wum wada la bala. Viisiriba en boe Navɔrenŋɔ Immassum Viisigo Tuma Zia la, Navɔrenŋɔ, Ghana la, lae welinŋo sɛka te ba wiira te "Faculty of Medicine, University of Ottawa" lae ba tigisito seto 'n bisiere viisigɔ tuma puan te ba wiira "ethics boards" la ta'am nyɛ.

De dee mam san tara sokere zamsegɔ la enŋa?

Sanŋa woo puan sosega wa porem fo san tara sokere yɛsera ethical issues bei bota te fo tɔgɛ lae nɛɛra en lagem bɔna zamsegɔ wa puan, zam, zamda zoe dabem la fo nyɛ.

3. **Dr. Patrick Ansah** (****) en boe Navɔrenŋɔ Immaassum Viisigɔ Zia, P. O. Box 114, Navɔrenŋɔ, Upper East Region or **James Sakeah** (Email: ***; Cell:*** ****).
4. Fo san tara sɛla zamsegɔ enŋa te la kana sonŋa te fo yele, bei ba'n enŋɛ de sem na, zam, zam nyɛ kariki, Navɔrenŋɔ Immassum Viisigɔ Tuma Zia, tigisigu sɛka en bisiere te danŋɔ dan kan bɔ viisigɔ tuma puan te ba wiira ba te "Institutional Review Board P.O Box 114, Navɔrenŋɔ U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org bei University of Ottawa office en bisere Viisigɔ Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1613-562-5387.

SAKERƐ TE FO POE ENƊƐ VIISIGƆ ZAMSEGƆ

VIISIGƆ NƐƐRA LA SAKERƐ GƆNƊƆ

Study Title: **Ka viisi bisɛ sem en base te ba ta'am yɛsera danŋɔ puan lae pupeilum Yizuo Ima'assum Tuntuniba puan Ghana puan**

Mam kaalem labaare la te ba bɔ ma la, bei ba kaalem de bɔ ma. Mam nyɛ sore te'n soke sokere yɛsera zamsegɔ la puan dee ba lerege sokere woo te mam soke la te mam tara pupeilem. Mam menŋa en sakɛ te'n poe bɔna zamsegɔ wa puan.

Yuurɛ: _____

Mena en poe enŋɛ la nuusi tigitigo/nudiire (nuusi tigitigo san kana bɔna):

_____

Dabserɛ la: _____

Darɛ/ŋwariga/yuune

Mena en sokere yɛla la:

“Mam sakɛ te mam garisɛ pa’alɛ nɛɛra (riba) zamsegɔ la en ane sem lae de vɔɔrɛ, sunŋre seto lae pɔsese en ta’am wam yɛsera fo poe bɔna zamsegɔ wa puan. Mam lerege sokere woo te ba soke dee ze’ele bisɛ nuusi titigito la en boe sazum na bɔna dabserɛ la te ba pa’alɛ tinŋa norem la”

Yuurɛ: _____

Nuusi tigitigo: _____

Dabserɛ la: _____

Daare la /ŋwariga/yuune

Appendix 2.4 Stakeholder Informed Consent Form (English)

Title of Study: Exploring Resilience and Well-being among Community Health Workers in Ghana

Funded By: International and Global Health Office, Faculty of Medicine, University of Ottawa

Version Date: June 28, 2023

Introduction:

My name is _____ and I am from_____. As part of the study "Exploring Resilience and Well-being among Community Health Workers in Ghana" we are asking some stakeholders who are involved with the work of community health workers (CHWs) in your District to take part in a verbal discussion to understand more about how CHWs go about their work in the community and what challenges and opportunities they have. It is important that you understand why we are doing this study, so please read this information sheet carefully. If you have any more questions, ask the interviewer and they will try to answer them for you.

We would like to talk to stakeholders in your district who are familiar with the work of CHWs about the experiences of CHWs as they go about their duties during public health campaigns and other duties related to the health of their communities. We want to understand their experiences of well-being as CHWs and the factors that play a role in how they recover from challenges or setbacks. This will help us better understand what kinds of interventions can be provided to support community health workers.

Your participation is completely voluntary, and you are under no obligation to participate. There are no expected risks or benefits to participation in this study

If you do choose to help with this study, we will only need about one hour of your time to ask you some questions and to discuss informally. At any time during this discussion, you are free to stop and withdraw from the study. You may refuse to answer any of the questions. You do not have to give the interviewer a reason.

The information that you provide during our discussion will be completely anonymous and we will not even write down your name or address. We will take some written notes during our

discussion and if you agree, we will also audio record the interview using a digital recorder and later write down the full conversation. This will help us to capture what you are saying.

All written and digital files will be password-protected and stored by the main investigator on www.sync.com and uOttawa R drive for ten years and your name and address will not be recorded. Other researchers may ask to look at our discussion together, and we may share it with them, provided that they respect the same rules of confidentiality. Study files may be accessed by the institutional Review Board at the Navrongo Health Research Centre, Navrongo, Ghana and The Faculty of Medicine, University of Ottawa ethics board.

I have read the information sheet provided or it has been read to me concerning this study and I understand what will be required of me if I participate in this study, which will be a verbal interview and discussion.

Contact Information for Principal Investigator and Primary supervisor

If you have any further question about the study feel free to contact the Principal Investigator: **James Kotuah Sakeah**: Tel: +1 *****, Email: ***; Dr Alison Krentel: Tel: +1*** **** ext. ***, Email:*** *****;

Contact for Additional Information (Ghana)

If you have any questions about your rights as a research participant in this study you may contact the Administrator of the Navrongo Health Research Centre Institutional Review Board P.O Box 114, Navrongo U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org.

Ethics review – University of Ottawa

This project has been reviewed and approved by the University of Ottawa Research Ethics Board as study #*****. If you have any ethical concerns about the study, or the way it is conducted, please contact the University of Ottawa office of Research Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1613-562-5387.

My questions regarding this study have been answered by: _____

I understand that at any time I may withdraw from this study without giving a reason and without having any effect on my access to health care.

I voluntarily agree to take part in this study ___Yes ___No

I agree to be audio-recorded ___Yes ___No

Signature/Thumbprint (if no signature) of the respondent:

_____

Signature of the enumerator to indicate that the informed consent has been read and the information sheet given to the respondent:

_____

Appendix 2.5 Stakeholder Informed Consent Form (Kasem)

University of Ottawa
Sɛɛm Tɔnɔ

Kasem consent translation (Sɛɛm tɔnɔ konto ye ko pa balo na toge ba jege woŋo yizura totoŋa wone to tɔnɔ mo)

Zamsem dem: "Ka lilage ka ni kolo na pae ba wae noŋe ba chana yam wone de ba wopolo katera Yizura Tontoŋena wone Ghana wone"

Boboa:

Amo yire mo _____ ye' amo ye skuuli bu mo "University of Ottawa" ne na wo Canada ne to. "Ka lilage ka ni kolo na pae ba wae noŋe ba chana yam wone de ba wopolo katera Yizura Tontoŋena wone Ghana wone" zamsem dem ŋwaane, de wora de bwoe nɔɔna de tigisena yalo na toge ba wora ba ke katera yizura totoŋa abam katere dem wone se ba toge ke laara se de nii tontoŋena abam katere dem wone se ba toge ba ke laara se de nii ko kuri lanyirane CHWs na ke tei ba toŋa katere dem wone dedane chana yɔ mo de hwe sɔ mo ba jega. Ko fii mo se'n ni ko kuri kolo ŋwaane de na wora de ke zamsem dento, konto ŋwaane jan,jan zuri yira'n ga (amo wo ga) labaare tɔnɔ konto. Mo na jege bwea yalo mama, bwe balo na ke bwea yanto se ba wo kwane ba lere bwea yam ba pa mo.

Bɛ ŋwaane mo zasem dento wora de ke?

De wo taa laga se de ŋwɔɔne de nɔɔna balo tigisena yalo mo katere dem wone balo na yei CHWs totoŋa ko maŋe de CHWs yenno na ye tei ba na wora ba ke ba totoŋa poone yiga yizura totoŋa maŋa ne dedane totoŋa yadonna na jege woŋo ya ke dedane ba katera yam yizura to. We laga se de nii ko kuri kolo banto na ye CHWs ye ba nɛ pa se ko pae ba wopolo to dedane wontelo de na toge te pae se ba noŋe chana wone wone naa kolo na chu pa se ko dane to. Konto wo wole debam se de ni ko kuri lanyirane wola yalo di ba na wo wane pa ese ko zem katera yizura totoŋena.

Ko ke tɛi mo?

Mo na sɛ se'n toge'n ke zamsem dento, de wo jem dednae laara wone na wo yi nene mita finna yanu –mita fiseredo. De wo pupune wonno de laara yam maŋa ye mo na sɛ, debam ta wo mae woŋo kom bwe wo "digital recorder" to de kwe laara yam ye ko kwoga sene de pupune laara yam mama de tiŋe. Konto wo wole debam se de jaa kolo mama mo na ŋwɔɔne to se de wane de pupune ko de tiŋe ko kwoga sene.

Bɛ nyɔɔre naa fune mo toge ko wo zamsem dento wone?

Mo na toge' n ke zamsem dento ba pa mo nyɔɔre mo tete. Se kolo ba na nɛa zamsem dento wone to wo wole debam se de ni ko kuri de na wo ke wola yalo se ya zem katera yizura totoŋena wopolo ye se ba totoŋa taa lama.

Fune delo na wora de pae mo ka toge ka ke zamsem dento ba daga. Maŋa kam mo na kwe ‘n ke laara yam to ye kolo mo ya wo ke se ko pae mo sabu naa n’ tam wo ‘n yudwonna wone to mo mo ba nɛ. Mo na toge’ n ke zamsem dem to ye mo tete boboŋa mo, konto to, ko dae fifio se’n lere bwea yalo mo na ba laga to.

Wo mo wo wane o nɛ amo labaare dem?

Labaare dem mo na pɛ de laara yam maŋa ne to baa taa jege yire fase ye de maŋe de ba pupune mo yire de tiŋe naa mo na zure mɛ to. Ba wo chi tɔnno mama ba na pupune de telo ba bwe wo “digital’les de kem dedoŋe ba na bwe wo “password” ye zamsem dem yuu tu na wo www.sync.com wo tiŋe ko bena fuga mo ye ba ba pupune mo yire de mo na zure mɛ to. Lilagem tina badwonna wae ba bwe se gware dane de ni de laara yam, ye de wae de pae ba, nene ba na sɛ wadɛ sem konto na wo ko ba noŋe poone to. Lilagem tina na wo Navɔro Yizura Lilagem Jega kam Ghana ne to dedane University of Ottawa, naga kalo ba bwe wo “Faculty of Medicine” de ba tigisina yalo na ni lilagem totoŋa to.

Se’ amo na jege bwea zamsem dem ŋwaane?

Maŋa kalo mama wone laara yanto kwoga mo na jege bwea ko maŋe de on ethical issues naa mo laga se’n ŋwɔɔne de nɔɔno na toge o wora zamsem dem to ne, jan jan ye kɔɔre fune se’n nɛ.

5. **Dr. Patrick Ansah** (******) na wo Navɔro Yizura Lilagem Jega kam ne, P. O. Box 114, Navɔro ne, Upper East Region naa **James Sakeah** (Email: ******; Cell: +1*****).
6. Mo na jege woŋo mo se’n ta k maŋe de mo chiga choŋa zamsem dem ŋwaane, naa de ke tei tei to, jan jan nɛ Navɔro Yizura Lilagem Jega kam tigisem delo na ni lilagem totoŋa yam se danem ye taa wora ya wone pa se ba bwe wo “Institutional Review Board” to karichi on, P.O Box 114, Navɔro ne U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org naa University of Ottawa office of Research Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1613-562-5387.

SƐ SE N TOGE N LILAGEM ZAMSEM

LILAGEM NƆƆNO SƐƐM TƆNƆ

Zamsem dem yire: **Ka lilage ka ni kolo na pae ba wae noŋe ba chana yam wone de ba wopolo katera Yizura Tontoŋena wone Ghana wone**

Amo gaga labaare dem ba na pɛ ne to, naa ba gaga de ba bere ne. Amo nɛ choŋa se’a bwe bwea de ŋwaane ye bwea yalo amo na bwe to ba lere ya pa se amo jege wopolo. Amo mo tete mo sɛ se’a taa ye lilagem nɔɔno zamsem dento wone.

Yire: _____

Wolo na laga o toge o ke to jeŋa titigem/ jeŋa ziim (ne jeŋa ziim na tera):

_____

Dɛ dem: _____

Dɛ/chana/bem

Interviewer:

“Amo sɛ wo amo ŋwɔɔne a bere konto tu (tina) baŋa ne zamsem dem na nyi tei dedane de kolo ŋwaane zamsem dem wora de ke, nyɔɔre de cham delo na wae ya wora ko maŋe de zamsem dento kem. Amo lere bwea yalo mama ba na bwe to ye’ a nɛ jeŋa ziim dem baŋa ne dɛ delo ba na bere tiga kuri ne to”

Yire: _____

Jeŋa ziim: _____

Dɛ dem: _____

Dɛ/chana/bem

Appendix 2.6 Stakeholder Informed Consent Form (Nankani)

University of Ottawa
Consent Form

Nankani consent translation (Gɔnŋɔ wa dela sakere gɔnŋɔ bɔra nɛɛriba sɛba en tare putirɛ ima'assum tuma pu sosega)

Zamsegɔ la yuurɛ: Ka viisi bisɛ sem en base te ba ta'am yɛsera danŋɔ puan lae pupeilum Yizuo Ima'assum Tuntuniba puan Ghana puan"

Pɔsega puan:

Mam yuure dela _____ de mam dela sikuuli bia bɔna "University of Ottawa" en boe Canada puan. "Ka viisi bisɛ sem en base te ba ta'am yɛsera danŋɔ puan lae pupeilum Yizuo Ima'assum Tuntuniba puan Ghana puan" te bo bi yeta nɛɛriba sɛba en tare putirɛ ima'assum tuma la puan dee lagem pa'asɛ yizuo ima'assum tuntuniba Ghana puan (CHWs) yama solem na puan te ba poe inŋɛ sosega te ba bɔkɛ sonŋa sonŋa (CHWs) en iti sem tuna ba tuma yizuo la lae danŋɔ lae sanŋa te ba tara. La dela pakerɛ fo te fo bɔkɛ sem inŋa te te bɔna bi ita zamsegɔ wa, bala inŋa la, zam, zam maa inŋa kaalem labaare gɔŋɔ wa. Fo san tara sokere woo, soke sɛba en iti sosega wa de ba inŋe paŋa de lere sokere duma wa bɔ fo.

Bem enŋa te zamsegɔ wa yete de enŋɛ?

Te ma wan bota te te tɔgɛ lae nɛɛriba sɛba putirɛ en boe ima'assum tuma la puan mina CHWs duma tuma puan yama solem yɛsera CHWs duma milum en sem bama en tune ba tuma yinŋa ima'assum tuma sanŋa puan lae tuma aseya en tare sɛla ita lae ba yizuto la. Te mam bote te te bɔkɛ bama en mii sem well-being bama en de CHWs duma lae yelseya en poe tara sɛla ita lae bama en iti sem yɛsera danŋɔ bei yelseya en guti ba nenŋa la. Ɔwana wan sunŋɛ te te bɔkɛ sonŋa sonŋa tum seya taba te ba wan ta'am bɔ te la sunŋɛ yizuo ima'assum tuntuniba.

Itigo la dela bem?

Fo san sakɛ te fo poe bɔna zamsegɔ wa puan, te wan enŋe sosega en wan yue paa miti pinaase lae anum- miti piyobe. Te wan gulsɛ yɛla binŋɛ te sosega la sanŋa puan de fo san sakɛ, te wan dikɛ sɛla te ba wira te "digital recorder" dikɛ sosega la de gulsɛ sosega wula binŋɛ. Ɔwana wan sunŋɛ te mam te tara sem te fo yeta la te te ta'am gulsɛ ko pore enŋa.

Bem sunŋrɛ bei pɔsese en lagem bɔna zamsegɔ wa puan?

Fo san poe paasɛ zamsegɔ wa puan kan sunŋɛ fo tintɔ. Nabala mɛ, sem te ba viise nyɛ zamsegɔ la puan wan sunŋɛ to te te bɔkɛ sem te ba wan ta'am enŋɛ tuma sunŋɛ yizuto immaassum tuntuniba pupeilem puan lae de ba tuma ana sonŋa.

Pɔsese en boe fo san poe enŋɛ dela pika pika. Sanŋa la te fo dikɛ inŋɛ sosega la dela te fo ta'am inŋɛ nyɛ lagifɔ bei fo poe bɔna lae fo taba te fo ka nyɛ. Fo san poe pa'asɛ dela fo menŋa putirɛ, bala enŋa la, peregede ka boe te fo lerege sokere yɛla wula te fo ka bota.

Ane'n wan ta'am nyɛ mam labaare la?

Labaare la te fo bɔ la sosega la sanŋa puan na yuurɛ kan makɛ bɔna bi dee te pum kan gulsɛ fo yuure binŋe bei fom en kiiri zia la. Ba wan guu gɔnno wula te ba gulsɛ lae seto te ba wiira te "digital files" la lae sɛla te ba wiira te "password" la dee te zamsegɔ zuo dana en boe www.sync.com puan na wan binŋe to yuma de kan gulsɛ fo yuurɛ bei fom en kiiri zia la. Viisiriba bataba ta'am yele te ba te lagem taba bisɛ te mam sosega la, dee te ta'am dike ko puan bɔ ba, wui ba san sakɛ bɔ tuba ayii kan wum wada la bala. Viisiriba en boe Navɔrenŋɔ Immassum Viisigo Tuma Zia la, Navɔrenŋɔ, Ghana la, lae welinŋo sɛka te ba wiira te "Faculty of Medicine, University of Ottawa" lae ba tigisito seto 'n bisiere viisigɔ tuma puan te ba wiira "ethics boards" la ta'am nyɛ.

De dee mam san tara sokere zamsegɔ la enŋa?

Sanŋa woo puan sosega wa porem fo san tara sokere yɛsera ethical issues bei bota te fo tɔgɛ lae nɛɛra en lagem bɔna zamsegɔ wa puan, zam, zamda zoe dabem la fo nyɛ.

7. **Dr. Patrick Ansah** (*******) en boe Navɔrenŋɔ Immaassum Viisigɔ Zia, P. O. Box 114, Navɔrenŋɔ, Upper East Region or **James Sakeah** (Email: *****; Cell: +1*****).
8. Fo san tara sɛla zamsegɔ enŋa te la kana sonŋa te fo yele, bei ba'n enŋɛ de sem na, zam, zam nyɛ kariki, Navɔrenŋɔ Immassum Viisigɔ Tuma Zia, tigisigu sɛka en bisiere te danŋɔ dan kan bɔ viisigɔ tuma puan te ba wiira ba te "Institutional Review Board P.O Box 114, Navɔrenŋɔ U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org bei University of Ottawa office en bisere Viisigɔ Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1613-562-5387.

SAKERƐ TE FO POE ENƊƐ VIISIGƆ ZAMSEGƆ

VIISIGƆ NƐƐRA LA SAKERƐ GƆNƊƆ

zamsegɔ la yuurɛ: **Ka viisi bisɛ sem en base te ba ta'am yɛsera danŋɔ puan lae pupeilum Yizuo Ima'assum Tuntuniba puan Ghana puan**

Mam kaalem labaare la te ba bɔ ma la, bei ba kaalem de bɔ ma. Mam nyɛ sore te'n soke sokere yɛsera zamsegɔ la puan dee ba lerege sokere woo te mam soke la te mam tara pupeilem. Mam menŋa en sakɛ te'n poe bɔna zamsegɔ wa puan.

Yuurɛ: _____

Mena en poe enŋɛ la nuusi tigitigo/nudiire (nuusi tigitigo san ka bɔna):

_____

Dabserɛ la: _____

Darɛ/ŋwariga/yuune

Mena en sokere yɛla la:

“Mam sakɛ te mam garisɛ pa’alɛ nɛɛra (riba) zamsegɔ la en ane sem lae de vɔɔrɛ, sunŋre seto lae pɔsese en ta’am wam yɛsera fo poe bɔna zamsegɔ wa puan. Mam lerege sokere woo te ba soke dee ze’ele bisɛ nuusi titigito la en boe sazum na bɔna dabserɛ la te ba pa’alɛ tinŋa norem la”

Yuurɛ: _____

Nuusi tigitigo: _____

Dabserɛ la: _____

Daare la /ŋwariga/yuune

Appendix 2.7 CHW Interview Guide

Supplementary Material 3

IDNO: ||_||_|_|_|_|_|_|_|_||_|_|

Date of interview: ___/___/___

Clinic/CHPS Zone:

Address:

Category of Respondent:

Gender/Sex:

Interviewer:

Duration of Interview:

Hello,

Thank you for agreeing to participate in this interview. This study is being conducted through the University of Ottawa's School of Epidemiology and Public Health. We are interested in knowing more about you and your experience as a community health worker (volunteer, CDD, yezura zenu) from your perspective. I will be your interviewer today and will be asking you some questions.

Please take time to carefully read and sign the consent forms. If you have any questions or concerns please let me know. Let's get started. If the person cannot read or write, you need to read to them so they thumbprint.

Interview Questions:

I'd like to start our conversation today by hearing a little about you and your work as CHW.

1. It's nice to meet you, thank you for taking the time today. As we get started, tell me a little about yourself. PROBE family, job, birthplace, hobbies, or interests

2. Tell me about how you started working as a community health worker (volunteer)? PROBE: how you were selected; how long you've been doing this; what motivated you to become a CHW?

3. What is it like to volunteer for your community? PROBE: community response to you / your work; community supportive (or not) – how? What are some challenges you face as a CHW?

4. Can you tell me about one of your most memorable experiences of being a community health worker (volunteer)? PROBE: When did this happen? [explore the importance of the seasonality of the story] How did you feel? Who else was there when this happened? How did you handle this situation? What did you learn from this experience?

   Is there another story/experience you'd like to share? PROBE with the opposite of the story told, if positive outcome in the first story, then ask for a negative outcome

Thanks for sharing those stories and experiences, I'd like us to talk a little bit more about how you handle different situations that arise in your work and in your life.

5. Can you tell me how you understand resilience? What does this mean to you? PROBE: Have you ever experienced a time when you had to be resilient? Can you describe that experience?

6. What does well-being mean to you? PROBE: How do you define or describe well-being? What are some things that contribute to your well-being?

   Possible Probes if not addressed in conversation:

7. Can you describe an experience in your life where you faced a significant challenge? How did you overcome it? What strategies did you use? PROBE: What did you learn from this experience? How has this experience influenced your work as a CHW?

8. How do you maintain or improve your well-being in your everyday life? PROBE what can negatively affect your well-being? PROBE: What are some things you do to take care of yourself? Are there any challenges or obstacles that make it difficult for you to take care of yourself?

9. How do you bounce back from setbacks or disappointments? What internal or external resources do you draw upon to regain your sense of well-being? PROBE: Can you describe a time when you faced a setback or disappointment as a CHW? What did you do to overcome it? How did you feel afterward?

Is there anything else you'd like to share with me?

We appreciate you taking time from your schedule to participate in this interview. If you have any questions, comments, or concerns do not hesitate to contact us. Thank you!

Appendix 2.8 CHW Interview Guide – Kasem Translation

Kasem translation

IDNO: ||_||_|_|_|_|_|_|_||_|_|

Lwaara yam dɛ dem: ___/___/___

Clinic:

N' na zuure mɛ:

Wolo dwi na laga' o toge'o ke:

Wolo na bwoe bwoea yam to:

Lwaara yam na wo daane tei tei to:

Hello,

A ke'n le de nmo na sɛ se'n toge'n ke lwaara yanto to. Zamsem dento wora de ke Skuuli delo ba na bwoe wo "University of Ottawa's School of Epideemiology and Public Health" ŋwaane mo. De laga se de lwoore de wole da komanŋ de nmo dedane nmo na yei kolo nmo na ye Katere yizura tontoŋeno to (ka kwe ka tete ka pa katere dem zɛra, CDD, yezura zenu) ko noŋe nmo bubuŋa na ye tei to. Amo wo taa ye wolo na bwoe nmo bwea to zim ye' amo wo taa bwoe nmo bwoea yadwonna.

Jan, jan, zuri yera 'n gaa ye'n dare'n titige sɛɛm tɔnno tem. Nmo na jege bwoea naa woŋo na daane nmo bubuŋa jan, jan pa se'a lwɔɔre. Pa se de bubu. Nɔɔno on na ware 'o gaa naa' o puupune, nmo jege se'n gaa' n bre ba se ba zii jinŋa.

Lwaara bwoea:

Amo wo ta laga se'a bubu de lwaara yam zim se'a ni woŋo fin komanŋ de nmo na ye wolo de nmo totoŋa nmo na ye CHWs.

5. Ko lamma se'a jeere nmo to, a ke lle dedane nmo na nɛ maŋa zim to. De na wora de bubu to, ta'n bere ne woŋo fin komanŋe de nmo na ye wolo to? BWOE'N WOLI DA diga , tiina, totoŋa, mɛ ba na luge nmo, kolo nmo na soe se'n ta'n ke to.

6. Ta' n bere ne ko na bubu tei ye' n tonŋa' n ye katere yizura totoŋno to (a kwe'a tete'a toŋe' a pae katere dem zɛɛra)? BWOE'N WOLI DA: ko na ke tei ye ba kuri nmo to, tento nmo nak e to, ko dane tɛ tɛ mo, bɛ woŋo ŋwaane mo pɛ se'n tan ye CHW?

7. Ko ye tei mo se' n kwe' n tete' n toŋe'n pa 'n katere? BWOE'N WOLI DA: katere dem na jonŋe nmo tei/ nmo totoŋa yam; katere dem zenna (na ko ba ke)- tɛ tɛ mo? Chana yɔ mo na nɛi nmo CHW to?

8. Nmo wo wane'n ta'n bere ne komanŋ de woŋo dedoa na kea nmo ŋwia wone pa se nmo ba'n swe nmo na ye katere yizura tontonŋno to na (a kwe'a tete'a toŋe' a pae katere dem zɛɛra)? PROBE: Maŋa kɔ mo konto kea? [lwaare maŋa kam na fia kolo ŋwaane de sinsɔli kam to] Ko dem ke nmo tɛ tɛ nmo? Wɔ de dem mo toge'o wora konto na ke to? Nmo ke kem dem tento tɛ tɛ mo? Nmo zamse bɛ mo 'n noŋe kem dem tento wone?

   Sinsɔla/nmo nɛ kolo to kodwaoŋ da wora nmo na wo ta laga se'n taa na? PROBE sinsɔli kam ba na tage to na ye ka tere, kolo na noŋa bubua sinlsɔli kam wone to na lana, nan bwoe kolo na noŋe da ye ko ba lama to.

A ke'n lle de nmo tage sinlɔsim tento dedane nmo na nɛ kolo to, amo wo ta laga se'a ŋwɔɔne fin ko manŋe de nmo na yene'n ke tei de kena yam dwi dwi na tui nmo totoŋa wone de nmo ŋwia wone to.

10. Nmo wo wane' n ta'n bere amo nmo na nige n' wane'n tan dana ye ye jege wopolo kuri tei tei? Konto ye bɛ mo ko pa nmo? BWOE' N WOLE DA: maŋa wora nmo tabe'n nɛ we'n jege se'n tan dama mo ye'n jege wopolo na? Nmo wo wane'n maŋe ken dem konto na?

11. Se ko ta lana'n yerane ye'n jege wopolo(well-being) kuri mo bɛ ko pa nmo? BWOE' N WOLE DA:Tɛ tɛmo, nmo wo wane'n maŋe ko ta lana'n yerane ye'n jege wopolo' n bere? Wontɔ tedwonna mo wola pa se ko lana nmo yerane ye' nmo jege wopolo?

Ko na ye tei bwoe nene ne ko wo na tage lwaara yam wone:

12. Nmo wo wane'n maŋe kem nmo na nɛ n ŋwia wone nmo na nɛ cham na tiine de duma na? Nmo ke tɛ mo 'n wane ko? Chwoe sɔ mo nm mɛ' n ke? BWOE' N WOLE DA: Nmo zamse bɛmo ko ja noŋe kem dem tento wone? Kem dem tento pɛ se nmo totoŋa ye tɛ tɛ mo, nmo na ye CHW?

13. Tɛ, tɛ nmo wo wane'n pa se ko ta ye konto naa ko ta fɔg ko vei yiga ko ta lana 'n yerane ye'n jege wopolo nmo dɛ dɛ ŋwia wone? BWOE' N WOLE DA: Kɔ mo ba lana na wo wane ko chi nmo ko ta lama no yerane ye'n jege wopolo? BWOE' N WOLE DA: Wontɔ mo nmo ke se'n tam ni'n tete baŋane? Chana wora na pa ko chana ko pa nmo se'n tam ni nmo tete baŋane na?

14. Nmo yene'n ke tɛ mo' n wane' joore'n zige lanyerane lila kolo na vaŋe nmo ko joore kwɔga to naa wopolo tera ko wone tem konto wone? Bɛ Jeŋa nmo noŋe nmo teene naa pwoone yiga ne mo nmo yene'n tɔge da se'n joore' n nɛ wopolo? BWOE' N WOLE DA: Nmo wo wane'n ta maŋa kalo nmo na nɛ cham delo na vaŋe nmo ko joore kwɔga naa wopolo tera ko wone nmo na ye CHW? Nmo ke tɛ mo'n wane ko? Ko ke nmo tɛ mo ko kwɔga sene?

Woŋo daa wora nmo na wo taal aga se'n pwɔɔre dedane amo na?

De jege wopolo dedane nmo na kwe' n maŋa se'n toge'n ke lwaara yanto. Nmo na jege bwoea mama, woŋo mo se'n ta , woŋo mo dane nmo ye kɔre fuune se'n nɛ debam. De'n lle!

Appendix 2.9 CHW Interview Guide – Kasem Back-Translation

Kasem Back translation
IDNO: ||_||_|_|_|_|_|_|_|_||_|_|

Date of Interview: ___/___/___

Clinic:

Your address:

Type of respondent:

The Interviewer:
Duration of interview:

Hello,

Thank you for agreeing to participate in this interview. This study is being because of the University of Ottawa's School of Epidemiology and Public Health. We want to know more about you and what you know as Community health workers (to work for community for free (to volunteer), CDD, yezura zenu) from what you think about it. I will be the interviewer today and I will be asking you some questions.

Please take time and read the consent forms carefully. If you have any questions or concerns, please let me know. Let's start. If the person cannot read or write, you have it to them before they thumbprint.

Interview questions:
I would like to start with our interview today by hearing something small about you and your work as a CHWs.

9. It good for me to meet you, thank you for having time today. As we are starting, tell me something small about you yourself? BWOE'N WOLI DA family, work, where you're, what you like doing.

10. Tell me how you started to be a community health worker (to give yourself up to work for community free)? PROBE: how you selected, how long you have doing this, what made you to become a CHW?

11. How is it like to volunteer to work your community? PROBE: what the community did to you/your work; community support (or not done)- how? What are some challenges you face as a CHW?

12. Can you tell me about one thing that happened in your life that you wouldn't forget as a community health worker (to put yourself up to work for community free)? PROBE: When did this happen? [discuss the importance of the time with the story] What did it do to you? Who else was there when it happened? What did you do about this experience? What did you learn from this experience?

    Is there another story/ experience you would like to tell me? PROBE if the story told is different, if the outcome of the first story is good, then ask for the outcome that is not good.

Thank you for telling me this story and your experience, I would like to talk small about what you do and different situations that come in your work and your life.

15. Can you tell me how you understand how you are able to picking yourself up after facing difficulties or challenges (resilience)? What does this mean to you? PROBE: is there a time when you ever have to pick yourself up after facing difficulties or challenges? Can you describe this experience?

16. What does it mean to possess good health and happiness? PROBE: How can you describe to be well with you and happy to me? What other things helps you to have good health and happiness?

    Possible Probes if not addressed in conversation:

17. Can you describe your experience in your life when you face a difficult challenge? How did you handle? What methods did you use? PROBE: What did you learn from this experience? How has this experience affected your work as a CHW?

18. How can you maintain or improve your ability to pick yourself up after facing difficulties or challenges in your daily life? PROBE What is not good that can prevent your ability to pick yourself up after facing difficulties or challenges? PROBE: What things do you do to take care of yourself? Are there challenges that makes it difficult for you to take care of yourself?

19. What do you do to be able to come back strong quickly from the setbacks or disappointments? What resources are from you or external that you pass through to gain back your happiness and good health? PROBE: Can you describe when you face setbacks or disappointments as a CHW? How did you handle it? How did you feel afterwards?

Is there anything else you would like to share with me?

De jege wopolo dedane nmo na kwe' n maŋa se'n toge'n ke lwaara yanto. Nmo na jege bwoea mama, woŋo mo se'n ta , woŋo mo dane nmo ye kɔre fuune se'n nɛ debam. De'n lle!

Appendix 2.10 CHW Interview Guide – Nankani Translation

Nankani translation on interview guide for CHWs

IDNO: ||_||_|_|_|_|_|_|_||_|_|

Sosega la dabsere la: ___/___/___

Clinic:

Fo kia zia dela bɛ:

Mena' n leerege la dela' ane taba:

Mena en iti sosega la:

Sosega la'n yuwe paa sem:

Hello,

N' puusiya lae fo'n sake te fo poe inŋe sosega wa. Zamsego wa' n bo bi ita la dela Skuuli la te ba wiira "University of Ottawa's School of Epidemiology and Public Health" inŋa. Te bote te te banŋɛ sonŋa sonŋa yɛsera yizuo imma'assum tuntuniba (mena'n dike' a menŋa bɔ te'a tum zaalem bɔ yizuo la, CDD, imma'assum sunŋra) iti la ŋwaane tuna ba tuma yizuo la puan lae bem danŋɔ lae yɔrɔ te ba nyɛta. Mam wan dena mena'n wan sokera fo sokere duma bataba zina.

Zam, zam, maa inŋa de kaalem de sanŋɛ sakere gɔnno la. Fo san tara sokere woo bei sɛla tef o yele zam, zam base te'n banŋɛ. Base te te pɔsɛ. Nɛɛra la san ka ta'am kaalem bei gulsɛ, fo tare fo kaalem bɔ ba mɛ te bay a dii nuusi.

Sosega la sokere yela:

Mam wan bota te'n pɔsɛ te sosega la zina te'n wum sɛla fiin yɛsera fom'n de mena lae fo tuma fom'n de CHW la.

13. La’ ane sonŋa te’n nyɛ fo, n’ puusiya lae fo sanŋa la zina. Te’n bo bi pɔsera la, yele mam sɛla fiin yɛsera fo menŋa? SOKE TE FO BANƆƐ deo duma, tuma, dɔgum zia, fo nɔnŋ te fo ita la bem.

14. Yele pa’ale mam yɛsera la’n inŋe sem te fom pɔse tuna te fo dela yizuo imma’ssum tuntuna (sɛba’n tuni bɔra ba yizuo la za’alem)? SOKE TE FO BANƆƐ: la inŋe la ŋwane te b aloe fom, la yuu la ŋwane fom’ n iti ŋwana la, be men base te fom dena CHW?

15. La’ane la ŋwane te fom tum bɔ fo yizuo za’alem? SOKE TE FO BANƆƐ: yizuo la’n inŋe sem lae fom, fo tuma; yizuo la tare sunŋere (bei ba ka tare sunŋere), ŋwane? Danŋɔ tena taba te fom en de CHW la nyɛta?

16. Fo wan ta’am yele pa’ale mam yɛsera zugo ayila’n inŋɛ fom en de yizuo imma’assum tuntuna fo vɔɔm puan te kan ta’am tamɛ ayɛla(mena’n tuni bɔra’a yizuo la za’alem)? PROBE: La’inŋe la sanŋa kana winem? [explore the importance of the seasonality of the story] La’inŋe fo la wane? Ane’ mɛ’ n dare bo bi la’n inŋe la? Fom inŋe la ŋwane bise itigo wa zum? Fom zamse la bem yɛsera itigo wa puan?

    Sem en inŋe bala taba len bɔna bi tef o wan bota te fo yele? PROBE sɔlinŋa san da na buyila lae sɛka te ba bɔ la, sem en yese yia sɔlinŋa puan na san ana sonŋa, ye soke bise sem en yese bi de kana sonŋa la.

N’ puusiya lae fom’n dike solima wa lae sem te fom nyɛ la, Mam wan bota te te tɔge sɛla fiin yɛsera fom inŋe sem bise yela bala buuri buuri ’n wam fo tuma lae fo vɔɔm puan.

20. Fo wan ta’am yele pa’ale mam fom en bɔkɛ (resilience) vɔɔre dela bem? Ɔwan pa’ale te la dela bem bɔ fom? PROBE: Fo tabele bo bi te fo tare te fo inŋe panŋa te ta’am ze’le sonŋa sonŋa? Fo wan ta’am sose itigo la bala pa’ale?

21. La’ana sonŋa bɔra fo de fo pupeilum bɔna bi pa’ale la bem bɔ fo? PROBE: Ɔwane te fo sose pa’ale La’ana sonŋa bɔra fo de fo pupeilum bɔna bi’n de sem? Yele’ ana taba’ n sunŋere base te La’ana sonŋa bɔra fo de fo pupeilum bɔna bi wana?

    Possible Probes if not addressed in conversation:

22. Fo wan ta’am ma’ake pa’ale fo vɔɔm puan te fo nyɛ danŋɔ kankanŋe? Fom inŋe la ŋwane nyanŋɛ ko? Sodɔto ten ate fom doose inŋɛ? PROBE: Bem tef om zamse yɛsera itigo wa puan? Itiigo wa base tef om tuma puan fom en de CHW ana la ŋwane?

23. Ŋwane te fom wan ta'am gura bala bei base te la'ana sonŋa bɔra fo de fo pupeilum bɔna bi tole nenŋa fo dare woo vɔɔm puan? PROBE Bem en ta'am daam sem en'ane sonŋa bɔra fo de fo pupeilum bɔna bi? PROBE: Bem buno tef o it ate bisera fo menŋa? Danŋɔ bo bi bɔra fo base te la' ana teem bɔ fo te fo bisera fo menŋa?

24. Fom nen inŋe ŋwane ta'am len ze'ele atito lae panŋa yɛsera yelseya'n tare fo lebera porem bei susagennɔ la puan? Bem nutatem en ze'le fom ziam bem yinŋa te fom dola bi nyɛta panŋa len ze'ele? PROBE: Fo wan ta'am pa'ale sanŋa sɛka tef om nyɛ yelyesa 'n tare fo lebera porem lae susgennɔ fom en de CHW la? Fom inŋe la bem tef o nyanŋɛ ko? La' inŋe fo la ŋwane pore inŋa?

Sɛla len bɔna bi te fo wan bota te yele pa'ale mam?

Te mam puure pei lae fom dike fo sanŋa fo tuma puan poe inŋe sosega puan. Fo san tara sokere woo, sɛla tef o yele, bei sɛla'n dane fo putriɛ da zoe nabem tef o nyɛ te mam. N' puusi fo! Te puusi fo lae fo sanŋa tef o dike fo tuma puan te poe inŋe sosega wa. Fo san sokere woo, sɛla tef o yele, bei sɛla fo putire puan, da zoe nabem te fo nyɛ te mam. N puusiya!

Appendix 2.11 CHW Interview Guide – Nankani Back-Translation

Nankani Back translation on interview guide for CHWs

IDNO: ||_||_|_|_|_|_|_|_||_|_|

Date of interview: ___/___/___
Clinic:
Your Address:

Type of respondent:

Interviewer:
Duration of interview:

Hello,

Thank you for agreeing to participate in this interview. This study is being because of the University of Ottawa's School of Epidemiology and Public Health. We want to know more about you and what you know as Community health workers (to work for community for free (to volunteer), CDD, yezura zenu) from what you think about it. I will be the interviewer today and I will be asking you some questions.

Please take time and read the consent forms carefully. If you have any questions or concerns, please let me know. Let's start. If the person cannot read or write, you have it to them before they thumbprint.

Interview questions:
I would like to start with our interview today by hearing something small about you and your work as a CHWs.

17. It good for me to meet you, thank you for having time today. As we are starting, tell me something small about you yourself? PROBE, family, work, where you're, what you like doing.

18. Tell me how you started to be a community health worker (to give yourself up to work for community free)? PROBE: how you selected, how long you have doing this, what made you to become a CHW?

19. How is it like to volunteer to work your community? PROBE: what the community did to you/your work; community support (or not done)- how? What are some challenges you face as a CHW?

20. Can you tell me about one thing that happened in your life that you wouldn't forget as a community health worker (to put yourself up to work for community free)? PROBE: When did this happen? [discuss the importance of the time with the story] What did it do to you? Who else was there when it happened? What did you do about this experience? What did you learn from this experience?

    Is there another story/ experience you would like to tell me? PROBE if the story told is different, if the outcome of the first story is good, then ask for the outcome that is not good.

Thank you for telling me this story and your experience, I would like to talk small about what you do and different situations that come in your work and your life.

25. Can you tell me how you understand how one can pick oneself up after facing difficulties or challenges (resilience)? What does this mean to you? PROBE: is there a time when you ever have to pick yourself up after facing difficulties or challenges? Can you describe this experience?

26. What does to be well with you and happy mean to you? PROBE: How can you describe to possess good health and happiness to me? What other things helps you to have good health and happiness?

    Possible Probes if not addressed in conversation:

27. Can you describe your experience in your life when you face a difficult challenge? How did you handle? What methods did you use? PROBE: What did you learn from this experience? How has this experience affected your work as a CHW?

28. How can you maintain or improve your ability to pick yourself up after facing difficulties or challenges in your daily life? PROBE What is not good that can prevent your ability to pick yourself up after facing difficulties or challenges? PROBE: What things do you do to take care of yourself? Are there challenges that makes it difficult for you to take care of yourself?

29. What do you do to be able to come back strong quickly from the setbacks or disappointments? What resources are from you or external that you pass through to gain back your happiness and good health? PROBE: Can you describe when you face setbacks or disappointments as a CHW? How did you handle it? How did you feel afterwards?

Is there anything else you would like to share with me?

De jege wopolo dedane nmo na kwe' n maŋa se'n toge'n ke lwaara yanto. Nmo na jege bwoea mama, woŋo mo se'n ta , woŋo mo dane nmo ye kɔre fuune se'n nɛ debam. De'n lle!

Te puusi fo lae fo sanŋa tef o dike fo tuma puan te poe inŋe sosega wa. Fo san sokere woo, sɛla tef o yele, bei sɛla fo putire puan, da zoe nabem te fo nyɛ te mam. N puusiya!

Appendix 2.12 Stakeholder Interview Guide

IDNO: ||_||_|_|_|_|_|_|_||_|_|

Date of interview: ___/___/___

Clinic:

Address:

Category of Respondent:

Interviewer:

Duration of Interview:

Hello,

Thank you for agreeing to participate in this interview. This study is being conducted through the University of Ottawa's School of Epidemiology and Public Health. We are interested in knowing more about how Community health workers (volunteer, CDD, yezura zenu) go about their work in the community and what challenges and opportunities they have. I will be your interviewer today and will be asking you some questions.

Please take time to carefully read and sign the consent forms. If you have any questions or concerns please let me know. Let's get started. If the person cannot read or write, you need to read to them so they thumbprint.

Interview Questions:

I'd like start our conversation today hearing a little about you and your involvements with CHWs.

21. It's nice to meet you, thank you for taking the time today. As we get started, tell me a little about yourself? PROBE job, role in relation to CHWs

22. Tell me about how you are involved with community health workers (volunteers)? PROBE: how long you've been doing this?

23. What is it like for people to volunteer for their community? PROBE: community response to the work of CHW; community supportive (or not), supervisory support, health system (Clinic, DHMT, GHS, Special programs) support – how? What are some challenges CHWs face?

In the next set of questions, I would like to talk about CHWs network of relationships (Institutions, community etc.) and some questions on seasons and CHW work.

30. How is the work of CHWs supported by the healthcare system and its institutions like clinic, CHPS zone, DHMT, GHS and health campaign programs? PROBE: What institutional challenges affect the work of CHWs? What institutional supports impacts the work of CHWs? Are there differences in the types of support CHWs receive from the health system compared to vertical campaigns with NGOs? What are differences (remuneration, supervisory, workload guidance etc.)?

31. Can you think of some policies and systems that impact the work of CHWs? PROBE: How do these policies and systems support or hinder their ability to provide health services to their communities?

32. When you think about CHWs, what do you think contributes to their resilience and well-being? Can you provide examples of how they can influence a CHW's life? PROBE: Are there any individuals or groups, healthcare system (GHS etc) within the network of CHW' relationships, social support networks, or community that have been particularly helpful in supporting their resilience and well-being? How have they helped you?

33. When you think of the whole year, from January to December, how does CHW workload change from month to month? How do you think this might affect their resilience / well-being? PROBE: Are there any times of the year that are more challenging or difficult for CHWs? Are there any times of the year that are particularly easier for CHWs?

Is there anything else you'd like to share with me?

We appreciate you taking time from schedules to participate in this interview. If you have any questions, comments, or concerns do not hesitate to contact us. Thank you!

Appendix 2.13 Stakeholder Interview Guide – Kasem Translation

Kasem translation interview guide for Stakeholders

HIDNO: ||_||_|_|_|_|_|_|_||_|_|

Lwaara yam dɛ dem: ___/___/___

Clinic:

N' na zuure mɛ:

Wolo dwi na laga' o toge'o ke:

Wolo na bwoe bwoea yam to:

Lwaara yam na wo daane tei tei to:

Hallo,

A ke'n le de nmo na sɛ se'n toge'n ke lwaara yanto to. Zamsem dento wora de kolo ŋwaane Skuuli delo ba na bwoe wo "University of Ottawa's School of Epideemiology and Public Health" ŋwaane mo. De laga se de lwoore mo de wole da Katere yizura tontoŋena (ka kwe ka tete ka pa katere dem zɛra, CDD, yezura zenu) na ke ba ke ba totoŋa tei tei katere dem wone dedane chana yalo de chwoe selo ba na jega. Amo wo taa ye wolo na obwoe nmo bwea to zim ye amo wo bwoe nmo bwea yadwonna.

Jan, jan, zuri yera 'n gaa ye'n dare'n titige sɛɛm tɔnno tem. Nmo na jege bwoea naa woŋo na daane nmo bubuŋa jam, jam pa se'a lwɔɔre. Pa se de bubu. Nɔɔno on na ware 'o gaa naa' o puupune, nmo jege se'n gaa' n bre ba se ba zii jinŋa.

Lwaara yam bwea:

Amo wo ta laga se'a bubu de lwaara yam zim se'a ni woŋo fin komanŋ de nmo na ye wolo dedane 'n na toge'n wora dedane CHWs.

24. Ko lamma se de jeere dane, a ke lle dedane nmo na nɛ maŋa zim to. De na wora de bubu to ta'n bere ne komanŋe de mo na ye wolo to? BWOE' N WOLE DA: totoŋa, nmo totoŋa na jege kolo ko ke de CHWs

25. Ta'n bere ne ko na ke kolo ye nmo toge'n wo katere yizura tontoŋna wone(balo na kwe ba tete ba pa se ba toŋe zeera ŋwaane to)? BWOE' N WOLE DA: nmo na ke tento pa se ko daane tei to?

26. Ko ye tɛ tɛ mo se nɔɔna kwe ba tete ba pa se ba toŋe zeera ba pa ba katere na? BWOE' N WOLE DA: katere dem na sɛ CHWs tina totoŋa tei; katere dem zenne (naa ko ba ke), zennem ba totoŋa yam niim baŋane, yizura totoŋa yam (Clinic, DHMT, GHS, kena yadwona na ye ya teere) zenna – nene ne tɛ tɛ? Chana yɔ mo CHWs nɛ?

Bwea yadwona yam na toge wone, amo wo taa laga se'a ŋwɔɔne ko manŋe de CHWs yidaane na ye tei to(Tigisina, katere dem etc.) dedane bwoea komanŋe de tipwonŋa de yadwɛ dedane CHW totoŋa.

34. Yizura totoŋa yam dedane de tigisina nene ne "clinic, CHPS zone, DHMT, GHS dedane yizura labare totoŋa ke tɛ mo de zenne CHWs tina totoŋa? BWOE' N WOLE DA: Tigisina chana yɔ mo CHWs tina nɛi? Tigisina zenna yɔ mo jege pimpano CHWs totoŋa baŋane? Wola yalo CHWs na nɛ to ye ya tere mo dedane yizura totoŋa yam nene'n na kwe'n maŋe de NGOs totoŋa na vei tei tei to mo na? Bɛ wonno mo ye te tere (ŋwiro, ka taa ni 'a totoŋa baŋane, totoŋa zam, zam nim baŋane etc.)?

35. Nmo wo nwae' n boŋe kena yadwona dedane tigisina na jege pimpano CHWs totoŋa baŋane na? BWOE' N WOLE DA: Kenna yanto dedane tigisina yanto zenne tɛ tɛ mo na ya chu ba na wae ba ke tei se ba ta ke yizura totoŋa yam ba katera yam wone?

36. Nmo na boŋe CHWs, tina bubuŋa, bɛ woŋo nmo boŋe we ko wola ko pa se ba yene joore ba wane ba nɛ dam de wopolo? Nmo wo wane'n bere wonno telo na wae te jege leera CHW tu ŋwia wone na? BWOE' N WOLE DA: Nɔɔna naa tigisina, yizura totoŋa yam (GHS ete) CHWs tiina bam yedaane batotoŋa yama wone, katere dem wola totoŋa, naa katere dem na tinne de jege wola de zenne ba ba na wae ba ke tei se ba joore ba fanŋe ba zige lanyerane dedane wopolo? Tɛ tɛ mo te wole nmo?

37. Nmo na bwoŋe bene dem mama wone, ko zige benduuri chana kam ko vo yi Burinyom chana kam wone, totoŋa leere chana wone ko vo kadwonŋ wone tɛ tɛ mo? Nmo boŋe wo konto wo wae ko dane ba na ke kolo se ba wane ba joore ba zige lanyerane / wopolo tɛ tɛ mo? BWOE' N WOLE DA: Maŋa wora bene dem wone na tine de jege yaara naa ko chana ko pae CHWs na? Maŋa wora bene dem wone na tine ko ye mɔle ko pae CHWs?

Woŋo daa wora nmo na wo taa laga se'n pwoore dedane amo na?

De jege wopolo dedane nmo na kwe' n maŋa se'n toge'n ke lwaara yanto. Nmo na jege bwoea mama, woŋo mo se'n ta, woŋo mo dane nmo ye daane se'n nɛ debam. De'n lle!

Appendix 2.14 Stakeholder Interview Guide – Kasem Back-Translation

Kasem Back translation interview guide for Stakeholders

HIDNO: ||_||_|_|_|_|_|_|_||_|_|

Date of interview: ___/___/___

Clinic:

Your address:

Type of respondent:

Interviewer:

Duration of interview:

Hello,

Thank you for agreeing to participate in this interview. This study is being conducted because of University of Ottawa's School of Epidemiology and Public Health. We are interested in knowing more about you Community health workers (to agree to work for free for your community, CDD, yezura zenu) how they are doing their work in the community and the challenges and opportunities they have. I will be your interviewer today and I will be asking you some questions.

Please take time and read carefully before you sign the consent forms. If you have any questions or concerns please, let me know. Let us start. If the person cannot read or write, you have to read to them before they thumbprint.

Interview questions:

I would like to start our discussion today to hear something small about you and your involvement with CHWs.

27. It nice to meet, thank you for having time today. As starting, tell me about yourself? PROBE work, your work related to CHWs

28. Tell me how you are involved in community health workers (those who agree to work for free for their community)? PROBE: how long have you been doing this?

29. How is like for people to work as volunteers for their community? PROBE: how community received CHWs work; community support (or not), support for supervision, health system (Clinic, DHMT, GHS, Special programs) support – how? What challenges do CHWs face?

In the other questions that follow, I would like to talk about how they relate with others (institutions, the community etc.) and questions on whether dry or wet season and CHW work.

38. How is the work of CHWs supported by the health system and their institutions like clinic, CHPS zone, DHMT, GHS and health campaigns? PROBE: What institutional challenges do CHWs face? What institutional support gives CHWs encouragement in their work? Are there any differences in the kind of support CHWs get from the health system compared with NGOs? What things are different (payment, supervision, supervision of too much work, etc.)?

39. Can you think of some things and organizations that gives encouragement in CHWs work PROBE: how do these things and organizations support or affect ability to their work in their communities?

40. When you think about the CHWs, what do you think helps their ability to pick themselves up after facing difficulties or challenges? Can you give examples of how they can impact the life of a CHW? PROBE: Individuals and the health system (GHS ete) CHW's relations in their work, community support is, or the community that has been so helpful in supporting their ability to pick themselves up after facing difficulties or challenges? How have do they helped you?
41. When you think about the whole year, from January to December, how does CHWs work change from a month to another? How do you think this may affect their ability to pick themselves up after facing difficulties or challenges? PROBE: Are there any times in the year that are very difficult for CHWs? Are there any times in the year that are very easy for CHWs?

Is there anything that you would like to share with me? workload

We are happy with you for taking time to participate in this interview. If you have any questions concerns do not waste time in seeing us. thank you.

Appendix 2.15 Stakeholder Interview Guide – Nankani Translation

Nankani translation for interview guide Stakeholders

IDNO: ||_||_|_|_|_|_|_|_||_|_|

Sosega la dabsere la: ___/___/___

Clinic:

Fo kia zia dela bɛ:

Mena' n leerege la dela' ane taba:

Mena en iti sosega la:

Sosega la'n yuwe paa sem:

Hello,

N' puusiya lae fo'n sake te fo poe inŋe sosega wa. Zamsego wa' n bo bi ita la dela Skuuli la te ba wiira "University of Ottawa's School of Epidemiology and Public Health" inŋa. Te bote te te banŋɛ sonŋa sonŋa yɛsera yizuo imma'assum tuntuniba (mena'n dike' a menŋa bɔ te'a tum zaalem bɔ yizuo la, CDD, imma'assum sunŋra) iti la ŋwaane tuna ba tuma yizuo la puan lae bem danŋɔ lae yɔrɔ te ba nyɛta. Mam wan dena mena'n wan sokera fo sokere duma bataba zina.

Zam, zam, maa inŋa de kaalem de sanŋɛ sakere gɔnno la. Fo san tara sokere woo bei sɛla tef o yele zam, zam base te'n banŋɛ. Base te te pɔsɛ. Nɛɛra la san ka ta'am kaalem bei gulsɛ, fo tare fo kaalem bɔ ba mɛ te bay a dii nuusi.

Sosega la sokere yela:

Mam bote te'n pɔsɛ te sosega la zina te'n wum sɛla fiin yɛsera fo'n de men alae fo'n lagem poe bɔna lae CHWs.

30. La' ane sonŋa te'n nyɛ fo, n' puusiya la fo sanŋa la zina. Te'n bo bi pɔsera la, yele mam sɛla fiin yɛsera fo menŋa? SOKE TE FO BANƊƐ tuma, fo tuma en de sem CHWs puan.

31. Yele pa'ale mam yɛsera fo inŋe la ŋwane lagem bɔna yizuo imma'ssum tuntuniba puan (sɛba'n tuni bɔra ba yizuo la za'alem)? SOKE TE FO BANƆƐ: fo'n iti ŋwana la, la yuu paa la ŋwane?

32. La'ane la ŋwane te nɛɛriba tum bɔ ba yizuo za'alem? SOKE TE FO BANƆƐ: yizuo la itigo lae CHW tuma puan dela ŋwane; yizuo la sunŋere (bei ba ka sunŋere), sunŋera bis aba tuma la, imma'assum tuma la (Clinic, DHMT, GHS, pakire tuma) sunŋerɛ – ŋwane? Danŋɔ tena taba te CHWs duma nyɛta?

Sokere duma la'n tagle la, mam bote te'n tɔge mɛ yɛsera CHWs duma tuma puan' n ane sem (Tigisito, yizuo etc.) lae sokere duma yɛsera sanŋa la puan lae CHW tuma.

42. Ɔwane te imma'assum tuma la lae ba tigisito la fo yete clinic, CHPS zone, DHMT, GHS lae imma'assum labaare tuma sunŋera CHWs tuma? SOKE TE FO BANƆƐ: Bem tuma zia yela en tare danŋɔ bɔ CHWs tuma? Bem tuma zia sunŋere'n bɔre CHWs duma tuma inŋkwenŋre? Sunŋere sɛka taba te CHWs toe ze'ele imma'assum tuma la ziam bo bi toka toka lae fo san dike makɛ lae tuma lae nsoe' n mia tuma NGOs duma? Bem en bo bi toka toka (yɔɔro, tuma zum bisega puan, tuma zoe'y zoe'y bisega etc.)?

43. Fo tire itigo te taba lae tuma'n ta'am ba'ase te inŋkwenŋre bɔna CHWs tum puan? SOKE TE FO BANƆƐ: Ɔwane te itigo duma wa lae tigisito la sunŋra bei la dana ba' n iti sem tuna imma'assum tuma la ba yizuto la puan?

44. Fo san tise yɛsera CHWs duma puan, bem te fom tise te bala'n sunŋre ba mama en iti sem ta'am len nyɛta kwenŋo tuna lae ba pupeilum puan? Fo wan ta'am bɔ yelseya te la dena te ŋwana te ba ta'am tara sɛla CHW's vɔɔm puan? SOKE TE FO BANƆƐ: Nɛɛriba bei tigisito woo, imma'assum tuma (GHS etc) CHW tuma la puan te ba' ana sem lae taba, yinŋa sunŋre taba,bei te yizuo la' n tim tara sunŋre bɔ ba ba'n iti sem ta'am ana ze'ele nyɛ panŋa tuna lae ba pupeilum puan? Ba sunŋe fom la ŋwane?

45. Fo san tise yuune na wula puan, ze'ele yum palɛ ŋwarega tare paa buriya ŋwarega, ŋwane te CHW tuma teera ŋwarega, ŋwarega puan? Ɔwane te fom tise te ŋwana ta'am ba'ase te inŋkwenŋre bɔna ba'n iti sem ta'am ana panŋa tuna/ ba pupeiplum puan? SOKE TE FO BANƆƐ: Sanŋa bo bi yunne la puan en tim tara danŋɔ bei ana teem bɔ CHWs duma? Sanŋa bo bi yunne la puan te la dena faga faga bɔ CHWs duma ba tuma puan?

Sɛla len bɔna bi te fo wan bota te fo yele lae mam?

Te puusi fo lae fo sanŋa tef o dike fo tuma puan te poe inŋe sosega wa. Fo san sokere woo, sɛla tef o yele, bei sɛla fo putire puan, da zoe nabem te fo nyɛ te mam. N puusiya!

Appendix 2.16 Stakeholder Interview Guide – Nankani Back-Translation

Nankane Back translation for interview guide Stakeholders

IDNO: ||_||_|_|_|_|_|_|_||_|_|

Date of interview: ___/___/___

Clinic:

Your address:

Type of respondent:

interviewer:

Duration of interview:

Hello,

Thank you for agreeing to participate in this interview. This study is being conducted because of University of Ottawa's School of Epidemiology and Public Health. We are interested in knowing more about you Community health workers (to agree to work for free for your community, CDD, yezura zenu) how they are doing their work in the community and the challenges and opportunities they have. I will be your interviewer today and I will be asking you some questions.

Please take time and read carefully before you sign the consent forms. If you have any questions or concerns please, let me know. Let us start. If the person cannot read or write, you have to read to them before they thumbprint.

Interview questions:

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33. It nice to meet, thank you for having time today. As starting, tell me about yourself? PROBE work, your work related to CHWs

34. Tell me how you are involved in community health workers (those who agree to work for free for their community)? PROBE: how long have you been doing this?

35. How is like for people to work as volunteers for their community? PROBE: how community received CHWs work; community support (or not), support for supervision, health system (Clinic, DHMT, GHS, Special programs) support – how? What challenges do CHWs face?

In the other questions that follow, I would like to talk about how they relate with others (institutions, the community etc.) and questions on whether dry or wet season and CHW work.

46. How is the work of CHWs supported by the health system and their institutions like clinic, CHPS zone, DHMT, GHS and health campaigns? PROBE: What institutional challenges do CHWs face? What institutional support gives CHWs encouragement in their work? Are there any differences in the kind of support CHWs get from the health system compared with NGOs? What things are different (payment, supervision, supervision of too much work, etc.)?

47. Can you think of some things and organizations that gives encouragement in CHWs work PROBE: how do these things and organizations support or affect ability to their work in their communities?

48. When you think about the CHWs, what do you think helps their ability to pick themselves up after facing difficulties or challenges? Can you give examples of how they can impact the life of a CHW? PROBE: Individuals and the health system (GHS ete) with CHW relations in their work, community support is, or the community that has been so helpful in supporting their ability to be pick themselves up after facing difficulties or challenges? How have do they helped you?

49. When you think about the whole year, from January to December, how does CHWs work change from a month to another? How do you think this may affect their ability to pick themselves up after facing difficulties or challenges? PROBE: Are there any times in the year that are very difficult for CHWs? Are there any times in the year that are very easy for CHWs?

Is there anything that you would like to share with me? workload

We are happy with you for taking time to participate in this interview. If you have any questions concerns do not waste time in seeing us. thank you

Appendix 2.17 Thematic Framework

Thematic Framework for resilience of Community Health Workers in Ghana

Theme	Sub-theme	Common topics relating to sub-theme	Quotes
Cognitive and Adaptive Resilience	Adaptability and Resourcefulness	Cognitive flexibility	*"I learned the machine work (seamstress)…I have taken that to be my school (education) that I stopped and couldn't continue…" (Female CHW005)*
		Reframing Challenges and finding alternatives	*"I wanted to further it (my education) but couldn't but what can I do? What I did at the time was, I got a small job to do." (Female CHW005)*
	Avoiding overthinking and letting go	Emotional suppression	*"Where you cannot do it again, you need to stop…if you are pushing yourself to do it, you will suffer without doing it" (Male CHW008)*
		Cognitive deferral	*"Personally, whenever you want to do something and there is a problem, if it is possible you should forget of it" (Male CHW008)*
	Personal Agency	Self-efficacy	*"I do that by standing on my feet again to see how I can move on. By not giving up" (Female CHW013)*
		Psychological endurance	*"You force yourself to improve within the situation and try to survive" (Male CHW004)*
		Persistence	*"You must keep on doing what keeps you moving by every means" (Male CHW004)*
Collective or Communal Resilience	Family and Friend	Advice and encouragement	*"Receiving advice from friends and loved ones is important" (Male CHW004)*

		Physical and spiritual support	*"They come to help me… so that's the support they have for me….in a spiritual way, they pray for me…" (Male CHW004).*
	Community	Community solidarity	*"If the children are healthy in the community that is why I devote time to volunteer" (Male CHW008)*
		Reciprocal altruism	*"There is a saying that when you wash someone's clothes your hands too are washed clean" (Male CHW004)*
		Resource	*"There are some people in the community that I can go to for maybe a bicycle or means of transport" (Female CHW013)*
	Social and professional networks	Social networks and groups	*"We have a women's group in this community where we come together to support ourselves in different ways" (Female CHW013)*
		Professionals (Nurses)	*"The nurses encourage us and always tell us to share any challenge or problems with them" (Female CHW001)*
		CHWs shared experiences	*"Hearing experiences like that of yours makes you stronger or gives you more strength to do [their] work." (Female CHW001)*
Emotional Resilience	Emotional regulation	Self-regulation	*"There are some things in life that you should ignore" (Male CHW002)*
		Emotional distancing	*"If you want to harbour things people say you will die early." (Male CHW002.)*

	Self-reflection	reflection	*"There are challenges so any time it happens I give it a second thought" (Male CHW015)*
		Impulse control	*"If you go there and then you are not careful, you are likely to retaliate to some of their actions" (Female CHW013).*
	Positive reinforcement	Emotional reward	*"She told me I have done very well so it made me feel that I have offered something in someone's life" (Male CHW004)*
Spiritual and Faith-based Resilience	Prayer and divine intervention	Prayer and consultations	*"I pour libation or go to consult the soothsayer" (Male CHW008)*
		Divine providence	*"I ask God, he would do it for me" (Male CHW008)*
	Spiritual coping and Surrender	Spiritual coping	*"I have to give it to God and still continue to work for the betterment of my community" (Female CHW001)*
		Divine control	*"I don't panic and the reason I don't panic, is I know it is God's work" (Male CHW008)*
		Spiritual Motivation	*"God that gives me the strength to continue to work If I stop the work meaning Satan has won" (Female CHW001)*
	Spiritual Guidance	Biblical Guidance	*"Pick some of the ten commandments and learn something from it or it will help you regarding your thinking" (Female CHW005)*
		Guidance from religious leaders	*"I always call my pastor and tell him I am doing this and this is what has happened" (Female CHW016)*

Thematic Framework for well-being of Community Health Workers in Ghana

Theme	Sub-theme	Common topics relating to sub-theme	Quotes
Environmental Well-being	Relationship between the individual (community) and the environment	Healthy Environment	*"Disposing your bowels in the right place…and doing away with stagnant water" (Female CHW001)*
		Sustainable living	*"For me, it (well-being) is about keeping your environment clean" (Female CHW001)*
Financial Well-being	Lack of economic resources	Poverty	*"Poverty too can prevent you from having good health" (Female CHW001)*
		Money/Finances	*"To wake up and take care of the body is a problem because…you need money to buy food, to take care of the body" (Male CHW002)*
		Food insecurity	*"You wake up you don't have money, you're hungry, the children are crying for food" (Female CHW001)*
Mental and Emotional Well-being	Mental	Peace of mind	*"In my opinion, if you have peace of mind, it gives you good health" (Female CHW005)*
	Emotional	Happiness	*"Don't be angry always, and if you are always happy your well-being is there forever" (Female CHW005)*

Physical Well-being	Engaging in preventive measures	Illness prevention	*"Mosquitos give us big sickness, if you don't sleep under a net, you cause yourself a big sickness" (Male CHW011)*
		Physical activity	*"We the adults or elderly and young people, need to exercise our body" (Male CHW002)*
	Nutritional awareness	Healthy food	*"For the well-being of a child, it depends on the parent and that means you have to give the child food that has no problem" (Male CHW002)*
	Functional health	Community participation	*"And if you are not healthy you cannot participate or you cannot partake in everyday life." (Female CHW001)*
		Economic participation	*"Our forefathers have a saying that if you have good health, you farm the best valleys" (Female CHW001)*
Social or Relational well-being	Family	*Harmony*	*"When you wake up and, in the family, there is no happiness among the family you will not also be healthy and have peace of mind" (Male CHW015)*
		Reciprocity and Mutual Aid	*"If there is no unity among the family you cannot take care of each other well" (Male CHW015)*
	Community	Relationship between personal and community health	*"It is the community but not me, but if it affected me" (Male CHW002)*
Spiritual and Faith-based Well-being	Sense of Purpose and Meaning	Divine will and purpose	*"God has a day for the human being where he is happy and a day for the human being where he is angry" (Male CHW011)*

	Faith and Religious Practice	Prayers and Rituals	*"I don't go to church I pour libation so when I go to the soothsayers, I am looking for health I am searching to know what to do so that God will give me and my family good health" (Male CHW008)*
	Beliefs	Taboos	*"They could tell you not to eat this mud fish because it is a taboo… if you eat it and something will happen" (Female CHW005)*
		Destiny	*When you wake up the following day, you thank your God and go out, what is destined for you by God will happen (Female CHW016)*

Appendix 3 Data collection Documentation for Longitudinal Cohort Study

Appendix 3.1 CHW Informed Consent Form (English)

Title of Study: Longitudinal examination of seasonal resilience variations and their impact on the well-being of community health workers in Ghana

Funded By:

Version Date: January 24, 2024

Introduction:

My name is _____ and I am from_____. As part of the study "Longitudinal examination of seasonal resilience variations and their impact on the well-being of community health workers in Ghana" we are asking some CHWs in your District to take part in a survey. This survey will help us understand how you manage to continue your work during the dry, rainy, and harvest (Fao) seasons despite facing challenges, and how this relates to your well-being. It is important that you understand why we are doing this study, so I will read the information sheet carefully. If you have any more questions, ask me and I will try to answer them for you.

We want to learn about the experiences of CHWs like you during public health campaigns and other duties related to the health of your communities. We want to know your experiences doing your job during the dry, rainy and harvest seasons and what helps you bounce back from tough times or challenges during these periods, and how this relates to your well-being. This will help us know the best ways to support community health workers.

By being part of this study, you will not get direct benefits. But the information we learn will help us know how to better help community health workers stay well and do their jobs effectively. We will not pay you for joining the study, but we will give you phone credit each time we want to call you so that you can take our calls. The risks to you for taking part in this study are minimal. The main thing is the time you spend talking to us might mean you miss out on other activities or work. Remember, joining is completely your choice.

If you choose to help with this study, we will contact you three times to spend about 15 minutes asking you questions, once during each of the following periods: the dry season (April to May), the rainy season (August to September), and the harvest season (October to November). Please know that during the calls, you are free to stop the conversation and withdraw from the study at

any point. You may refuse to answer any of the questions, and you do not have to give the interviewer a reason. The information that you provide during our conversation will be completely anonymous.

All completed surveys and digit files will be password-protected and stored by the main investigator on www.sync.com and a uOttawa R drive for ten years and your name and address will not be recorded. Other researchers may ask to look at the anonymized data, and we may share it with them, provided that they respect the same rules of confidentiality. Study files may be accessed by the institutional Review Board at the Navrongo Health Research Centre, Navrongo, Ghana and The Faculty of Medicine, University of Ottawa ethics board.

I have read the information sheet provided or it has been read to me concerning this study and I understand what will be needed from me if I take part in this study, which will be a verbal phone interview.

Contact Information for Primary Investigator and Primary supervisor

If you have any further question about the study, feel free to contact the Principal Investigator: **James Kotuah Sakeah**: Tel: +1 *****, Email: ******; **Dr Alison Krentel**: Tel: +1 ***** ext. *****, Email: ******;

Contact for Additional Information (Ghana)

If you have any questions about your rights as a research participant in this study you may contact the Administrator of the Navrongo Health Research Centre Institutional Review Board P.O Box 114, Navrongo U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org.

Ethics review – University of Ottawa

This project has been reviewed and approved by the University of Ottawa Research Ethics Board as study [H-04-24-10186] and the Navrongo Health Research Centre Institutional Review Board as study [NHRCIITB600]. If you have any ethical concerns about the study, or the way it is conducted, please contact the University of Ottawa office of Research Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1613-562-5387.

My questions about this study have been answered by: _____.

I understand that at any time I may withdraw from this study without giving a reason and without having any effect on my access to health care.

I voluntarily agree to take part in this study ___Yes ___No

I agree to be called on phone ___Yes ___No

Verbal consent ___Yes ___No

Signature of the enumerator to write down that the informed consent has been read and the information sheet given to the respondent:

_____

Appendix 3.2 Letter of Information (English)

Title of Study: Longitudinal examination of seasonal resilience variations and their impact on the well-being of community health workers in Ghana

Principal Investigator: James Kotuah Sakeah: Tel: +1 ******, Email: *****

Supervisor: Dr Alison Krentel: Tel: +1 ******ext. ****, Email: *******

Funded By: International and Global Health Office (uOttawa)

Version Date: April 16, 2024

Introduction:

My name is _____ and I am from_____. As part of the study "Longitudinal examination of seasonal resilience variations and their impact on the well-being of community health workers in Ghana" we are asking 450 CHWs in your District to take part in a survey. This survey will help us understand how you manage to continue your work during the dry, rainy, and harvest (Fao) seasons despite facing challenges, and how this relates to your well-being. It is important that you understand why we are doing this study, so I will read the information sheet carefully. If you have any more questions, ask me and I will try to answer them for you.

We want to learn about the experiences of CHWs like you during public health campaigns and other duties related to the health of your communities. We want to know your experiences doing your job during the dry, rainy and harvest seasons and what helps you bounce back from tough times or challenges during these periods, and how this relates to your well-being. This will help us know the best ways to support community health workers.

By being part of this study, you will not get direct benefits. But the information we learn will help us know how to better help community health workers stay well and do their jobs effectively. We will not pay you for joining the study, but we will give you phone credit each time we want to call you so that you can take our calls. The risks to you for taking part in this study are minimal. The main thing is the time you spend talking to us might mean you miss out on other activities or work. Please note that this study is being conducted independently of the District Health Administration and the Ghana Health Service, and joining is completely your choice.

If you choose to participate in this study, we will contact you three times over the next year to spend about 15 minutes asking you some questions, once during each of the following periods:

the dry season (April to May), the rainy season (August to September), and the harvest season (October to November). At each of these times that we call you, we will ask you again if you still want to continue with the study. Please know that during the calls, you are free to stop the conversation and withdraw from the study at any point. You may refuse to answer any of the questions, and you do not have to give the interviewer a reason. If you choose to withdraw from the study, your data will be destroyed and not used further in the study. The information that you provide during these conversations will be anonymous, and people will not be able to identify you

As the conversation is taking place, the interviewer will be writing down your responses. All completed surveys and digit files will be password-protected and stored by the main investigator on www.sync.com and a uOttawa R drive for ten years and your name and address will not be recorded. Other researchers may ask to look at the anonymized data, and we may share it with them, provided that they respect the same rules of confidentiality. Study files may be accessed by the institutional Review Board at the Navrongo Health Research Centre, Navrongo, Ghana and the Research

Ethics Board at the University of Ottawa.

The information sheet has been read to me concerning this study and I understand what will be needed from me if I take part in this study, which will be three verbal phone interviews.

Contact Information for Primary Investigator and Primary supervisor

If I have any further question about the study, I will contact the Supervisor: **Dr Alison Krentel**: Tel: +1 ******* ext. ****, Email: *******and Principal Investigator: **James Kotuah Sakeah**: Tel: +1 *******, Email: ********

Contact for Additional Information (Ghana)

If I have any questions about my rights in this study, I may contact the Administrator of the Navrongo Health Research Centre Institutional Review Board P.O Box 114, Navrongo U/E Region, Ghana. Tel: (233) (0) 20-166-0158, Email: irb@navrongo-hrc.org.

Ethics review – University of Ottawa

This project has been reviewed and approved by the University of Ottawa Research Ethics Board as study [H-04-24-10186] and the Navrongo Health Research Centre Institutional Review Board as study [NHRCIITB600]. If I have any concerns about the study, or the way it is conducted, I will contact the University of Ottawa office of Research Ethics and Integrity via email: ethics@uottawa.ca, Tel: +1 613-562-5387.

Appendix 3.3 CHW Questionnaire (English)

UNIVERSITY OF OTTAWA

SCHOOL OF EPIDEMIOLOGY AND PUBLIC HEALTH

STUDY ID

C	H	W	1			

DATE

DD	MM	YY

We want your opinion considering these questions. Now answer the questions as they relate to you.

RRC-ARM						
Those issues below that you are asked, please answer how these relate to you						
		It is not like this	**A Little**	**Somewhat like this**	**Quite like this**	**A Lot as this**
1	I have people that I can respect in my life	☐	☐	☐	☐	☐
2	I come together and cooperate with the people around me	☐	☐	☐	☐	☐
3	Book qualifications and hand work are important for me	☐	☐	☐	☐	☐
4	I know how to handle myself well in the midst of people	☐	☐	☐	☐	☐
5	My family have usually supported me throughout my life	☐	☐	☐	☐	☐
6	My family know a lot of things about me	☐	☐	☐	☐	☐
7	If I am hungry, I can get food to eat	☐	☐	☐	☐	☐
8	Whatever thing I start, I try to finish it	☐	☐	☐	☐	☐
9	Things of God are a source of strength for me	☐	☐	☐	☐	☐
10	I am proud of my ancestral background	☐	☐	☐	☐	☐
11	People think that I am fun to be with	☐	☐	☐	☐	☐
12	Me and my family have conversations about how I feel	☐	☐	☐	☐	☐
13	I can solve my own problems without harming myself or others (e.g., without using drugs or being violent)	☐	☐	☐	☐	☐
14	My friends give me support and help	☐	☐	☐	☐	☐
15	I know where to get help in my community	☐	☐	☐	☐	☐
16	I feel and believe I belong in my community	☐	☐	☐	☐	☐
17	My family stands by me during difficult times	☐	☐	☐	☐	☐

18	My friends stand by me during difficult times	☐	☐	☐	☐	☐
19	I am treated fairly in my community	☐	☐	☐	☐	☐
20	I have ways to show others that I can act responsibly	☐	☐	☐	☐	☐
21	I am aware of where my own strengths are	☐	☐	☐	☐	☐
22	I join with people to participate in things of God and offering prayers	☐	☐	☐	☐	☐
23	I believe it is important to support my community	☐	☐	☐	☐	☐
24	I don't entertain any fears when I am with my family	☐	☐	☐	☐	☐
25	There are job opportunities available for me to demonstrate my skills acquired in life (like skills, a job, caring for others)	☐	☐	☐	☐	☐
26	I enjoy my partner's cultural and family traditions	☐	☐	☐	☐	☐
27	I enjoy my community's culture and traditions	☐	☐	☐	☐	☐
28	I am proud to be from _____ (insert community)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐

WHO-5 Well-being Index

Please respond to each item by marking one box per row, regarding how you felt in the last two weeks.		**All of the time**	**Most of the time**	**More than a week**	**Less than a week**	**Some of the time**	**Has not happened**
	I have felt happy and at peace with myself	☐	☐	☐	☐	☐	☐
	I have felt calm and relaxed	☐	☐	☐	☐	☐	☐
	I have felt active and strong	☐	☐	☐	☐	☐	☐
	I woke up feeling healthy and rested	☐	☐	☐	☐	☐	☐
	My daily life has been filled with things that bring me joy	☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐

DEMOGRAPHICS						
1	May I ask your age?					
2	Sex	Male	☐	Female	☐	
3	What is the highest level of schooling	Tertiary Education	☐	Senior High School	☐	Junior High School ☐
		Primary School	☐	Did not complete primary school	☐	Vocational Training ☐
		No Formal Education	☐			
4	What is your marital status?	Single	☐	I have a wife/husband	☐	Divorced ☐
		Other (Specify)		_____		
5	Do you have children?	Yes	☐	No	☐	
6	How many children do you have?					
7	What work do you do?	Agricultural work (e.g., farming, fishing)	☐	Homemaker/housewife	☐	Day worker (e.g., factory, construction) ☐
		Hand work (tailor, welder etc.)	☐	Student	☐	Small scale enterprise (e.g., Kiosk owner, market stall, etc.) ☐
		Private employment (e.g., bank, business, etc.)		Government work		No work
		Other (specify)	☐	_____		
8	Estimate your income level for your household	Less than GHC 10,000	☐	GHC 10,000 to 29,999	☐	GHC 30,000 to 49,999 ☐
		GHC 50,000 to 69,000	☐	Above GHC 70,000	☐	

CHW WORK-RELATED QUESTIONS							
9	Since you started working as a CHW, how many years now?	Not up to 1 year	☐	1 to 2 years	☐	Not up to 1 year	
10	What did you do to be selected as a CHW?	Community Health Management Committees (CHMCs)/Community	☐	Inherited/apprenticeship	☐	Through Radio	
		Through Nurse/Midwife	☐	Other (Specify)	☐		
		More than 5 years	☐				
11	How many health campaigns are you currently involved in?	Not currently involved	☐	One	☐	2 - 3	☐
		More than three	☐				
12	For the past three months, which health interventions have you engaged in?	Everyday work (Weighing, child health days, etc.,)	☐	NGO interventions (Interventions not part of routine work)	☐	Both	☐
		Through Nurse/Midwife	☐	Other (Specify)	☐		
13	In the past 3 months, have you received any form of transportation assistance for your work?	Yes	☐	No	☐		
14	What means of transportation do you typically utilize for your work as a CHW?	Walking	☐	Bicycle	☐	Motorbike	☐
		Public transport ("Cando", taxi)	☐	Other (specify)	_____		
15	For the past three months, which work tools have you been provided with?	Raincoat	☐	Wellington boots	☐	Torchlight	☐
		T-shirt	☐	Stationery (notepad, pens bag etc.)	☐	Promotional material and training booklets	
16	For the past 3-4 months have you learned anything concerning your work?	Yes	☐	No	☐	Can't remember	☐
	Has your head at work ensured that you are working well health duties?	Yes	☐	No	☐	Can't remember	☐
17	If yes, how frequently did you receive supervision whilst carrying out CHW related work?	Daily	☐	Weekly	☐	Monthly	☐
		As needed	☐				
18	As a CHW do you receive any pay?	Yes	☐	No	☐		
19	If yes, how often?	Consistently	☐	Not consistent	☐		

20	Do you receive any gifts that are not monetary?	Yes	☐	No	☐		
21	Do you do any other work in the community beyond being a CHW?	Yes	☐	No	☐		
		If yes, elaborate	_____				
22	Within these 3-6 months have these things occurred in your life?	Marriage	☐	Divorced	☐	Birth of a child	☐
		New job	☐	Death of a close family member	☐	Loss of primary household income	☐
		Suffered a violent act (robbery, physical assault)	☐	Experienced new disability	☐		☐
	CLIMATE CHANGE QUESTIONS						
23	The weather changes that we call climate change, how has it affected the local weather conditions in your community over the past ten years?	Has brought about bad change	☐	Somewhat bad change	☐	No noticeable change	☐
		Improved	☐	Not sure	☐		☐
24	In your experience as a volunteer (CHW), have you noticed any changes in the severity of climate-related events (e.g., heatwaves, floods) that impact your work?	Significant increase	☐	Slight increase	☐	No change	☐
		Slight decrease	☐	Significant decrease	☐	Not sure	☐
25	Can you describe any challenges you face when providing care during extreme weather events?	Increased workload	☐	Limited access to compounds	☐	Supply shortages	☐
		Communication difficulties	☐	Other (please specify)	_____		
26	How concerned are you about the long-term impacts of climate change on your health and well-being?	Very concerned	☐	Somewhat concerned	☐	Neutral	☐
		Not very concerned	☐	Not concerned at all	☐		☐

Thank you!

Appendix 3.4 CHW Questionnaire (Nankani)

UNIVERSITY OF OTTAWA

SCHOOL OF EPIDEMIOLOGY AND PUBLIC HEALTH

STUDY ID

SC	H	W	1			

DATE

DD	MM	YY

Taa yaaka fi popola a taa va benga dea po. Yaabi tulisi benga ale kadii atefi la.

RRC-ARM						
Wa ngai ale doa ate ma yaa nbeg fi la kase atefi? Tulisi kuli kadii fi jigi la						
		Ku daa nnaa	**Nnaa maga**	**Nnaa si dila la**	**Ku anye si dila la**	**Ku ka dila**
1	Mi taa nueriba kama azuli ba mi nyeboka po	☐	☐	☐	☐	☐
2	Mi a gumchaab ale nueribai ale moti mi la kama	☐	☐	☐	☐	☐
3	Gbang zamsika wei ale nisima tuima wei ka wa ngai ate mi kan de gbera ale nga	☐	☐	☐	☐	☐
4	Mi baga ayig mi dek nueriba po kama	☐	☐	☐	☐	☐
5	Mi dokdema a yiem ma ate mi maaka kama ataava nyeboka po	☐	☐	☐	☐	☐
6	Mi dokdema aseba mi wei ka yegayega	☐	☐	☐	☐	☐
7	Kom a dan ta mi, mi nya ngandienta a de kama	☐	☐	☐	☐	☐
8	Mi a dan piilim wari, mi a nuedi kama	☐	☐	☐	☐	☐
9	Naawen wei ka wa ngai ale ate mi pagrim	☐	☐	☐	☐	☐
10	Mi zug a zaka ma, mi koma ale mi kinni nying	☐	☐	☐	☐	☐
11	Nueriba a wein mi teng kalik masa kama	☐	☐	☐	☐	☐
12	Mi ale mi dokdema a biisi kama a taa vachaab ale mi nying po ale kadii la	☐	☐	☐	☐	☐
13	Mi dek baga mi wei ajaari kama ale kan basi ate ku ta daanika ajaam mi yaasi nueriba jigjya (asi., tiita neka, daam nyuka a yaasi girigiri nyeka)	☐	☐	☐	☐	☐
14	Mi vanchaama ate mi maarika kama	☐	☐	☐	☐	☐
15	Mi seba maamaka jigi mi naakuni po kama	☐	☐	☐	☐	☐
16	Mi ta seika kama ayen mi naakuni a tuesi mi kama	☐	☐	☐	☐	☐

17	Mi dokdema a za mi ngaang kama tuilim po	☐	☐	☐	☐	☐
18	Mi vanchaama a za mi ngaang kama tuilim po	☐	☐	☐	☐	☐
19	Mi naakuni po a nye mi a magsi kama	☐	☐	☐	☐	☐
20	Mi taa vuuta kama asag nueriba ayen mi baga anye a magsi kama	☐	☐	☐	☐	☐
21	Mi seba mi pagrim ale bo juejue la kama	☐	☐	☐	☐	☐
22	Mi a agumchaab ale nueriba Naawen wei ale wen juisika po kama	☐	☐	☐	☐	☐
23	Mi ta seika kama ayen kuka wa mang ayen ti pa maamaaka ate ti naakuni	☐	☐	☐	☐	☐
24	Mi a dan bo mi dokdema po, mi kpaziim a kan nagi	☐	☐	☐	☐	☐
25	Tuima a boro kama, ate mi baga toum (asi nisa tuima yaase fa nya wai zug la)	☐	☐	☐	☐	☐
26	Mi a yaa mi dokdena wa kobrum mu kama	☐	☐	☐	☐	☐
27	Mi a yaa mi naakuni kobrum mu kama	☐	☐	☐	☐	☐
28	Mi zug za kama mi ale nying _____ (pa naakuni yue a dueni)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐

WHO-5 Well-being Index

Tulisi benga dei a ta vachaab ale fi nyin ka po ale kadii bakoai buye wa dei pola		**Tam meena**	**Tam wa na yegayega**	**Ku ganye bakoai**	**Kun pai bakoai ya**	**Tam mu gela**	**Kun nye ya**
	Mi ta popientik ale suiyogni	☐	☐	☐	☐	☐	☐
	Mi ka na koum ale taa fasiyaa	☐	☐	☐	☐	☐	☐
	Mi ta ying pagra	☐	☐	☐	☐	☐	☐
	Mi ta yinyogsa ale vuusi chaka	☐	☐	☐	☐	☐	☐
	Mi da yeng po tuima a taka wa masa ajaam	☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐

DEMOGRAPHICS							
1	Fi ta bena ngai dinaa?						
2	Fi ka nidoa yaasi nipokgoa	Nidoa	☐	Nipok	☐		
3	Fi cheng sikuu pa ka bey?	Tertiary Education	☐	Senior High School	☐	Junior High School	☐
		Primary School	☐	Did not complete primary school	☐	Vocational Training	☐
		No Formal Education	☐				
4	Fi nipok faaka yaasi nidoa yaalika jigi kase?	Mi ka mi dek nyini	☐	Mi ta choroa/Nipok	☐	Yaalika kasi kama	☐
		Tulisi yong ale boro (wein ngai)		_____			
5	Fi ta binbansa?	Nguu	☐	Aiya	☐		
6	Fi ta binbansa badina?						
7	Fi tuima ale boa?	Kpari tuima (asi., kpari, kpikpelik)	☐	Dok Nipok	☐	Biday tuima(asi., concrete tuima)	☐
		Nisa tuima (tailor, welder etc.)	☐	Sikuubiik	☐	Wa ale da sitore fiik po kolima (asi., yaba sitore, yaase kioski la)	☐
		Nueriba ayaasi fidek tuima (asi., banki po tuima, gerung,)		Gomenti tuima		Mi ka tuima	
		Tulisi yong allim boro	☐	_____			
8	Fi dokdema ligri a paaka ka dina	Ku kan pai GHC 10,000	☐	GHC 10,000 to 29,999	☐	GHC 30,000 to 49,999	☐
		GHC 50,000 to 69,000	☐	Ku ganye GHC 70,000	☐		

CHW WORK-RELATED QUESTIONS							
9	Fi ale pilim yinyogsa wei tuima toumka naakuni po la ka bena ngai dina?	Kun pai bein ya	☐	Bein ta ga pai bena ngaiye	☐	Kun pai bein ya	
10	Fi nyegse tiba lueri fi ayen fa toum yinyogsa wei naakuni po?	Naakuni po yinyogsa wei tigsung ku	☐	Mi tuesi ka wai tueni atoum/ Mi zamisi kama	☐	Mi womi nyenika wireless wa zuk	
		Mi womi nyenka nursiwa jigi	☐	Tulisi yong allim boro	☐		
		Agaim bena nganu	☐				
11	Yinyogsa wei molisa si dina ate fi boa nye?	Min boa nye	☐	Bein	☐	Bena ngaye a taa pai bena ngata	☐
		Agaim bena ngata	☐				
12	Chiisa sita ngai ale taam la, fi toumi yinyogsa wei touminga dei?	Daa meena tuima (Bisa ale puusa magsika,)	☐	*NGO Maamaka (Maamaak ai ale kan gum daa meena tuima la)*	☐	Wei nga dei buyewa	☐
		Mi womi nyeni ka nursiwa jigi	☐	Tulisi yong ale boro	☐		
13	Chiisa sita ngai ale taam la, fi tuesi logri ligra amagsichaab ale tuiminga ate fi toumi la?	Nguu	☐	Aiya	☐		
14	Fi nyegse a cheng gai atoum fi tuiminga?	Nansa chelim	☐	Wusum	☐	Moto	☐
		Yaba logri (“Cando”)	☐	Tulisi yong allim boro		_____	
15	Chiisa sita ngai ale taam la tuima kollingma ngana ate ba pa te fi?	Mwaruk garuk	☐	Wellington boots	☐	Kana-ngmieng	☐
		Garuk	☐	Gbansa mwarisika kollima (gbangsa, penba,)	☐	Molika kollima ale gbansa	
16	Chiisa sita- sinansi ngai ale taam la, fi zamsi a ta vachaab ale fi tuiminga jigiya?	Nguu	☐	Aiya	☐	Mi kan teeri	☐
	Yingyogsa wei tuiminga ate fa toumi la, fi kpagni a nya asi fi touma a magsiya?	Nguu	☐	Aiya	☐	Mi kan teeri	☐
17	Fi dan siak nguu, ku bunoi budina ate ba ya asi fi touma a magsiya?	Da meena	☐	Bakoai bakoai	☐	Chiik chiik	☐
		Ku ni magsi	☐				

18	Yingyogsa wei tuiminga ate fi atoum la, tutuna a bo ku po?	Nguu	☐	Aiya	☐		
19	Fi dan siak nguu, tutuninga ajaam nalim nyini?	Tam meena	☐	Kan jam nalim nyini	☐		
20	Fi nya tiirim tii ale kan chim ligra?	Nguu	☐	Aiya	☐		
21	Fi maa toum tuini a ta bo naakuni po agum yingyogsa wei tuiminga?	Nguu	☐	Aiya	☐		
		Fi dan siak nguu, tok lak		_____			
22	Chiisa sita-siyuebi ngai ale taam la, wei nga dei anye bo fi vuum po:	Yalika/faaka	☐	Yalika kaasi	☐	Fi biak biik yaase fi nipok biak biik	☐
		Tuim paala	☐	Wai a kpi bo ni yeni po	☐	Ni jogi ni doku ligi dii a la nya ni zuk la	☐
		Zueba a vari fu ayaasi nueriba anak fu	☐	Nying po womsum paalim ajaam fi jigiya	☐		☐

CLIMATE CHANGE QUESTIONS

23	Weni ale tagri ate ba wein climate change la ku ta tagrun ajaam nama naakuni po bena pi ale taam la?	Ku ta tagrum biok ajaam	☐	Ku ta tagrun biok maga ajaam	☐	Tagrun ajaam ya	☐
		Tagrun nalung ajaami	☐	Mi potinze	☐		☐
24	Fi ale zain dii ya toum yingyogsa wei tuiminga la, fi nya weni tagrun a ta vachaab ale kantueng wulum yaasi nyiem mbobika?	Tagrun zueng	☐	Tagrun fiik	☐	Tagrun ajaam ya	☐
		Tagrun fiik	☐	Wei nga de asinteng ka na yega	☐	Mi potinze	☐
25	Fi nyiem a da atoum fi tuiminga weni tagrika ta wagrama ajaamu?	Ku nyiem basi a tin tuiminga a piisi kama	☐	Ku nyiem basi kama ate min baga ajo nueriba dabasa po a chagi	☐	Ku nyiem basi kama ate tuima koalima nyaka toa	☐
		Tok laka nyeim toa kama	☐	Tulisi yong allim boro		_____	
26	Weni tagrika ate fi popola a taa fachaab ale fi yingyogsa jigiya?	Ku ate mi popola paan	☐	Ku ate mi popola	☐	Mi ka tulisika	☐

			magamaga kama			
	Kun poti ma ate mi popola	☐	Ku kan ate mi popola ale maga	☐		☐

Fi jiam!

Appendix 3.5 CHW Questionnaire-Nankani Back Translation

Nankani Back translation

STUDY ID	C	H	W	1			

UNIVERSITY OF OTTAWA

SCHOOL OF EPIDEMIOLOGY AND PUBLIC HEALTH

DATE

DD	MM	YY

We want your opinion on the following questions. Please respond to these questions the way they apply to you.

RRC-ARM						
To what extent do the sentences below describe you? Circle one answer for each statement						
		Not at All	**A Little**	**Somewhat**	**Quite a Bit**	**A Lot**
1	I have people that I can respect in my life	☐	☐	☐	☐	☐
2	I cooperate with people with me	☐	☐	☐	☐	☐
3	Getting and improving qualifications or skills is important to me	☐	☐	☐	☐	☐
4	know how to behave in different social situations	☐	☐	☐	☐	☐
5	My family have always supported me through life	☐	☐	☐	☐	☐
6	My family know me very well	☐	☐	☐	☐	☐
7	If I am hungry, I can get food to eat	☐	☐	☐	☐	☐
8	I am trying to finish what I started	☐	☐	☐	☐	☐
9	Spiritual beliefs are a source of strength for me	☐	☐	☐	☐	☐
10	I am satisfied with my ethnic background	☐	☐	☐	☐	☐
11	People think that I am fun to be with	☐	☐	☐	☐	☐
12	I talk to my family/my partner about how I feel	☐	☐	☐	☐	☐

13	I can solve problems without affecting myself or others (e.g., without taking drugs or being violent)	☐	☐	☐	☐	☐
14	I think I am supported by my friends	☐	☐	☐	☐	☐
15	I know where I can get help in my community	☐	☐	☐	☐	☐
16	I think I am in my community	☐	☐	☐	☐	☐
17	My family are behind me during difficult times	☐	☐	☐	☐	☐
18	My friends are behind me during difficult times	☐	☐	☐	☐	☐
19	I am treated fairly in my community	☐	☐	☐	☐	☐
20	I have opportunities to show others that I can act responsibly	☐	☐	☐	☐	☐
21	I am aware of my own strengths	☐	☐	☐	☐	☐
22	I enjoy participating in organized prayers and thanksgiving	☐	☐	☐	☐	☐
23	I think it is important to support my community	☐	☐	☐	☐	☐
24	I feel safe if I am with my family	☐	☐	☐	☐	☐
25	I have chances to show that what I can do in my life (like skills, work, taking care of other people)	☐	☐	☐	☐	☐
26	I enjoy my family's/partner's cultural and family traditions	☐	☐	☐	☐	☐
27	I enjoy my community's culture and traditions	☐	☐	☐	☐	☐
28	I am pleased to come from _____ (put in community)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐

WHO-5 Well-being Index						
Please respond to each item by marking one box per row, regarding how you felt in the last two weeks.	**All of the time**	**Most of the time**	**More than half of**	**Less than half**	**Some of the time**	**There is no time**

				the time	**the time**		
	I have felt cheerful and in good spirit	☐	☐	☐	☐	☐	☐
	I have felt calm and relaxed	☐	☐	☐	☐	☐	☐
	I have felt active and vigorous	☐	☐	☐	☐	☐	☐
	I woke up feeling fresh and rested	☐	☐	☐	☐	☐	☐
	My daily life has been filled with things that interest me	☐	☐	☐	☐	☐	☐

DEMOGRAPHICS							
1	Can I ask your age?	☐					
2	Gender	Male	☐	Female	☐		
3	What is the highest level of your education?	Tertiary Education	☐	Senior High School	☐	Junior High School	☐
		Primary School	☐	Vocational Training	☐	No Formal Education	☐
4	What is your marital status?	Single	☐	Married	☐	Divorced	☐
		Other (Specify)		_____			
5	Do you have children?	Yes	☐	No	☐		
6	How many children do you have?	☐					
7	What is your main source of income?	Farmer	☐	Trader	☐	Teacher	☐
		Vocational work (tailor, welder etc.)	☐	Student	☐	Not employed	☐
		Other (specify)	☐	_____			
8	What is your approximate annual household income?	Less than GHC 10,000	☐	GHC 10,000 to 29,999	☐	GHC 30,000 to 49,999	☐

		GHC 50,000 to 69,000	☐	Above GHC 70,000	☐		
CHW WORK-RELATED QUESTIONS							
9	How many years have you worked as CHW?	Less than 1 year	☐	1 to 2 years	☐	3 to 5 years	☐
		More than 5 years	☐				
10	How many health campaigns or interventions are you currently involved in?	One	☐	More than one	☐		
11	Which type of volunteer work do you lean towards as a community health worker?	Vertical or NGO health interventions	☐	Routine health campaigns/interventions run by the district health administration			☐

12	Have you received any transportation support for your work?	Yes	☐	No	☐		
13	What means of transportation do you typically utilize for your work as a CHW?	Walking	☐	Bicycle	☐	Motorbike	☐
		Public transport ("Cando", taxi)	☐	Other (specify)	_____		
14	Which of the following resources or tools were provided to support your work?	Raincoat	☐	Wellington boots	☐	Torchlight	☐
15	How many times have you participated in job-specific training or professional development activities relevant to your work over the past year?	None	☐	Once	☐	Two or more	☐
16	How frequently do you typically receive supervision?	None	☐	Weekly	☐	Monthly	☐
		Quarterly	☐	Yearly	☐	As needed	☐
17	Do you receive any financial incentives for your work?	Yes	☐	No	☐		
18	If yes, how often?	Consistently	☐	Not consistent	☐		
19	Do you receive any non-financial rewards or incentives?	Yes	☐	No	☐		
20	Are you involved in any other community roles besides being a CHW?	Yes	☐	No	☐		
		If yes, specify	_____				
CLIMATE CHANGE QUESTIONS							
21	How has climate change affected the local climate patterns and weather conditions in your community over the past decade?	Significantly worsened	☐	Somewhat worsened	☐	No noticeable change	☐
		Improved	☐	Not sure	☐		☐
22	In your experience as a volunteer (CHW), have you noticed any changes in the frequency or severity of climate-related events (e.g., heatwaves, floods) that impact your work and the well-being of the community?	Significant increase	☐	Slight increase	☐	No change	☐

		Slight decrease	☐	Significant decrease	☐	Not sure	☐
23	Can you describe any challenges you and your fellow volunteers face when providing care during extreme weather events or seasonal changes?	Increased workload	☐	Limited access to compounds	☐	Supply shortages	☐
		Communication difficulties	☐	Other (please specify)	_____		
24	How concerned are you about the long-term impacts of climate change on the health and well-being of you and your community?	Very concerned	☐	Somewhat concerned	☐	Neutral	☐
		Not very concerned	☐	Not concerned at all	☐		☐

Thank you!

Appendix 3.6 CHW Questionnaire (Kasem)

Kasem Translation

UNIVERSITY OF OTTAWA

SCHOOL OF EPIDEMIOLOGY AND PUBLIC HEALTH

STUDY ID	**C**	**H**	**W**	**1**			

DATE			
	DD	MM	YY

Debam laga nmo de boboŋa mo bwoea yanto wone. A lwoora lere bwoea yam komaŋe de ya na ye tei ya pa nmo to.

RRC-ARM						
Taana yanto tiga kuri ne to bere nmo tɛtɛ mo? Kuri leera yam wone dedoa n pa taane maama						
		Awoo ko wo ke	**fifin**	**Ko nyi de ko daga fifin**	**Ko ba tini ko daga**	**Ko daga dedɛ**
1	Amo jege nɔɔna amo na wo wane'a zula amo ŋwia wone	☐	☐	☐	☐	☐
2	Amo wae a toŋe de nɔɔna na gilimi amo to	☐	☐	☐	☐	☐
3	Ka ta nɛ ye ka wole se zamsem naa yeino kɛ yiga is fifio mo ko pae' amo	☐	☐	☐	☐	☐
4	Amo yei amo na wo ja a tete tei tei nɔɔna wone totoŋa dwi dwi wone	☐	☐	☐	☐	☐
5	Maŋa maama amo diga tina zena amo mo a ŋwia wone.	☐	☐	☐	☐	☐
6	Amo diga tiina yei amo lanyirane	☐	☐	☐	☐	☐
7	Kana na jege amo, amo wo wane' a nɛ wodiu se'a di	☐	☐	☐	☐	☐
8	Amo yene a kwaane a ti kolo amo na bubu to	☐	☐	☐	☐	☐
9	Jworo wone boŋem mo ye mɛ kom na pae amo dam	☐	☐	☐	☐	☐
10	Amo jege wopolo de amo na ye dwi delo to	☐	☐	☐	☐	☐
11	Nɔɔna boŋe amo ye wolo ba na wora dedane amo wopolo wora mo	☐	☐	☐	☐	☐
12	Amo ŋwɔɔne dedane amo diga tina/amo baaro komaŋe de amo na boŋe tei to	☐	☐	☐	☐	☐

13	Amo wo wane a kwɛ chana na yi amo ye ko wo daane amo naa nɔɔna badwonna (e.g., liri kweim wo wole da naa ko taa ye jaara)	☐	☐	☐	☐	☐
14	Amo boŋe we amo badwona zenna amo	☐	☐	☐	☐	☐
15	Amo yei mɛ kom amo na wo nɛ wola amo katere dem wone	☐	☐	☐	☐	☐
16	Amo boŋe we amo toge' a wo amo katere dem wone	☐	☐	☐	☐	☐
17	Amo diga tina ziga' amo kwaga ne maŋa kalo ko na chamma to	☐	☐	☐	☐	☐
18	Amo badwonna ziga amo kwaga ne maŋa kalo amo na wo cham wone	☐	☐	☐	☐	☐
19	Ba ke' amo lanyirane amo katere dem wone	☐	☐	☐	☐	☐
20	Amo jege chowe se'a bere nɔɔna badwona we amo wo wane a toŋe de swoa	☐	☐	☐	☐	☐
21	Amo yei amo tete na wae kolo a ke to ni ne	☐	☐	☐	☐	☐
22	Amo toge'a ke Wɛ- choŋa totoŋa yalo ba na ni baŋane to	☐	☐	☐	☐	☐
23	Amo boŋe we ko fi mo se ba toge ba zene amo katere dem	☐	☐	☐	☐	☐
24	Amo ba fuuna amo na wora dedane a diga tiina	☐	☐	☐	☐	☐
25	Amo jege chowe se'a bere amo na wae kolo a ke amo ŋwia wone (nenɛne yeino, totoŋe, ka ni badwona baŋane)	☐	☐	☐	☐	☐
26	Amo laga amo diga tiina/ bwolu nabaara de diga tiina kekero	☐	☐	☐	☐	☐
27	Amo laga amo katere dem nabara wonnu de ba kekea wone	☐	☐	☐	☐	☐
28	Amo jege yiiro se'a noŋe _____ (ke katere dem da)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐
WHO-5 Well-being Index						

A lwoora ke maŋem "box" dedoa wone, gina dedoa ne se ko taa ye nmo leera ko pae woŋo dedoa komaŋe de nmo na ye tei tei bakwɛ yalee na kɛ to wone.		Maŋa maama	Maŋa dedɛ	Kodwoe Maŋa kam ka checher o	Ko wo yi Maŋa kam ka checher o	Maŋa kadwo ŋe	Maŋa tera
	Amo nɛ wopolo ye a ye wopolo yirane	☐	☐	☐	☐	☐	☐
	Amo ye chim mo ye a ye zim	☐	☐	☐	☐	☐	☐
	Amo nɛ dam ye amo ye dam yirane	☐	☐	☐	☐	☐	☐
	Amo zaŋe a ye dam yirane ye' a si a su	☐	☐	☐	☐	☐	☐
	Amo dɛ dɛ ŋwia su dedane wonnu amo na laga to	☐	☐	☐	☐	☐	☐

DEMOGRAPHICS							
1	Amo wo wane'a bwoe nmo bena na?	☐					
2	Baaron aa kaane	Male	☐	Female	☐		
3	Nmo vei sikuuli n yi yeim mo?	Tertiary Education	☐	Senior High School	☐	Junior High School	☐
		Primary School	☐	Vocational Training	☐	No Formal Education	☐
4	Nmo banzurem /kadiire wone ye tɛ tɛ mo?	Single	☐	Married	☐	Divorced	☐
		Other (Specify)	_____				
5	Nmo jege bia na?	Yes	☐	No	☐		
6	Nmo jege bia ba gra mo?	☐					
7	Bɛ woŋo baŋane mo chiki, nmo mae'n nɛ sabu?	Farmer	☐	Trader	☐	Teacher	☐
		Vocational work (tailor, welder etc.)	☐	Student	☐	Not employed	☐
		Other (specify)	☐	_____			

8	Nmo diga tiina nɛ sabu komaŋe de ba gra mo bene dem wone?	Less than GHC 10,000	☐	GHC 10,000 to 29,999	☐	GHC 30,000 to 49,999	☐
		GHC 50,000 to 69,000	☐	Above GHC 70,000	☐		
CHW WORK-RELATED QUESTIONS							
9	Bena ya gra mo, nmo na ye CHW ye' n toŋa?	Less than 1 year	☐	1 to 2 years	☐	3 to 5 years	☐
		More than 5 years	☐				
10	Pwoone yiga yizura labare naa totoŋa yɔ mo nmo wora n toŋa leleh konto?	One	☐	More than one	☐		
11	Nmo na ye katere yizura tontoŋeno to, ka sɛ ka toŋe ka pa totoŋe dɔ dwi mo toŋa de seine?	Vertical or NGO health interventions	☐	Routine health campaigns/interventions run by the district health administration			☐

Debam laga nmo de boboŋa mo bwoea yanto baŋane. A lwoora leere bwoea yam nenɛne ko na maŋe de mɛ na mŋe ko pa nmo to.

12	Have you received any transportation support for your work?	Yes	☐	No	☐		
13	What means of transportation do you typically utilize for your work as a CHW?	Walking	☐	Bicycle	☐	Motorbike	☐
		Public transport ("Cando", taxi)	☐	Other (specify)	_____		
14	Which of the following resources or tools were provided to support your work?	Raincoat	☐	Wellington boots	☐	Torchlight	☐
15	How many times have you participated in job-specific training or professional development activities relevant to your work over the past year?	None	☐	Once	☐	Two or more	☐
16	How frequently do you typically receive supervision?	None	☐	Weekly	☐	Monthly	☐
		Quarterly	☐	Yearly	☐	As needed	☐
17	Do you receive any financial incentives for your work?	Yes	☐	No	☐		
18	If yes, how often?	Consistently	☐	Not consistent	☐		
19	Do you receive any non-financial rewards or incentives?	Yes	☐	No	☐		
20	Are you involved in any other community roles besides being a CHW?	Yes	☐	No	☐		
		If yes, specify	_____				
CLIMATE CHANGE QUESTIONS							
21	How has climate change affected the local climate patterns and weather conditions in your community over the past decade?	Significantly worsened	☐	Somewhat worsened	☐	No noticeable change	☐
		Improved	☐	Not sure	☐		☐
22	In your experience as a volunteer (CHW), have you noticed any changes in the frequency or severity of climate-related events (e.g., heatwaves, floods) that impact your work and the well-being of the community?	Significant increase	☐	Slight increase	☐	No change	☐

		Slight decrease	☐	Significant decrease	☐	Not sure	☐
23	Can you describe any challenges you and your fellow volunteers face when providing care during extreme weather events or seasonal changes?	Increased workload	☐	Limited access to compounds	☐	Supply shortages	☐
		Communication difficulties	☐	Other (please specify)	_____		
24	How concerned are you about the long-term impacts of climate change on the health and well-being of you and your community?	Very concerned	☐	Somewhat concerned	☐	Neutral	☐
		Not very concerned	☐	Not concerned at all	☐		☐

Thank you!

Appendix 3.7 CHW Questionnaire-Kasem Back Translation

Kasem Back translation

STUDY ID	**C**	**H**	**W**	**1**			

UNIVERSITY OF OTTAWA

SCHOOL OF EPIDEMIOLOGY AND PUBLIC HEALTH

DATE

DD	MM	YY

We want your opinion on the following questions. Please respond to these questions the way they apply to you.

RRC-ARM						
How do these sentences below describe? Choose one answer for each statement						
		Never	**A Little**	**Somewhat**	**Quite a Bit**	**A Lot**
1	I have people that I can respect in my life	☐	☐	☐	☐	☐
2	I cooperate with people around me	☐	☐	☐	☐	☐
3	Getting and helping to improve learning or skills is important for me	☐	☐	☐	☐	☐
4	I know how to behave in different public situations	☐	☐	☐	☐	☐
5	My family always support me through life	☐	☐	☐	☐	☐
6	My family know too well about me	☐	☐	☐	☐	☐
7	If I am hungry, I can get food to eat	☐	☐	☐	☐	☐
8	I try and finish what I have started	☐	☐	☐	☐	☐
9	Things of God are a source of strength for me	☐	☐	☐	☐	☐
10	I am satisfied with my ethnic background	☐	☐	☐	☐	☐
11	People think I am someone to be with fun	☐	☐	☐	☐	☐
12	I talk to my family/husband about how I feel	☐	☐	☐	☐	☐
13	I can solve problems that affect me without affecting me or other people (e.g., without taking drugs or being violent)	☐	☐	☐	☐	☐

14	I feel that my friends support me	☐	☐	☐	☐	☐
15	I know where to get help in my community	☐	☐	☐	☐	☐
16	I feel that I am part of this community	☐	☐	☐	☐	☐
17	My family are with me during difficult times	☐	☐	☐	☐	☐
18	My friends are with me during difficult times	☐	☐	☐	☐	☐
19	I am treated well in my community	☐	☐	☐	☐	☐
20	I have chances to show other people that I can act responsibly	☐	☐	☐	☐	☐
21	I know of my own strengths	☐	☐	☐	☐	☐
22	I take part in religious works that are organized	☐	☐	☐	☐	☐
23	I think that it is important to support my community	☐	☐	☐	☐	☐
24	I am not afraid when I am with my family	☐	☐	☐	☐	☐
25	I have chances to show what I can do in life (like skills, job, caring for others)	☐	☐	☐	☐	☐
26	I like my family/partner's culture and family traditions	☐	☐	☐	☐	☐
27	I like my community's culture and their traditions	☐	☐	☐	☐	☐
28	I am satisfied that I come from _____ (enter the community)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐

WHO-5 Well-being Index

Please respond to each item by marking one box per row, regarding how you felt in the last two weeks.		**All the time**	**Most of the time**	**More than half of the time**	**Less than half of the time**	**Some of the time**	**There is no time**
	I have been happy and I am full of happiness	☐	☐	☐	☐	☐	☐
	I am quite and relaxed	☐	☐	☐	☐	☐	☐
	I am strong and full of energy	☐	☐	☐	☐	☐	☐

	I woke up feeling strong and rested	☐	☐	☐	☐	☐	☐
	My daily life is filled with things that I like	☐	☐	☐	☐	☐	☐

DEMOGRAPHICS							
1	Can I ask about your age?	☐					
2	Gender	Male	☐	Female	☐		
3	What is the highest level of your education?	Tertiary Education	☐	Senior High School	☐	Junior High School	☐
		Primary School	☐	Vocational Training	☐	No Formal Education	☐
4	What is your marital status?	Single	☐	Married	☐	Divorced	☐
		Other (Specify)		_____			
5	Do you have children?	Yes	☐	No	☐		
6	How many children do you have?	☐					
7	What is your main source of income?	Farmer	☐	Trader	☐	Teacher	☐
		Vocational work (tailor, welder etc.)	☐	Student	☐	Not employed	☐
		Other (specify)	☐	_____			
8	What is estimated income for the household do you get annually?	Less than GHC 10,000	☐	GHC 10,000 to 29,999	☐	GHC 30,000 to 49,999	☐
		GHC 50,000 to 69,000	☐	Above GHC 70,000	☐		
CHW WORK-RELATED QUESTIONS							

9	How many years have you worked as CHW?	Less than 1 year	☐	1 to 2 years	☐	3 to 5 years	☐
		More than 5 years	☐				
10	How many health campaigns or are you involved in currently?	One	☐	More than one	☐		
11	Which type of voluntary work that work towards?	Vertical or NGO health interventions	☐	Routine health campaigns/interventions run by the district health administration			☐

12	Have you received any transportation support for your work?	Yes	☐	No	☐		
13	What means of transportation do you typically utilize for your work as a CHW?	Walking	☐	Bicycle	☐	Motorbike	☐
		Public transport ("Cando", taxi)	☐	Other (specify)	_____		
14	Which of the following resources or tools were provided to support your work?	Raincoat	☐	Wellington boots	☐	Torchlight	☐
15	How many times have you participated in job-specific training or professional development activities relevant to your work over the past year?	None	☐	Once	☐	Two or more	☐
16	How frequently do you typically receive supervision?	None	☐	Weekly	☐	Monthly	☐
		Quarterly	☐	Yearly	☐	As needed	☐
17	Do you receive any financial incentives for your work?	Yes	☐	No	☐		
18	If yes, how often?	Consistently	☐	Not consistent	☐		
19	Do you receive any non-financial rewards or incentives?	Yes	☐	No	☐		
20	Are you involved in any other community roles besides being a CHW?	Yes	☐	No	☐		
		If yes, specify	_____				
CLIMATE CHANGE QUESTIONS							
21	How has climate change affected the local climate patterns and weather conditions in your community over the past decade?	Significantly worsened	☐	Somewhat worsened	☐	No noticeable change	☐
		Improved	☐	Not sure	☐		☐
22	In your experience as a volunteer (CHW), have you noticed any changes in the frequency or severity of climate-related events (e.g., heatwaves, floods) that impact your work and the well-being of the community?	Significant increase	☐	Slight increase	☐	No change	☐

		Slight decrease	☐	Significant decrease	☐	Not sure	☐
23	Can you describe any challenges you and your fellow volunteers face when providing care during extreme weather events or seasonal changes?	Increased workload	☐	Limited access to compounds	☐	Supply shortages	☐
		Communication difficulties	☐	Other (please specify)	_____		
24	How concerned are you about the long-term impacts of climate change on the health and well-being of you and your community?	Very concerned	☐	Somewhat concerned	☐	Neutral	☐
		Not very concerned	☐	Not concerned at all	☐		☐

Thank you!

Appendix 3.8 CHW Questionnaire (Buli)

UNIVERSITY OF OTTAWA

SCHOOL OF EPIDEMIOLOGY AND PUBLIC HEALTH

STUDY ID

SC	H	W	1			

DATE

DD	MM	YY

Taa yaaka fi popola a taa va benga dea po. Yaabi tulisi benga ale kadii atefi la.

RRC-ARM						
Wa ngai ale doa ate ma yaa nbeg fi la kase atefi? Tulisi kuli kadii fi jigi la						
		Ku daa nnaa	**Nnaa maga**	**Nnaa si dila la**	**Ku anye si dila la**	**Ku ka dila**
1	Mi taa nueriba kama azuli ba mi nyeboka po	☐	☐	☐	☐	☐
2	Mi a gumchaab ale nueribai ale moti mi la kama	☐	☐	☐	☐	☐
3	Gbang zamsika wei ale nisima tuima wei ka wa ngai ate mi kan de gbera ale nga	☐	☐	☐	☐	☐
4	Mi baga ayig mi dek nueriba po kama	☐	☐	☐	☐	☐
5	Mi dokdema a yiem ma ate mi maaka kama ataava nyeboka po	☐	☐	☐	☐	☐
6	Mi dokdema aseba mi wei ka yegayega	☐	☐	☐	☐	☐
7	Kom a dan ta mi, mi nya ngandienta a de kama	☐	☐	☐	☐	☐
8	Mi a dan piilim wari, mi a nuedi kama	☐	☐	☐	☐	☐
9	Naawen wei ka wa ngai ale ate mi pagrim	☐	☐	☐	☐	☐
10	Mi zug a zaka ma, mi koma ale mi kinni nying	☐	☐	☐	☐	☐
11	Nueriba a wein mi teng kalik masa kama	☐	☐	☐	☐	☐
12	Mi ale mi dokdema a biisi kama a taa vachaab ale mi nying po ale kadii la	☐	☐	☐	☐	☐
13	Mi dek baga mi wei ajaari kama ale kan basi ate ku ta daanika ajaam mi yaasi nueriba jigjya (asi., tiita neka, daam nyuka a yaasi girigiri nyeka)	☐	☐	☐	☐	☐
14	Mi vanchaama ate mi maarika kama	☐	☐	☐	☐	☐
15	Mi seba maamaka jigi mi naakuni po kama	☐	☐	☐	☐	☐
16	Mi ta seika kama ayen mi naakuni a tuesi mi kama	☐	☐	☐	☐	☐

17	Mi dokdema a za mi ngaang kama tuilim po	☐	☐	☐	☐	☐
18	Mi vanchaama a za mi ngaang kama tuilim po	☐	☐	☐	☐	☐
19	Mi naakuni po a nye mi a magsi kama	☐	☐	☐	☐	☐
20	Mi taa vuuta kama asag nueriba ayen mi baga anye a magsi kama	☐	☐	☐	☐	☐
21	Mi seba mi pagrim ale bo juejue la kama	☐	☐	☐	☐	☐
22	Mi a agumchaab ale nueriba Naawen wei ale wen juisika po kama	☐	☐	☐	☐	☐
23	Mi ta seika kama ayen kuka wa mang ayen ti pa maamaaka ate ti naakuni	☐	☐	☐	☐	☐
24	Mi a dan bo mi dokdema po, mi kpaziim a kan nagi	☐	☐	☐	☐	☐
25	Tuima a boro kama, ate mi baga toum (asi nisa tuima yaase fa nya wai zug la)	☐	☐	☐	☐	☐
26	Mi a yaa mi dokdena wa kobrum mu kama	☐	☐	☐	☐	☐
27	Mi a yaa mi naakuni kobrum mu kama	☐	☐	☐	☐	☐
28	Mi zug za kama mi ale nying _____ (pa naakuni yue a dueni)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐

WHO-5 Well-being Index

Tulisi benga dei a ta vachaab ale fi nyin ka po ale kadii bakoai buye wa dei pola		**Tam meena**	**Tam wa na yegayega**	**Ku ganye bakoai**	**Kun pai bakoai ya**	**Tam mu gela**	**Kun nye ya**
	Mi ta popientik ale suiyogni	☐	☐	☐	☐	☐	☐
	Mi ka na koum ale taa fasiyaa	☐	☐	☐	☐	☐	☐
	Mi ta ying pagra	☐	☐	☐	☐	☐	☐
	Mi ta yinyogsa ale vuusi chaka	☐	☐	☐	☐	☐	☐
	Mi da yeng po tuima a taka wa masa ajaam	☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐

DEMOGRAPHICS							
1	Fi ta bena ngai dinaa?						
2	Fi ka nidoa yaasi nipokgoa	Nidoa	☐	Nipok	☐		
3	Fi cheng sikuu pa ka bey?	Tertiary Education	☐	Senior High School	☐	Junior High School	☐
		Primary School	☐	Did not complete primary school	☐	Vocational Training	☐
		No Formal Education	☐				
4	Fi nipok faaka yaasi nidoa yaalika jigi kase?	Mi ka mi dek nyini	☐	Mi ta choroa/Nipok	☐	Yaalika kasi kama	☐
		Tulisi yong ale boro (wein ngai)		_____			
5	Fi ta binbansa?	Nguu	☐	Aiya	☐		
6	Fi ta binbansa badina?						
7	Fi tuima ale boa?	Kpari tuima (asi., kpari, kpikpelik)	☐	Dok Nipok	☐	Biday tuima(asi., concrete tuima)	☐
		Nisa tuima (tailor, welder etc.)	☐	Sikuubiik	☐	Wa ale da sitore fiik po kolima (asi., yaba sitore, yaase kioski la)	☐
		Nueriba ayaasi fidek tuima (asi., banki po tuima, gerung,)		Gomenti tuima		Mi ka tuima	
		Tulisi yong allim boro	☐	_____			
8	Fi dokdema ligri a paaka ka dina	Ku kan pai GHC 10,000	☐	GHC 10,000 to 29,999	☐	GHC 30,000 to 49,999	☐
		GHC 50,000 to 69,000	☐	Ku ganye GHC 70,000	☐		

CHW WORK-RELATED QUESTIONS							
9	Fi ale pilim yinyogsa wei tuima toumka naakuni po la ka bena ngai dina?	Kun pai bein ya	☐	Bein ta ga pai bena ngaiye	☐	Kun pai bein ya	
10	Fi nyegse tiba lueri fi ayen fa toum yinyogsa wei naakuni po?	Naakuni po yinyogsa wei tigsung ku	☐	Mi tuesi ka wai tueni atoum/ Mi zamisi kama	☐	Mi womi nyenika wireless wa zuk	
		Mi womi nyenka nursiwa jigi	☐	Tulisi yong allim boro	☐		
		Agaim bena nganu	☐				
11	Yinyogsa wei molisa si dina ate fi boa nye?	Min boa nye	☐	Bein	☐	Bena ngaye a taa pai bena ngata	☐
		Agaim bena ngata	☐				
12	Chiisa sita ngai ale taam la, fi toumi yinyogsa wei touminga dei?	Daa meena tuima (Bisa ale puusa magsika,)	☐	*NGO Maamaka (Maamaakai ale kan gum daa meena tuima la)*	☐	Wei nga dei buyewa	☐
		Mi womi nyeni ka nursiwa jigi	☐	Tulisi yong ale boro	☐		
13	Chiisa sita ngai ale taam la, fi tuesi logri ligra amagsichaab ale tuiminga ate fi toumi la?	Nguu	☐	Aiya	☐		
14	Fi nyegse a cheng gai atoum fi tuiminga?	Nansa chelim	☐	Wusum	☐	Moto	☐
		Yaba logri (“Cando”)	☐	Tulisi yong allim boro		_____	
15	Chiisa sita ngai ale taam la tuima kollingma ngana ate ba pa te fi?	Mwaruk garuk	☐	Wellington boots	☐	Kana-ngmieng	☐
		Garuk	☐	Gbansa mwarisika kollima (gbangsa, penba,)	☐	Molika kollima ale gbansa	
16	Chiisa sita- sinansi ngai ale taam la, fi zamsi a ta vachaab ale fi tuiminga jigiya?	Nguu	☐	Aiya	☐	Mi kan teeri	☐
	Yingyogsa wei tuiminga ate fa toumi la, fi kpagni a nya asi fi touma a magsiya?	Nguu	☐	Aiya	☐	Mi kan teeri	☐
17	Fi dan siak nguu, ku bunoi budina ate ba ya asi fi touma a magsiya?	Da meena	☐	Bakoai bakoai	☐	Chiik chiik	☐
		Ku ni magsi	☐				
18	Yingyogsa wei tuiminga ate fi atoum la, tutuna a bo ku po?	Nguu	☐	Aiya	☐		

19	Fi dan siak nguu, tutuninga ajaam nalim nyini?	Tam meena	☐	Kan jam nalim nyini	☐		
20	Fi nya tiirim tii ale kan chim ligra?	Nguu	☐	Aiya	☐		
21	Fi maa toum tuini a ta bo naakuni po agum yingyogsa wei tuiminga?	Nguu	☐	Aiya	☐		
		Fi dan siak nguu, tok lak		_____			
22	Chiisa sita-siyuebi ngai ale taam la, wei nga dei anye bo fi vuum po:	Yalika/faaka	☐	Yalika kaasi	☐	Fi biak biik yaase fi nipok biak biik	☐
		Tuim paala	☐	Wai a kpi bo ni yeni po	☐	Ni jogi ni doku ligi dii a la nya ni zuk la	☐
		Zueba a vari fu ayaasi nueriba anak fu	☐	Nying po womsum paalim ajaam fi jigiya	☐		☐

CLIMATE CHANGE QUESTIONS

23	Weni ale tagri ate ba wein climate change la ku ta tagrun ajaam nama naakuni po bena pi ale taam la?	Ku ta tagrum biok ajaam	☐	Ku ta tagrun biok maga ajaam	☐	Tagrun ajaam ya	☐
		Tagrun nalung ajaami	☐	Mi potinze	☐		☐
24	Fi ale zain dii ya toum yingyogsa wei tuiminga la, fi nya weni tagrun a ta vachaab ale kantueng wulum yaasi nyiem mbobika?	Tagrun zueng	☐	Tagrun fiik	☐	Tagrun ajaam ya	☐
		Tagrun fiik	☐	Wei nga de asinteng ka na yega	☐	Mi potinze	☐
25	Fi nyiem a da atoum fi tuiminga weni tagrika ta wagrama ajaamu?	Ku nyiem basi a tin tuiminga a piisi kama	☐	Ku nyiem basi kama ate min baga ajo nueriba dabasa po a chagi	☐	Ku nyiem basi kama ate tuima koalima nyaka toa	☐
		Tok laka nyeim toa kama	☐	Tulisi yong allim boro		_____	
26	Weni tagrika ate fi popola a taa fachaab ale fi yingyogsa jigiya?	Ku ate mi popola paan	☐	Ku ate mi popola magamaga kama	☐	Mi ka tulisika	☐

	Kun poti ma ate mi popola	☐	Ku kan ate mi popola ale maga	☐	☐

Fi jiam!

Appendix 3.9 CHW Questionnaire-Buli Back Translation

STUDY ID

C	H	W	1			

UNIVERSITY OF OTTAWA

SCHOOL OF EPIDEMIOLOGY AND PUBLIC HEALTH

DATE

DD	MM	YY

We want your opinion considering these questions. Now answer the questions as they relate to you.

RRC-ARM

Those issues below that you are asked, please answer how these relate to you

		It is not like this	A Little	Somewhat like this	Quite like this	A Lot as this
1	I have people that I can respect in my life	☐	☐	☐	☐	☐
2	I come together and cooperate with the people around me	☐	☐	☐	☐	☐
3	Book qualifications and hand work are important for me	☐	☐	☐	☐	☐
4	I know how to handle myself well in the midst of people	☐	☐	☐	☐	☐
5	My family have usually supported me throughout my life	☐	☐	☐	☐	☐
6	My family know a lot of things about me	☐	☐	☐	☐	☐
7	If I am hungry, I can get food to eat	☐	☐	☐	☐	☐
8	Whatever thing I start, I try to finish it	☐	☐	☐	☐	☐
9	Things of God are a source of strength for me	☐	☐	☐	☐	☐
10	I am proud of my ancestral background	☐	☐	☐	☐	☐
11	People think that I am fun to be with	☐	☐	☐	☐	☐
12	Me and my family have conversations about how I feel	☐	☐	☐	☐	☐
13	I can solve my own problems without harming myself or others (e.g., without using drugs or being violent)	☐	☐	☐	☐	☐
14	My friends give me support and help	☐	☐	☐	☐	☐
15	I know where to get help in my community	☐	☐	☐	☐	☐
16	I feel and believe I belong in my community	☐	☐	☐	☐	☐

17	My family stands by me during difficult times	☐	☐	☐	☐	☐
18	My friends stand by me during difficult times	☐	☐	☐	☐	☐
19	I am treated fairly in my community	☐	☐	☐	☐	☐
20	I have ways to show others that I can act responsibly	☐	☐	☐	☐	☐
21	I am aware of where my own strengths are	☐	☐	☐	☐	☐
22	I join with people to participate in things of God and offering prayers	☐	☐	☐	☐	☐
23	I believe it is important to support my community	☐	☐	☐	☐	☐
24	I don't entertain any fears when I am with my family	☐	☐	☐	☐	☐
25	There are job opportunities available for me to demonstrate my skills acquired in life (like skills, a job, caring for others)	☐	☐	☐	☐	☐
26	I enjoy my partner's cultural and family traditions	☐	☐	☐	☐	☐
27	I enjoy my community's culture and traditions	☐	☐	☐	☐	☐
28	I am proud to be from _____ (insert community)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐

WHO-5 Well-being Index

Please respond to each item by marking one box per row, regarding how you felt in the last two weeks.		**All of the time**	**Most of the time**	**More than a week**	**Less than a week**	**Some of the time**	**Has not happened**
	I have felt happy and at peace with myself	☐	☐	☐	☐	☐	☐
	I have felt calm and relaxed	☐	☐	☐	☐	☐	☐
	I have felt active and strong	☐	☐	☐	☐	☐	☐
	I woke up feeling healthy and rested	☐	☐	☐	☐	☐	☐
	My daily life has been filled with things that bring me joy	☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐

		☐	☐	☐	☐	☐	☐

DEMOGRAPHICS

1	May I ask your age?						
2	Sex	Male	☐	Female	☐		
3	What is the highest level of schooling	Tertiary Education	☐	Senior High School	☐	Junior High School	☐
		Primary School	☐	Did not complete primary school	☐	Vocational Training	☐
		No Formal Education	☐				
4	What is your marital status?	Single	☐	I have a wife/husband	☐	Divorced	☐
		Other (Specify)		_____			
5	Do you have children?	Yes	☐	No	☐		
6	How many children do you have?						
7	What work do you do?	Agricultural work (e.g., farming, fishing)	☐	Homemaker/housewife	☐	Day worker (e.g., factory, construction)	☐
		Hand work (tailor, welder etc.)	☐	Student	☐	Small scale enterprise (e.g., Kiosk owner, market stall, etc.)	☐
		Private employment (e.g., bank, business, etc.)		Government work		No work	
		Other (specify)	☐	_____			
8	Estimate your income level for your household	Less than GHC 10,000	☐	GHC 10,000 to 29,999	☐	GHC 30,000 to 49,999	☐
		GHC 50,000 to 69,000	☐	Above GHC 70,000	☐		

CHW WORK-RELATED QUESTIONS							
9	Since you started working as a CHW, how many years now?	Not up to 1 year	☐	1 to 2 years	☐	Not up to 1 year	
10	What did you do to be selected as a CHW?	Community Health Management Committees (CHMCs)/Community	☐	Inherited/apprenticeship	☐	Through Radio	
		Through Nurse/Midwife	☐	Other (Specify)	☐		
		More than 5 years	☐				
11	How many health campaigns are you currently involved in?	Not currently involved	☐	One	☐	2 - 3	☐
		More than three	☐				
12	For the past three months, which health interventions have you engaged in?	Everyday work (Weighing, child health days, etc.,)	☐	NGO interventions (Interventions not part of routine work)	☐	Both	☐
		Through Nurse/Midwife	☐	Other (Specify)	☐		
13	In the past 3 months, have you received any form of transportation assistance for your work?	Yes	☐	No	☐		
14	What means of transportation do you typically utilize for your work as a CHW?	Walking	☐	Bicycle	☐	Motorbike	☐
		Public transport ("Cando", taxi)	☐	Other (specify)	_____		
15	For the past three months, which work tools have you been provided with?	Raincoat	☐	Wellington boots	☐	Torchlight	☐
		T-shirt	☐	Stationery (notepad, pens bag etc.)	☐	Promotional material and training booklets	
16	For the past 3-4 months have you learned anything concerning your work?	Yes	☐	No	☐	Can't remember	☐
	Has your head at work ensured that you are working well health duties?	Yes	☐	No	☐	Can't remember	☐
17	If yes, how frequently did you receive supervision whilst carrying out CHW related work?	Daily	☐	Weekly	☐	Monthly	☐
		As needed	☐				
18	As a CHW do you receive any pay?	Yes	☐	No	☐		
19	If yes, how often?	Consistently	☐	Not consistent	☐		

20	Do you receive any gifts that are not monetary?	Yes	☐	No	☐		
21	Do you do any other work in the community beyond being a CHW?	Yes	☐	No	☐		
		If yes, elaborate	_____				
22	Within these 3-6 months have these things occurred in your life?	Marriage	☐	Divorced	☐	Birth of a child	☐
		New job	☐	Death of a close family member	☐	Loss of primary household income	☐
		Suffered a violent act (robbery, physical assault)	☐	Experienced new disability	☐		☐
	CLIMATE CHANGE QUESTIONS						
23	The weather changes that we call climate change, how has it affected the local weather conditions in your community over the past ten years?	Has brought about bad change	☐	Somewhat bad change	☐	No noticeable change	☐
		Improved	☐	Not sure	☐		☐
24	In your experience as a volunteer (CHW), have you noticed any changes in the severity of climate-related events (e.g., heatwaves, floods) that impact your work?	Significant increase	☐	Slight increase	☐	No change	☐
		Slight decrease	☐	Significant decrease	☐	Not sure	☐
25	Can you describe any challenges you face when providing care during extreme weather events?	Increased workload	☐	Limited access to compounds	☐	Supply shortages	☐
		Communication difficulties	☐	Other (please specify)	_____		
26	How concerned are you about the long-term impacts of climate change on your health and well-being?	Very concerned	☐	Somewhat concerned	☐	Neutral	☐
		Not very concerned	☐	Not concerned at all	☐		☐

Thank you!

Appendix 3.10 Verbal Script

Verbal Script

Hello, my name is _____ and I'm a student (or I am representing a student) at the University of Ottawa in Ontario, Canada. We are conducting a study called "Longitudinal examination of seasonal resilience variations and their impact on the well-being of community health workers in Ghana" and I would like to invite you to participate. We are interested in understanding your experiences as a community health worker and the factors that contribute to your well-being in your role.

We will be recruiting CHWs who meet the following criteria from the list of CHWs at your District Health Administration:

- CHWs who are currently active in their duties
- CHWs who have phones

If you meet the criteria from our list, we will contact you by phone to participate. If you agree, we will call you three times within the year: once in the dry season (April to May), once in the rainy season (August to September), and once during the harvest season (October to November). Each call will involve completing a survey that will take approximately 15-25 minutes. Some of the personal information we will be collecting during this survey will include things such as age, sex, education level, marital status, number of children, primary source of household income, and number CHW years. Your name will not be included but you will be assigned an ID to ensure confidentiality.

Please note that this study is being conducted independently of the District Health Administration and the Ghana Health Service.

If you are interested in knowing more about the study, please feel free to reach out to me through the provided contact information:

Phone number: ******* (a local phone number will also be acquired in Ghana)

Email: ********

Do you have any questions?

Thank you for considering participating in our study