# THE PERFORMANCE OF COMMUNITY HEALTH WORKERS IN AN INTEGRATED COMMUNITY CASE MANAGEMENT PROGRAM IN BURKINA FASO

by
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# Abstract

BACKGROUND: Integrated community case management (iCCM) is receiving increasing attention as a strategy to reduce child mortality in low-resource settings, yet the evidence for how to effectively implement large-scale iCCM programs is limited. A better understanding of community health worker (CHW) performance, and the factors that influence performance, will help to improve program implementation and impact. This dissertation examines CHW performance in an iCCM program in Burkina Faso.

METHODS: Quantitative data were collected from a cross-sectional survey of CHWs (n=386) using a structured questionnaire, inspection of drug kits and patient registers, and direct observation of 1 or 2 sick-child consultations per CHW, with gold standard re-examination by a trained clinician. Summary measures of performance were constructed and multi-linear regression analysis was used to explain variation in these measures. Qualitative data were collected from CHWs (n=52), supervisors (n=27), and caregivers (n=120), using in-depth interviews and focus groups, and analyzed by comparing and contrasting transcripts coded according to pre-established themes.

RESULTS: CHW performance varies greatly by task and district. Most illnesses are correctly classified (77%), but, on average, CHWs have only 38% of the drugs they need, and when CHWs do have drugs, they correctly treat illnesses in only 33% of cases. Performance is associated with a CHW's age, literacy, and education, and health system factors such as district and the time since most recent supervision. Qualitative analysis affirmed supervision as an important determinant of performance, not only for skills development, but for

motivation and for facilitating relationships between CHWs and village members. High- and low-performing CHWs struggle with health-facility stockouts, lack of financial incentives, and minimal community support.

CONCLUSIONS: Measuring CHW performance is important for overcoming iCCM implementation challenges. Summary measures of CHW performance that reflect multiple domains of performance could, along with other measures and data use approaches, help to strengthen data use and improve decision-making. Proactive supervision from motivated supervisors has a profound effect on CHW performance. Strategies to improve performance should emphasize the *quality* of program processes, recognizing the importance of how national policies are put into practice at the district, health facility, and village level.

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## Support

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# Chapter 1.   Introduction

## 1.1. Community health workers and integrated community case management

Community health workers (CHWs) have received renewed interest over the past decade as a means of achieving global targets for maternal, newborn, and child health (Haines *et al.*, 2007; Lehmann *et al.*, 2009; Arvey and Fernandez, 2012; Singh and Sachs, 2013). This dissertation explores the concept of *CHW performance* - how we can measure CHW performance and better understand the determinants of CHW performance to improve the effectiveness of CHW programs and their impact.

One type of CHW program that requires CHWs to perform well is integrated community case management (iCCM). ICCM programs involve training and equipping CHWs to diagnose and treat sick children at village level, typically for malaria, pneumonia, and/or diarrhea (CORE Group, 2010; UNICEF, 2012a). WHO and UNICEF advocate iCCM as "an essential strategy that can both foster equity and contribute to sustained reduction in child mortality" (UNICEF, 2012a). Caregivers who may face difficulties travelling to receive care at a health facility will, in theory, be more likely to seek care from a health provider who lives in their village and with whom they have an existing relationship.

The majority of countries in sub-Saharan Africa have now adopted iCCM as a strategy to reduce child mortality (George *et al.*, 2012; Bennett *et al.*, 2014; Oliphant *et al.*, 2014; Rasanathan *et al.*, 2014). However, despite the enthusiasm for iCCM, limited evidence exists

for the effectiveness of large-scale iCCM programs at reducing child mortality (Druetz *et al.*, 2013; Amouzou *et al.*, 2014; Walker, 2014). Some studies of community case management programs in South Asia have shown a statistically significant mortality reduction, but these studies have generally concerned small-scale programs run by NGOs with substantial resources (Bang *et al.*, 1990; Fauveau *et al.*, 1992; Baqui *et al.*, 2008; Das *et al.*, 2013). Evaluations of national and regional programs in sub-Saharan Africa have mostly shown a non-statistically-significant difference-in-differences between intervention and comparison districts (Amouzou *et al.*, 2014).

The evidence suggests not that iCCM does not work, but that the large-scale iCCM programs that have been evaluated did not perform sufficiently well to have an impact on child mortality (Hermann *et al.*, 2009; Amouzou *et al.*, 2014; Bagonza *et al.*, 2014; Miller *et al.*, 2014; UNICEF, 2014). We know that the treatments offered through iCCM programs are effective: artemisinin-combination therapies (ACTs), antibiotics, oral rehydration solution (ORS), and zinc are proven interventions for the treatment of malaria, pneumonia, and diarrhea (UNICEF, 2006, 2012a, 2012b). It stands to reason that increasing coverage of these treatments through iCCM will contribute to reduced child mortality. "The published evidence from these evaluations and trials consistently shows that when CHWs are properly trained and supervised, the quality of care they provide is high, resulting in better health outcomes for sick children" (CORE Group, 2010). It seems to be the case, therefore, that the question of the *efficacy* of iCCM has been answered: the question now concerns the *effectiveness* of iCCM programs.

Because of this unrealized potential, policy makers and evaluators are paying increasing attention to how iCCM programs are being implemented (Bryce *et al.*, 2013; Naimoli *et al.*, 2014; UNICEF, 2014). Ultimately, success for an iCCM program means increased coverage of iCCM interventions, reduced child mortality, and improved nutritional status. But to achieve this impact, programs first need to achieve intermediate outputs, such as quality of care and utilization. Children need to be seen by CHWs within reasonable time of becoming sick, be accurately assessed by CHWs, and be given appropriate treatment, counseling, or referral; and caregivers need to follow the counseling and drug regimen offered by CHWs.

The iCCM Task Force has proposed an "iCCM Benchmark Framework" that lists eight core elements of iCCM implementation: coordination and policy setting, costing and financing, human resources, supply chain management, service delivery and referral, communication and social mobilization, supervision and performance quality assurance, and monitoring and evaluation and health information systems (UNICEF, 2012a; MCHIP, 2013a). In deciding how to allocate resources for iCCM, policy makers face choices about all of these elements, including the profile of CHWs, the package of services CHWs provide, whether or not CHWs are paid, how CHWs are trained and supervised, the involvement of community members, and how CHWs restock their drug supply. Although iCCM is a common strategy, approaches to these issues vary from country to country (de Sousa *et al.*, 2012; George *et al.*, 2012; Rasanathan *et al.*, 2014).

Given these choices, policy makers need research and evaluation to guide them in selecting and prioritizing strategies that will yield greatest implementation strength, and therefore greatest program impact. In the "common framework" proposed by Bryce et al. for

evaluating maternal, newborn, and child health programs (Figure 1.1), implementation strength is assessed by measuring "processes" and "outputs" (Bryce *et al.*, 2011). Measuring processes and outputs allows evaluators to identify barriers to program effectiveness, and develop strategies to overcome those barriers (Mitsunaga *et al.*, 2013; Hazel *et al.*, 2014; Moore *et al.*, 2015). One important output measure is CHW performance.

**Figure 1.1. A common framework for the scale-up of MNCH interventions**



| Inputs | Process | Outputs | Outcomes | Impact |
|--------|---------|---------|----------|--------|
| **Funding for MNCH** Domestic sources International sources **MNCH Policies** Tx & care policies, provider mix, affordable access/user fees **MNCH Plan** Coherent, prioritised and funded **Human Resources** | **National MNCH plan implementation** Systems strengthening Priority interventions scale-up **Capacity building** Structures, systems and roles Staff and infrastructure Skills, Tools **Accountability** Performance monitoring Results focus Data-driven **Harmonization** Aligned international efforts with national plan Well coordinated and harmonized support | **Improved health system functioning** Improved governance, human resources, availability of commodities **Improved MNCH services** Improved access, quality, efficiency, utilization | **Intervention coverage** **Behaviour change** **Service responsiveness, including patient satisfaction** | **Improved survival** Under-five mortality Neonatal mortality Under-five deaths by cause Maternal mortality **Improved nutrition** Stunting prevalence Wasting prevalence Nutritional status among pregnant women **Reduced morbidity** **Total fertility rate** |

**Reducing inequities**

**Contextual factors**
Political, economic, social, technological, environmental
Epidemiological, e.g., levels and causes of child and maternal mortality; prevalence of HIV, malaria, undernutrition

(Bryce et al., 2011)

## 1.2. CHW performance

At the heart of an iCCM program are the CHWs. Some iCCM programs involve other types of health workers (for example, nurses based in community health posts), though iCCM has largely been promoted as a strategy involving CHWs. Thus, for the most part, if an iCCM program is performing well it is because individual CHWs are providing appropriate care for a sufficient number of sick children. CHW performance is sometimes described in terms of quality of care or utilization (Cardemil *et al.*, 2012; Miller *et al.*, 2014). To improve quality of care and utilization, we need to consider the physical and cognitive tasks that CHWs are asked to undertake. For ministries of health, understanding which tasks CHWs have been asked to perform, and how well they are performing these tasks, can clarify program expectations, help to identify gaps in health system support, and inform performance improvement strategies. At the district and health-facility level, performance metrics can help supervisors of CHWs to identify and address strong or weak competencies in individual CHWs, and set appropriate benchmarks.

Not all of *program performance* can be attributed to *CHW performance*. Under some models of iCCM, for example, activities such as demand generation and drug restocking may be the responsibility of other health system actors. Individual CHWs have no control over program policies that might ultimately be responsible for low program impact, such as the price of drugs. "Many failures in the implementation of national programs are due to inadequacies in planning and management and cannot be attributed to either the concept of community health workers or the performance of individual workers" (WHO, 1989). Nonetheless, analyzing CHW performance can offer significant insight into the strengths and weaknesses

of an iCCM program; and improving and maintaining the performance of CHWs will improve the performance of the program as a whole.

## 1.3. Research questions

In this dissertation I pose and address two research questions related to CHW performance, in the context of the Burkina Faso iCCM program:

(1) How well do CHWs perform?

(2) Why do some CHWs perform better than others?

In Chapter 2 I describe the performance of CHWs at providing iCCM services. Using quantitative data from an Implementation and Quality of Care Assessment, I develop task measures and summary measures of CHW performance, and employ these measures to describe the nature and variability of performance among individual CHWs and by district. In Chapters 3 and 4 I analyze the variability in CHW performance and its association with other factors, to understand the determinants of performance in the Burkina Faso context. In Chapter 3 I use quantitative data and statistical methods to see whether CHW characteristics, health system factors, and community factors are associated with CHW performance. In Chapter 4 I tackle the same issue using qualitative methods (in-depth interviews and focus groups with CHWs, supervisors, and caregivers); analyzing the qualitative attributes of high- and low-performing CHWs to see which factors are related to performance. The data and methods used to answer these questions are discussed in more detail in the chapters themselves. In my conclusions (Chapter 5) I synthesize the results of

the dissertation and suggest implications for the Burkina Faso iCCM program and for other programs.

## 1.4. A conceptual framework for CHW performance

Throughout the thesis I use a conceptual framework for CHW performance that describes both performance itself and the determinants of performance.

### 1.4.1. <u>CHW performance</u>

CHW roles and responsibilities are often outlined in government or NGO protocols for a CHW program (MoH Burkina Faso, 2008, 2010) or in documents that summarize the features of CHW programs across multiple countries (Winch *et al.*, 2005; Marsh *et al.*, 2008; de Sousa *et al.*, 2012; George *et al.*, 2012; Nalwadda Kayemba *et al.*, 2012; UNICEF, 2012c). For iCCM, several documents provide normative guidance for how iCCM should be implemented, including the role of the CHW (UNICEF, 2006; CORE Group, 2010; iCCM Task Force, 2014). For example, the Core Group lists a number of tasks that a CHW needs to perform in order to deliver iCCM, including (but not limited to) identifying the sick child, assessing danger signs, treating the child with the correct drugs, arranging follow-up visits, completing patient registers, maintaining medicine stock records, and storing medicines correctly (CORE Group, 2010).

In the peer-reviewed literature, studies on CHW performance in iCCM programs have taken a variety of competencies to represent performance:

- Whether the CHW has the drugs and equipment necessary to provide services (Stekelenburg et al., 2003; Blanas et al., 2013; Gilroy et al., 2013; IIP-JHU, 2013)

- Whether the CHW stores drugs appropriately (Kalyango et al., 2012)

- The CHW's knowledge of disease etiology and transmission (Yasuoka et al., 2010, 2012; Blanas et al., 2013)

- The CHW's ability to assess, classify, and treat correctly (Kelly et al., 2001; Rowe et al., 2007; Orji et al., 2011; Kalyango et al., 2012; Puett et al., 2012; Blanas et al., 2013; Gilroy et al., 2013; IIP-JHU, 2013; Lopes et al., 2014)

- The quality and completeness of the CHW's patient register (Gilroy et al., 2013; IIP-JHU, 2013)

- The CHW's use of, and compliance with, malaria diagnostic tests (Harvey et al., 2008; Orji et al., 2011; Counihan et al., 2012; Mukanga et al., 2012; Blanas et al., 2013)

- Whether the CHW follows-up patients (Yasuoka et al., 2010, 2012)

- The "activity level" of the CHW (a term defined differently by different authors, most often reflecting the number of consultations undertaken by the CHW in a given time period) (Stekelenburg et al., 2003; Yasuoka et al., 2010, 2012; Sato et al., 2014)

- Community/caregiver satisfaction with the CHW's services (Blanas et al., 2013; Puett et al., 2013)

The framework that I propose for CHW performance (Figure 1.2) reflects these various competencies. It emphasizes the multi-dimensional nature of a CHW's role by grouping a

CHW's responsibilities into four domains of performance: building community relationships, providing care, managing commodities, and reporting. Table 1.1 lists examples of CHW tasks that fall under these four domains. Although in my dissertation I apply the framework specifically to the Burkina Faso iCCM program, it is intended as a framework for assessing CHW performance in any program where CHWs are providing curative care. I suggest that in all CHW programs, the tasks that a CHW needs to undertake fall into these domains, and that individual CHWs may have stronger competencies or motivation in some domains than in others.

The domain of **building community relationships** concerns the relationships a CHW has with the people in his or her community; building awareness and confidence among community members, and cultivating a sense of trust and approachability so that community members are willing to utilize the CHW's services. **Managing commodities** concerns a CHW's ability to keep and maintain the supplies and equipment necessary for their role, such as behavior change print materials, drugs and diagnostic tests, and scales or measurement devices. A CHW's ability to manage a stock of drugs will depend on supply chain functioning, but CHWs may also play their own role in restocking drug kits. **Providing care** concerns the provision of care itself; for example, assessing, classifying, and treating sick children, and counseling caregivers. Some CHW programs, such as health promotion programs, do not require the delivery of clinical services, but nonetheless require CHWs to provide technical counseling and advice, or assessment and referral. **Reporting** concerns the paperwork that a CHW undertakes to document his or her activities, such as sick child forms, referral forms, patient registers, and monthly reports. Reporting is different to the other domains in that it does not directly contribute to the delivery of services, though

arguably reporting does contribute to program effectiveness by providing policy makers and program managers with data to make more informed implementation decisions.

I use these four domains to reflect the tasks that a CHW undertakes, not the outcomes that a CHW hopes to achieve. Articulating performance in this way helps to distinguish between CHW performance, and the performance of a CHW program as a whole, given other health system, community, and contextual factors. Whereas a program-centered term such as "quality of care" relies on both CHW performance in delivering care, and health system performance in making drugs available for the CHW to prescribe, the term "providing care" in the framework refers only to those actions within the control of a CHW, such as the correct assessment and treatment of sick children.

**Figure 1.2. A framework for CHW performance**



**Determinants of performance**

- CHW characteristics
- Health system factors
- Community factors
- Contextual factors

**Mediating factors**

- Knowledge, skills & attitudes
- Motivation
- Enabling environment

**Domains of performance**

- Building community relationships
- Providing care
- Managing commodities
- Reporting
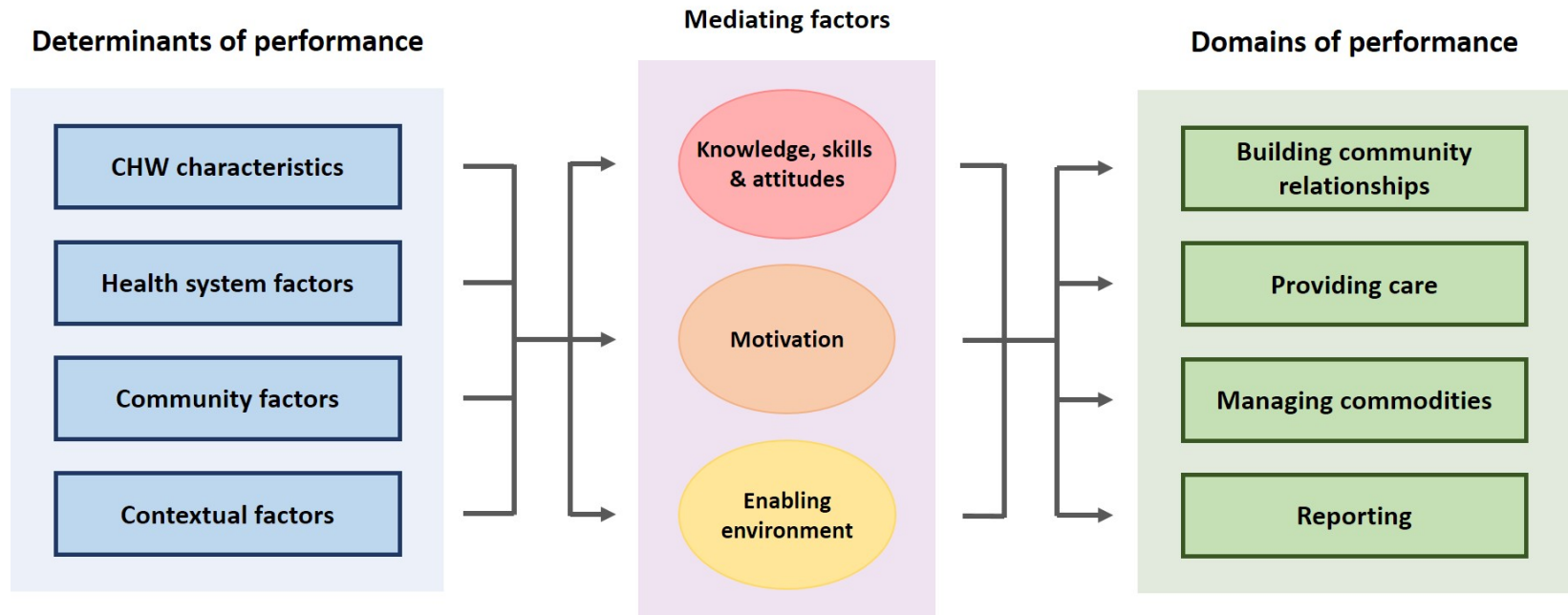
**Table 1.1. Domains of CHW performance**

| Performance domain | Examples of CHW tasks in a generic program where CHWs provide curative care | Examples of CHW tasks in the Burkina Faso iCCM program |
|---|---|---|
| Building community relationships | ▪ Raising awareness of CHW services<br><br>▪ Generating demand for services<br><br>▪ Building trust among community members<br><br>▪ Being available and accessible<br><br>▪ Publicizing activities<br><br>▪ Communicating with community members on health-related events and concerns<br><br>▪ Tracking health issues in the community<br><br>▪ Communicating with health facility staff on technical matters | ▪ Raising awareness and knowledge of the CHW's iCCM services among community members<br><br>▪ Building trust and rapport with community members so that caregivers feel comfortable taking their children to the CHW when they are sick<br><br>▪ Being available in a timely fashion when caregivers seek care for their sick children |
| Providing care | ▪ Delivery of technical services: including sick child consultations, counseling, referral<br><br>▪ Delivery of health education activities<br><br>▪ Technical advice and counseling on health matters for the community<br><br>▪ Screening for malnutrition, HIV and other illnesses | ▪ Delivery of iCCM services, including assessment and treatment for malaria, diarrhea and pneumonia<br><br>▪ Referral for severe illness or other illness<br><br>▪ Screening for malnutrition |
| Managing | ▪ Maintaining adequate stock of supplies | ▪ Maintaining a stock of cotrimoxazole, |

| commodities | necessary for the CHW role: drugs, diagnostic tests, therapeutic foods, print materials, hygiene kits<br><br>▪ Keeping supplies protected and in good condition<br><br>▪ Actively restocking when needed<br><br>▪ Tracking supply use<br><br>▪ Maintaining other equipment, such as assessment tools, transport | ORS, zinc, ACTs (infant and child), and paracetamol<br><br>▪ Keeping drugs safe and secure<br><br>▪ Charging fees for drugs that are sold<br><br>▪ Visiting the health facility to restock this supply of drugs when necessary<br><br>▪ Maintaining other equipment, such as MUAC tape, a breath-counter/timer |
|---|---|---|
| Reporting | ▪ Documenting activities in written registers and reports<br><br>▪ Aggregation and compilation of statistics for supervisor reports<br><br>▪ Maintaining patient registers, commodity registers<br><br>▪ Communicating with health facility for debriefing on activities | ▪ Recording details of sick child consultations in a patient register<br><br>▪ Completing and submitting monthly reports to health facility supervisors |

1.4.2.  <u>Determinants of CHW performance</u>

Determinants of CHW performance have interested researchers for many years. In 1989, WHO launched a report from a study group on CHW performance titled "Strengthening the performance of community health workers in primary health care" (WHO, 1989). Although this report was produced in 1989 and focused on CHWs in non-iCCM programs, it listed factors that still appear to be relevant today: political will, health system functioning, community involvement, the CHW's range of tasks, selection strategies, training, supervision, financial incentives, and monitoring and evaluation (WHO, 1989). More recent attempts to reflect on CHW performance have highlighted many of the same issues (Lehmann and Sanders, 2007; USAID, 2011, 2012; Glenton *et al.*, 2013).

For iCCM specifically, Winch et al. list the following factors that affect CHW performance: selection, competency-based training, job aids, monetary and non-monetary incentives, the availability of required equipment and supplies, and supportive supervision and coaching (Winch *et al.*, 2003). In a study involving interviews with "thought leaders" in iCCM, the respondents cited similar factors: recruitment, training, supervision, incentives, community involvement and ownership, information and data management, and mHealth (Strachan *et al.*, 2012). A recent systematic review of "intervention design factors" and their influence on the performance of CHWs found that financial and non-financial incentives, clearly defined CHW roles, supervision and continuous training, and the embedment of CHWs in community and health systems all helped to enhance performance (Kok *et al.*, 2014). An even more recent logic model developed by Naimoli et al. posits that "optimal CHW performance is a function of high quality CHW programming, which is reinforced,

sustained, and brought to scale by robust, high-performing health and community systems, both of which mobilize inputs and put in place processes needed to fully achieve performance objectives" (Naimoli *et al.*, 2014).

In my framework (Figure 1.2) I outline four categories of determinants: CHW characteristics, health system factors, community factors, and contextual factors. These categories echo frameworks used by other authors to describe the performance of CHWs and health workers (Dieleman *et al.*, 2009; Gopalan *et al.*, 2012; Kok *et al.*, 2014; Naimoli *et al.*, 2014). Table 1.2 lists examples, for each category, of specific factors that were found to have a significant association with CHW performance in peer-reviewed studies that analyzed determinants of performance.

Previous studies have highlighted the importance of **CHW characteristics** for performance, although the evidence for particular characteristics is contradictory. Studies have shown both younger age (Crispin *et al.*, 2012; Lopes *et al.*, 2014) and older age (Kawakatsu *et al.*, 2012) to be associated with higher performance. In some studies, male CHWs have performed better than female CHWs (Alamo *et al.*, 2012; Crispin *et al.*, 2012); in others, female CHWs have performed better (Bagonza *et al.*, 2014). The more experience a CHW has, the better they appear to perform (Ronaghy et al., 1976; Oxford Policy Management, 2009; Maji et al., 2010). CHWs with stronger intrinsic motivation also appear to perform better (Yasuoka et al., 2010; Javanparast et al., 2011). Other studies have shown the influence of **health system factors**, such as the positive effect of CHW supervision (Curtale et al., 1995; Kelly et al., 2001; Oxford Policy Management, 2009; Maji et al., 2010; Jaskiewicz and Tulenko, 2012), financial and non-financial incentives (Bhattacharyya et al., 2001; Alam et al., 2012), and

health system functioning, including the availability of drugs and materials (Ronaghy *et al.*, 1976; Stekelenburg *et al.*, 2003; Callaghan-Koru *et al.*, 2012; Gopalan *et al.*, 2012; Jaskiewicz and Tulenko, 2012; Medhanyie *et al.*, 2012; Naimoli *et al.*, 2014). Several authors suggest the role of **community factors**, with studies suggesting a link between CHW performance and the existence of community health committees (Oxford Policy Management, 2009; Javanparast et al., 2011; Callaghan-Koru et al., 2012; Gopalan et al., 2012; Jaskiewicz and Tulenko, 2012). A CHW's sense of acceptability and credibility among community members has been seen to be associated with higher performance (Glenton *et al.*, 2013), as has support and respect from immediate family members (Bagonza *et al.*, 2014). The influence of **contextual factors** on CHW performance was the subject of a recent literature review (Kok *et al.*, 2015). In it, the authors highlight the role of social-cultural factors, government policies, and the economy (Kok *et al.*, 2015).

In addition to determinants, the framework includes three "mediating factors", reflecting the pathways by which determinants influence performance. I propose that every determinant of CHW performance affects either a CHW's *ability* to do their job (their *knowledge, skills and attitudes* or *the enabling environment*), or a CHW's *willingness* to do their job (their *motivation*). These concepts come from the literature on occupational psychology (Anderson and Butzin, 1974; Locke *et al.*, 1978; Blumberg and Pringle, 1982). In 1982, Mitchell suggested that performance was a product of: aptitude level, skill level, and understanding of the task (which I term "knowledge, skills, attitudes"); choice to expend effort, choice of degree of effort, and choice to persist (which I term "motivation"); and the facilitating and inhibiting conditions not under the control of the individual (which I term "the enabling environment") (Mitchell, 1982). "In order to do well one must know what is required, have

the ability to do what is required, be motivated to do what is required, and work in an environment in which intended actions can be translated into behavior" (Mitchell, 1982).

Although the framework lists the three mediating factors separately, there is likely to be interaction between them: for example, lack of skills and a self-perception of poor competency may negatively affect motivation, as may a limited enabling environment.

**Table 1.2.  Categories of potential determinants of CHW performance**

| | |
|---|---|
| CHW characteristics | ▪ <u>Demographic characteristics</u>, such as the CHW's age, sex, and ethnicity<br><br>▪ <u>Personality traits</u>, such as the CHW's social competencies<br><br>▪ <u>Education</u>, including literacy and numeracy<br><br>▪ <u>Status in the community</u>, including any formal or informal roles, and ties to village members or village leaders<br><br>▪ <u>Location in the community</u>, including whether the CHW resides inside or outside the village |
| Health system factors | ▪ <u>Training, including initial basic training</u>, formal refresher training, and ongoing skills development by supervisors or other staff<br><br>▪ <u>Supervision provided by health system staff</u>, including mentoring, problem solving<br><br>▪ <u>Tangible/intangible incentives</u>, such as encouragement and respect from health system staff, financial payments, in-kind gifts (bags, bicycles)<br><br>▪ <u>Supply chain functioning</u>, the availability of drugs at village level<br><br>▪ <u>Demand generation</u>, including activities run by health system staff (not the CHW) to increase awareness of CHW services |
| Community factors | ▪ <u>Tangible/intangible incentives</u>, such as praise and encouragement, money, and in-kind goods/services from community members<br><br>▪ <u>Community participation</u>, including community supervision, and oversight and involvement from village committees<br><br>▪ <u>Security and safety</u> in the village |
| Contextual factors | ▪ <u>Geography</u>, such as the distance from the village to the health facility, and the accessibility of terrain during different seasons<br><br>▪ <u>Social-political context</u>, such as traditional care-seeking behaviors, and cultural attitudes to health services<br><br>▪ <u>Disease burden</u> of relevant childhood illnesses |

## 1.5. The context of Burkina Faso

### 1.5.1. Burkina Faso

Burkina Faso is a low-income country in West Africa with a population of approximately 17.4 million people (World Bank, 2014). In 2013, the United Nations Development Program (UNDP) Human Development Report ranked Burkina Faso in its lowest human development category, positioning the country at 183 out of 187 countries and territories (UNDP, 2013). Although cotton has been, and continues to be, the country's main export, the last five years have seen rapid growth in Burkina Faso's mining sector, with substantial investments in gold mining in the north of the country (World Bank, 2014).

The health system in Burkina Faso is largely decentralized with strong ownership given to regional and district health offices for the implementation of national health policies (Seck and Valéa, 2011). The CHW cadre in Burkina Faso dates back to the early 1980s and the revolutionary social reforms instituted under President Thomas Sankara. In each village across the country, two CHWs, two traditional birth attendants, and a village health committee, were elected and appointed by village members (Sauerborn *et al.*, 1989). At that time, the CHWs, known as *agents de santé communautaire*, were trained to deliver basic preventative and curative health care. By the early 2000s, less attention was being paid to the CHW program, resulting in CHW responsibilities being limited to assisting with vaccination campaigns (male CHWs) and accompanying pregnant women to health facilities for delivery (female CHWs) (Seck, 2011).

## 1.5.2. Child survival in Burkina Faso

Burkina Faso has one of the highest under-five mortality rates in the world: measured at 129 under-five deaths per 1,000 live births for the period 2006-2010 (INSD and ICF, 2010). The equivalent rate was 156 in rural areas, and 175 nationally among households in the lowest wealth quintile (INSD and ICF, 2010). As with many countries in sub-Saharan Africa, the majority of child deaths in Burkina Faso are caused by malaria (31.3%), pneumonia (18.6%), and diarrhea (13.6%) (Liu *et al.*, 2012). Most children in Burkina Faso still do not receive the basic life-saving interventions for these illnesses that are readily available in other parts of the world. Coverage estimates in 2010 suggested that only 46.8% of children with suspected pneumonia received antibiotics; 35.1% received antimalarials for fever; and 21.2% received ORS for diarrhea (INSD and ICF, 2010).

## 1.5.3. The Burkina Faso iCCM program

In 2009, the Burkina Faso Ministry of Health (MoH) launched a four-year "Rapid Scale-up" (RSU) program to reduce maternal, newborn and child mortality in the North and Center-North regions of the country (MoH Burkina Faso, 2008, 2011; Seck and Valéa, 2011). The program was implemented by the MoH with funding from the Bill and Melinda Gates Foundation and technical support from UNICEF (the focal agency for maternal, newborn and child health in Burkina Faso), WHO, UNFPA, and the World Bank. Implementation of the RSU program was extended by one year, ending in 2014.

As part of the RSU program, CHWs were trained and equipped to deliver iCCM for children aged 2 to 59 months (MoH Burkina Faso, 2010; ISSP and IIP-JHU, 2014). In nine intervention districts, two CHWs in each village were trained to provide ORS and zinc to children with diarrhea; ACTs and paracetamol to children with suspected malaria; and to screen and refer children for acute malnutrition. In two of the nine intervention districts, CHWs were also trained to provide antibiotics (cotrimoxazole) to children with suspected pneumonia. In some villages, it was the existing CHWs who were trained to deliver iCCM. In other villages, new CHWs (often younger and more educated) were recruited to deliver iCCM.

Unlike iCCM programs in other parts of the world, CHWs in Burkina Faso who provide iCCM are volunteers and do not receive a salary or stipend for their work. However, CHWs in intervention districts are authorized to sell drugs at a higher price than the price at which drugs are sold at health facilities. This mark-up, determined by the CHW at their own discretion, enables the CHW to earn a small profit from drug sales, and is the only financial incentive that CHWs receive for iCCM (though CHWs are occasionally paid for other work, such as assisting health workers with vaccination campaigns). CHWs are supervised for iCCM by health workers at first-level health facilities. The number of CHWs supervised by each facility-based supervisor varies greatly and depends on the number of villages in the health facility's catchment area. In our study, the number of CHWs per supervisor ranged from 2 to 42 CHWs.

To date, no peer-reviewed journal articles have been published on the performance of CHWs in the Burkina Faso iCCM program. Sauerborn et al. published an article 25 years ago

on the low utilization of CHWs in Burkina Faso, reporting a lack of demand for CHWs due to caregivers' preferences for family care and professional health services, and suggested abandoning the idea of CHWs delivering curative care altogether (Sauerborn *et al.*, 1989). The data that I discuss in this dissertation suggest that the utilization of CHWs is still low in Burkina Faso today.

### 1.5.4. The ISSP/IIP-JHU evaluation of the Burkina Faso iCCM program

The *Institut Supérieur des Sciences de la Population* (ISSP) and the Institute for International Programs at Johns Hopkins University (IIP-JHU) conducted an independent evaluation of the RSU program. The objectives of the evaluation were to assess the impact of the RSU program on coverage of child survival interventions; to determine whether the MoH met its goal of reducing under-five mortality by 25 percent in the North and Center-North regions relative to 2008 mortality levels in the same regions; and to determine to what extent any observed mortality reductions were attributable to the RSU program. The evaluation included two cross-sectional household surveys (baseline and endline) to measure the coverage of child survival interventions in the nine intervention districts and in seven comparison districts. The baseline survey was completed in 2010 (ISSP *et al.*, 2011) and the endline survey was completed in March 2014 (ISSP and IIP-JHU, 2014). A paper from ISSP/IIP-JHU reporting the results of the independent evaluation of the RSU program has been submitted for publication (Munos *et al.*, 2015).

In addition to the baseline and endline household surveys, ISSP and IIP-JHU conducted a Qualitative Study in February-March 2013 and an Implementation and Quality of Care

Assessment in March-April 2013 (ISSP and IIP-JHU, 2014). These studies are the two data sources I use for my dissertation and I describe them in detail in the methods sections of Chapters 2, 3, and 4. The tools used for these studies are attached as Appendix 1. The objectives of these joint studies were to assess the implementation strength of the iCCM component of the RSU program; assess the quality of care provided by CHWs to sick children aged 2-59 months; and understand the factors affecting utilization of CHWs for iCCM services. The research methods for the Implementation and Quality of Care Assessment drew heavily from two similar studies conducted by IIP-JHU in Malawi (Gilroy *et al.*, 2013) and Ethiopia (Miller *et al.*, 2014).

# Chapter 2.    Measuring the Performance of Community Health Workers in an Integrated Community Case Management Program in Burkina Faso (Paper 1)

## 2.1.  Abstract

BACKGROUND: Integrated community case management (iCCM) is a promising strategy for reducing child mortality, though evidence suggests that large-scale iCCM programs often struggle to achieve sufficient implementation strength to have an impact. The performance of community health workers (CHW) is an important intermediate measure of program effectiveness that can help to inform implementation. This paper examines the performance of CHWs in an iCCM program in Burkina Faso, using summary measures to explore the level and variability of performance across tasks, and among individual CHWs and districts.

METHODS: 386 CHWs were interviewed using a structured questionnaire and observed in consultation with 1 or 2 sick children (726 consultations), with children re-examined by a clinician for a gold standard assessment of the illness. Data were aggregated into summary measures according to a framework of CHW performance with four domains and nine sub-domains. Summary measures were analyzed using statistical methods to answer two program management questions: (1) *How well do CHWs perform at different tasks?* (2) *Is performance at one task related to performance at other tasks?*

RESULTS: CHW performance varies greatly by task. CHWs perform best at illness classification and equipment maintenance, and worst at treatment, caregiver counseling, and drug stock management. While most CHWs correctly classify diarrhea (76%) and fever (80%), less than a third of CHWs correctly prescribe ORS (32%) and zinc for diarrhea (26%), and only 4% of CHWs correctly prescribe paracetamol. On average, CHWs have only 38% of the drugs they are supposed to carry. District-level variation in CHW performance is high, with some districts performing twice as well as others. Correlation across performance domains is weak at the individual level, but strong at the district level, with high-performing districts performing well in all domains of performance.

CONCLUSIONS: If the Burkina Faso iCCM program is to achieve its intended impact of reducing child mortality, CHW performance needs to improve. Summary measures of CHW performance may be useful for program managers to inform resource allocation, answer policy questions, and assist supervision.

## 2.2. Introduction

### 2.2.1. <u>CHW performance</u>

Recent evaluation efforts have shown that many large-scale CHW programs are not impacting health outcomes as expected - not because the underlying CHW strategy is necessarily flawed, but because program implementation has been insufficiently strong to achieve success (Hermann *et al.*, 2009; Amouzou *et al.*, 2014; Bagonza *et al.*, 2014; Miller *et al.*, 2014). For this reason, program managers and evaluators are beginning to pay increasing attention to intermediate measures of program performance (Bryce *et al.*, 2013; UNICEF, 2014). Evaluators need data on program processes and outputs to identify barriers to implementation and develop strategies to overcome these barriers, and program managers need similar data to inform real-time decision making and resource allocation (Mitsunaga *et al.*, 2013; Hazel *et al.*, 2014; Moore *et al.*, 2015).

One such intermediate measure is CHW performance. The performance of CHWs is sometimes described in terms of quality of care or utilization (Cardemil *et al.*, 2012; Miller *et al.*, 2014). These measures are important as population-level indicators of program performance. To improve quality of care and utilization, we need to consider the physical and cognitive tasks that CHWs are asked to undertake. For ministries of health, understanding which tasks CHWs have been asked to perform, and how well they are performing at these tasks, can clarify program expectations, help to identify gaps in health system support, and inform performance improvement strategies. At the health-facility level,

performance metrics can help supervisors of CHWs to identify strong or weak competencies in individual CHWs, and set appropriate benchmarks.

### 2.2.2. The Burkina Faso iCCM program

This paper examines CHW performance in an Integrated Community Case Management (iCCM) program in Burkina Faso. ICCM involves training and equipping CHWs to diagnose and treat sick children at village level, often for malaria, pneumonia, and diarrhea (CORE Group, 2010; UNICEF, 2012a). In 2009, the Burkina Faso Ministry of Health (MoH) recruited and trained CHWs to deliver iCCM for children aged 2 to 59 months as part of a four-year "Rapid Scale-up" (RSU) program to reduce maternal, newborn, and child mortality in the North and Center-North regions of the country (MoH Burkina Faso, 2010; ISSP and IIP-JHU, 2014). In nine intervention districts, two CHWs per village were trained to provide ORS and zinc to children with diarrhea, ACTs and paracetamol to children with suspected malaria, to refer children with cough, and to screen and refer children for acute malnutrition. In two of these districts, CHWs were also trained to provide cotrimoxazole to children with suspected pneumonia. In some villages, existing CHWs were trained to deliver iCCM; in other villages, new CHWs were recruited. The volunteer CHWs were not given a salary for their work, but were authorized to sell drugs for iCCM at a mark-up for a profit (at their own discretion). The CHWs were to be supervised for iCCM by health workers at first-level health facilities.

2.2.3.  Studies on CHW performance

Only a few studies have examined the performance of CHWs in an iCCM program. Table
2.1 describes the studies that are available in the peer-reviewed literature, and the measures
they employed to assess performance. The variety of competencies taken to represent CHW
performance highlights the multi-faceted nature of a CHW's role: from provision of care, to
drug storage, to patient follow-up, to register completion.

Most of the studies measured CHW performance either to provide a program-level snapshot
of quality of care in the iCCM program, or to enable a subsequent analysis of the *determinants*
of performance. None of the studies examined variability in CHW performance across
program intervention areas (e.g. districts) for the purposes of program management. Only a
handful of studies attempted to record the performance of CHWs at diverse tasks; for
example, a CHW's ability to assess illnesses versus treat illnesses (Maji *et al.*, 2010; Kalyango
*et al.*, 2012; Blanas *et al.*, 2013; Gilroy *et al.*, 2013; Miller *et al.*, 2014). Fewer still attempted to
differentiate between performance in different domains; for example, by distinguishing
between tasks associated with providing care (such as assessment and treatment) and tasks
associated with reporting (such as completing a patient register); or by comparing across
these domains (Maji *et al.*, 2010; Gilroy *et al.*, 2013; Miller *et al.*, 2014). Only three studies
synthesized multiple measures of performance, and these studies did so using data on tasks
in a single performance domain (Yasuoka *et al.*, 2010; Kalyango *et al.*, 2012; Puett *et al.*, 2012).
None of the studies attempted to construct an overall measure of performance that
incorporated data on multiple CHW competencies. Among the studies on determinants,
most used only a single dichotomous variable to represent CHW performance.

**Table 2.1. Studies of CHW performance in iCCM programs**

| Study | Study site | Measures of performance | Methods used to measure performance |
|---|---|---|---|
| (Bagonza et al., 2014) | Uganda | A composite score of seven core activities related to the provision of iCCM services | Interviews with CHWs and register review |
| (Miller et al., 2014) | Ethiopia | Whether the CHW has the drugs and equipment necessary to provide services; the CHW's ability to assess, classify, and treat correctly; the quality and completeness of the CHW's patient register | Direct observation with re-examination; drug kit inspection; register review |
| (Sato et al., 2014) | Laos | The activity level of the CHW | Interviews with health facility supervisors; self-evaluations |
| (Lopes et al., 2014) | Guinea-Bissau | The CHW's ability to assess, classify, and treat correctly | Direct observation with re-examination |
| (Blanas et al., 2013) | Senegal | Whether the CHW has the drugs and equipment necessary to provide services; the CHW's knowledge of disease etiology and transmission; the CHW's ability to assess, classify, and treat correctly; the CHW's use of, and compliance with, malaria diagnostic tests; community/caregiver satisfaction with the CHW's services | Knowledge checks (written questionnaire); self-report for stockouts of drugs; focus group discussions |
| (Gilroy et al., 2013) | Malawi | Whether the CHW has the drugs and equipment necessary to provide services; the CHW's ability to assess, classify, and treat correctly; the quality and completeness of the CHW's patient register | Direct observation with re-examination; drug kit inspection; register review; case scenarios |
| (Puett et al., 2013) | Bangladesh | Community/caregiver satisfaction with the CHW's services | Direct observation (only); focus group discussions with caregivers |
| (Kalyango et al., 2012) | Uganda | Whether the CHW stores drugs appropriately; the CHW's ability to assess, classify, and treat correctly | Knowledge tests / case scenarios; register review; observation (only) of consultations |

| (Puett *et al.*, 2012) | Bangladesh | The CHW's ability to assess, classify, and treat correctly | Knowledge tests / case scenarios |
|---|---|---|---|
| (Counihan *et al.*, 2012) | Zambia | The CHW's use of, and compliance with, malaria diagnostic tests | Direct observation (only) |
| (Mukanga *et al.*, 2012) | Multiple | The CHW's use of, and compliance with, malaria diagnostic tests | Direct observation (only) |
| (Orji *et al.*, 2011) | Nigeria | The CHW's ability to assess, classify, and treat correctly; the CHW's use of, and compliance with, malaria diagnostic tests | Direct observation (only) |
| (Yasuoka *et al.*, 2010, 2012) | Cambodia | The CHW's knowledge of disease etiology and transmission; whether the CHW follows-up patients; the activity level of the CHW | Self-report scorecard with knowledge checks |
| (Harvey *et al.*, 2008) | Zambia | The CHW's use of, and compliance with, malaria diagnostic tests | Direct observation (only) |
| (Rowe *et al.*, 2007) | Kenya | The CHW's ability to assess, classify, and treat correctly | Register review |
| (Stekelenburg *et al.*, 2003) | Zambia | Whether the CHW has the drugs and equipment necessary to provide services; the activity level of the CHW | Record review / register review to examine drug stocks; inspection of drug kits |
| (Kelly *et al.*, 2001) | Kenya | The CHW's ability to assess, classify, and treat correctly | Direct observation with re-examination by an expert clinician (CHWs were taken to a health facility) |

<u>Aims: a program management perspective</u>

Our goal in this paper is to describe the performance of CHWs in the Burkina Faso iCCM program, and to do so in a way that (a) reports and compares data across multiple domains of CHW performance, and (b) synthesizes this information in summary measures that are useful for program managers and evaluators. We address two overarching program management questions: (1) *How well do CHWs perform at different tasks?* (2) *Is performance at one task related to performance at other tasks?* We answer these questions for individual CHWs, for districts, and for the iCCM program as a whole. In addition to presenting data on specific CHW tasks, we use this data to create summary measures of CHW performance. We show that summary measures of CHW performance, created through relatively simple aggregating equations, can yield great utility for program managers.

To guide the construction of our summary measures we developed a framework of CHW performance. A description of this framework is given in Chapter 1. To reflect the multi-dimensional nature of a CHW's role, we used existing literature (Winch *et al.*, 2005; UNICEF, 2006, 2012c; Marsh *et al.*, 2008; CORE Group, 2010; de Sousa *et al.*, 2012; George *et al.*, 2012; Nalwadda Kayemba *et al.*, 2012; iCCM Task Force, 2014) to identify four domains of performance: Building Community Relationships, Providing Care, Managing Commodities, and Reporting. These domains are summarized in Table 2.2 and used in this paper to structure a hierarchy of summary measures.

**Table 2.2. Domains of CHW performance**

| Performance domain | Examples of CHW tasks in a generic program where CHWs provide curative care | Examples of CHW tasks in the Burkina Faso iCCM program |
|---|---|---|
| Building community relationships | ▪ Raising awareness of CHW services<br><br>▪ Generating demand for services<br><br>▪ Building trust among community members<br><br>▪ Being available and accessible<br><br>▪ Publicizing activities<br><br>▪ Communicating with community members on health-related events and concerns<br><br>▪ Tracking health issues in the community<br><br>▪ Communicating with health facility staff on technical matters | ▪ Raising awareness and knowledge of the CHW's iCCM services among community members<br><br>▪ Building trust and rapport with community members so that caregivers feel comfortable taking their children to the CHW when they are sick<br><br>▪ Being available in a timely fashion when caregivers seek care for their sick children |
| Providing care | ▪ Delivery of technical services: including sick child consultations, counseling, referral<br><br>▪ Delivery of health education activities<br><br>▪ Technical advice and counseling on health matters for the community<br><br>▪ Screening for malnutrition, HIV and other illnesses | ▪ Delivery of iCCM services, including assessment and treatment for malaria, diarrhea and pneumonia<br><br>▪ Referral for severe illness or other illness<br><br>▪ Screening for malnutrition |
| Managing | ▪ Maintaining adequate stock of supplies | ▪ Maintaining a stock of cotrimoxazole, |

| commodities | necessary for the CHW role: drugs, diagnostic tests, therapeutic foods, print materials, hygiene kits<br><br>▪ Keeping supplies protected and in good condition<br><br>▪ Actively restocking when needed<br><br>▪ Tracking supply use<br><br>▪ Maintaining other equipment, such as assessment tools, transport | ORS, zinc, ACTs (infant and child), and paracetamol<br><br>▪ Keeping drugs safe and secure<br><br>▪ Charging fees for drugs that are sold<br><br>▪ Visiting the health facility to restock this supply of drugs when necessary<br><br>▪ Maintaining other equipment, such as MUAC tape, a breath-counter/timer |
|---|---|---|
| Reporting | ▪ Documenting activities in written registers and reports<br><br>▪ Aggregation and compilation of statistics for supervisor reports<br><br>▪ Maintaining patient registers, commodity registers<br><br>▪ Communicating with health facility for debriefing on activities | ▪ Recording details of sick child consultations in a patient register<br><br>▪ Completing and submitting monthly reports to health facility supervisors |

## 2.3. Methods

In the following section we describe the methods used to collect data, construct summary measures of CHW performance, and analyze CHW performance in the Burkina Faso iCCM program.

2.3.1.   Implementation and Quality of Care Assessment

The data for this paper come from an Implementation and Quality of Care Assessment of CHWs participating in an iCCM program in the North and Center-North regions of Burkina Faso. From 2010 to 2014, the *Institut Supérieur des Sciences de la Population* (ISSP) and the Institute for International Programs at Johns Hopkins University (IIP-JHU) conducted an independent evaluation of the abovementioned "Rapid Scale-up" (RSU) program (Munos *et al.*, 2015). The evaluation included an Implementation and Quality of Care Assessment in March-April 2013 to assess the implementation strength of the iCCM component of the RSU program and assess the quality of care provided by CHWs to sick children aged 2-59 months (ISSP and IIP-JHU, 2014).

*Study design*

The assessment took the form of a cross-sectional survey of CHWs in the 9 districts of the Burkina Faso iCCM program. To assess implementation strength, data collectors interviewed CHWs using a structured questionnaire covering training, supervision, work practices, and drug supply, and inspected each CHW's drug kit, equipment, and patient registry. To assess

quality of care, CHWs were observed in consultations with sick children (1 or 2

consultations per CHW). Data collectors used a checklist to record the assessment of danger

signs, classification of illness, decision to refer or treat, and counseling given to the caregiver.

Sick children were re-examined by a trained clinician for a gold standard assessment of their

illness. Following consultations, caregivers were interviewed to determine their

understanding of treatment and referral instructions, and their satisfaction with the care

provided by the CHW.

Each data collection team carried a drug kit throughout the assessment with all the drugs

that CHWs are authorized to prescribe. CHWs used this drug kit for observed consultations

and provided any drugs necessary for the child's treatment free of charge to the caregiver.

CHW performance in treating children was therefore independent of performance in

maintaining a drug kit.

The tools used for the assessment are attached as Appendix 1 (Forms 1 to 6).

*Sampling*

CHWs were sampled using systematic random sampling, stratified by district. The sampling

frame for each district (a list of all CHWs in the district, provided by the MoH district health

office) was ordered by health facility and by village before systematic sampling, to ensure

maximum spread of CHWs across health facilities and villages.

We sampled 420 CHWs from among an estimated 4,281 CHWs trained for the iCCM program. We over-sampled in the two intervention districts where CHWs had been trained to deliver CCM for pneumonia, to obtain more precise measures of pneumonia treatment. 210 CHWs were sampled in the 2 districts where CHWs were trained to deliver iCCM for pneumonia ("pneumonia study arm") and 210 CHWs were sampled in the 7 districts where CHWs were not trained to deliver iCCM for pneumonia ("non-pneumonia study arm"). This corresponded to 105 CHWs per district in the pneumonia study arm and 30 CHWs per district in the non-pneumonia study arm. The reason for these unequal sample sizes was to increase the precision of the point estimates for the quality of care given by ASCs for pneumonia and for appropriate use of antibiotics, which was a research question of interest to the MoH and partners at the time the evaluation was conceived.

*Sample size calculation and justification*

For implementation strength indicators, we estimated that sampling 420 CHWs would enable us to calculate point estimates separately for the pneumonia and non-pneumonia arms with precision of within +/- 9 percentage points (assuming a point estimate of 50%, a design effect of 1.5, a confidence level of 95%, and an estimated non-response rate of 5%). For quality of care indicators, we estimated that sampling 210 CHWs in each study arm would enable us to achieve precision for child-consultation indicators in each study arm of within +/- 9 percentage points given an average of 1 child-consultation per CHW; within +/- 7 percentage points given an average of 1.5 child-consultations per CHW; and within +/- 6 percentage points given an average of 2 child-consultations per CHW (again assuming

a point estimate of 50%, a design effect of 1.5, a confidence level of 95%, and an estimated non-response rate of 5%).

*Data collection*

Training for the Implementation and Quality of Care Assessment was led by ISSP and IIP-JHU and conducted in French and Mooré. The training covered the study procedures, tools, data collection techniques, iCCM clinical guidelines, quality assurance procedures, and study ethics, and included role-playing and simulation to enable data collectors to practice observation of consultations. Eighteen people were trained as observers and 14 people (clinicians designated by the MoH with experience in iCCM) were trained as re-examiners. As part of the training, the observers and re-examiners practiced observations and re-examinations at a local health facility, and we conducted concordance testing to assess inter- and intra-observer agreement. At the end of training, 14 people were selected as observers and paired with re-examiners to form 14 data collection teams (1 observer and 1 re-examiner in each team). Two people were selected as supervisors for the assessment and were given additional training on supervision methods.

Prior to training, the assessment tools and procedures were piloted by a team of 4 data collectors (2 observers and 2 re-examiners). These data collectors were trained in the same manner as for the assessment, and spent two days in the field interviewing CHWs, observing consultations, and conducting re-exams. The pilot followed the exact procedures of the study.

Samsung smartphones with Pendragon survey software were used for data collection. All personnel involved in quantitative data collection were trained how to use the smartphones, including navigation and completion of questionnaires, and sending data to the secure server database. Throughout the survey, a study coordinator analyzed incoming data to ensure quality and consistency of responses.

Data collection for the Implementation and Quality of Care Assessment lasted 5 weeks. Assessment teams worked approximately 6 days per week and completed 1 assessment visit per work day (i.e. 1 CHW per work day).

*Participant non-response*

Of the 420 sampled CHWs we found only 339 CHWs. This was a result of district CHW lists (the lists that formed our sampling frame) being out-of-date or CHWs being absent from the village on the day of the assessment. Of the 339 CHWs who were found, only 231 CHWs said they delivered iCCM services. The reason for this low proportion is as follows: although we were told by the MoH that all CHWs had been trained to deliver iCCM, some new CHWs had been recruited to deliver iCCM instead of existing CHWs, and those changes had not been reflected in district CHW lists. Thus although in some way this represents non-response, we don't believe that it reflects a weakness or bias in our sample - the purpose of our study was to measure the performance of CHWs delivering iCCM, and the CHWs that were excluded from our sample were excluded because they were not supposed to provide care in the first place. It would arguably have been more of a bias to *include* those CHWs in the sample. For the 189 CHWs who were not found or who said they

did not deliver iCCM services, we found 155 replacement CHWs who said they delivered

iCCM services, making a total of 386 CHWs who were successfully interviewed. All

replacement CHWs were selected from the village of the non-responding CHW. Finally, for

7 of these CHWs we were not able to find sick children for observation or re-examination,

thus we have complete data for 379 CHWs. District-level response rates were incorporated

into weighted estimates of performance scores, to account for participant non-response.


*Ethical clearance*


The Implementation and Quality of Care Assessment received ethical clearance from the

*Comité d'Éthique pour la Recherche en Santé* (Ethics Committee for Heath Research) in Burkina

Faso, and from the Johns Hopkins School of Public Health Institutional Review Board.


### 2.3.2. Constructing summary measures of CHW performance


Our goal in constructing summary measures of CHW performance was to report both an

overall measure of performance, and lower-level measures for the four domains of

performance in our framework. The Implementation and Quality of Care Assessment

collected data covering most, but not all, of these domains. The observation-re-examination

component of the assessment measured CHWs' ability to correctly assess and treat sick

children for iCCM illnesses, giving information on tasks in the domain of Providing Care.

The inspection of CHWs' drug kits, equipment, and patient registers, gave information on

the domains of Managing Commodities, and Reporting. The one domain for which no data

were collected was Building Community Relationships. In the structured questionnaire there

were some questions that might have been useful (such as a CHW's self-report on village members' awareness of their CHW services), but the responses to these questions showed negligible variation, and in any case, didn't truly capture the domain of Building Community Relationships as conceived in our framework. As such, this domain was omitted from our analysis.

To construct the summary measures, we developed a hierarchy of aggregation with four levels (Figure 2.1). At the first level are "task measures", which correspond to the individual tasks that CHWs are expected to perform. In total we constructed 58 task measures, all of which were binary or categorical variables. Descriptions of these task measures are provided in Appendix 2. At the second level are sub-domain measures. These sub-domains synthesize data from groups of related tasks. We constructed nine sub-domain measures: Assessment, Classification, Treatment, Counselling, Drug Stock, Equipment, Drug Practices, Register Use, and Register Quality. At the third level are domain measures, corresponding to the domains in our framework on CHW performance (with the exception of Building Community Relationships). The highest-level summary measure was a single measure of Overall Performance, incorporating all data from lower-level measures.

**Figure 2.1. Hierarchy of summary measures with four levels of aggregation**
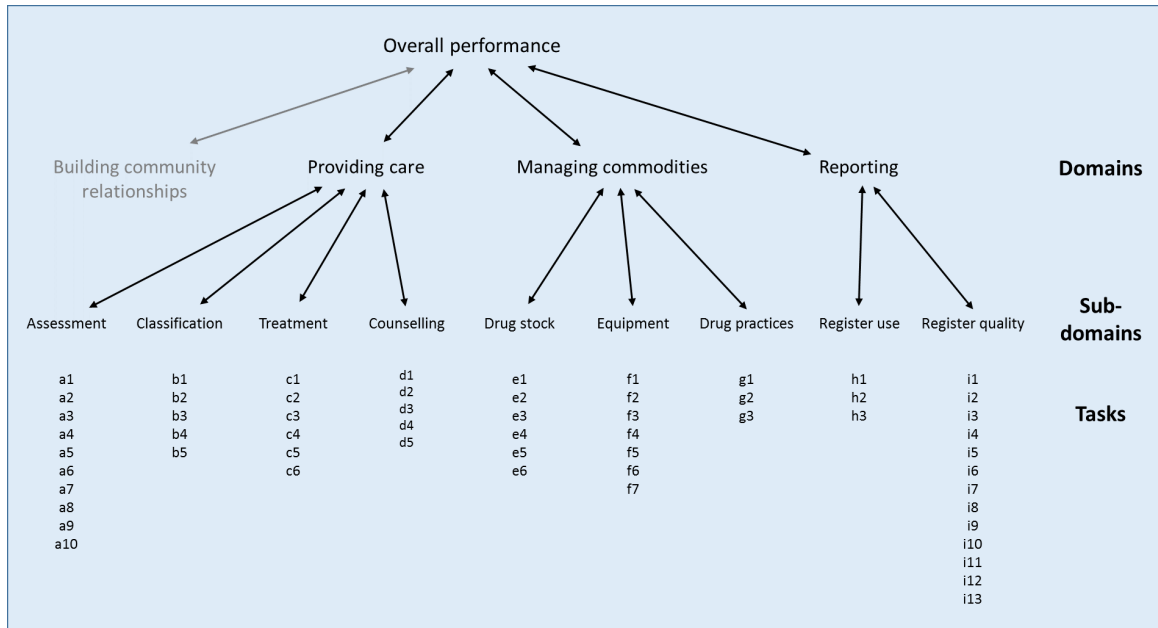


The equations used to construct the summary measures are shown in Figure 2.2. Each summary measure is an arithmetic mean of the component measures at the level below. Task measures are the base-level measures, with binary or categorical scores calculated directly from the data; sub-domain measures aggregate data from task measures; domain measures aggregate data from sub-domain measures; and the Overall Performance measure aggregates data from domain measures.

**Figure 2.2. Equations for constructing summary measures**

$$\text{Score for sub-domain i} = \frac{\text{sum of scores for tasks in sub-domain i}}{\text{number of tasks in sub-domain i that were recorded}}$$

$$\text{Score for domain j} = \frac{\text{sum of scores for sub-domain measures in domain j}}{\text{number of sub-domain measures in domain j that were recorded}}$$

$$\text{Score for Overall Performance} = \frac{\text{sum of scores for domain measures}}{3}$$

Since each summary measure was an arithmetic mean of the component measures at the level below, and all task measures had values between 0 and 1, all summary measures also took on values between 0 and 1, with 1 representing the maximum possible score for every CHW. Not all tasks were recorded for all CHWs. For example, some CHWs did not participate in a consultation with a child with fever, so tasks on classification or treatment of fever were not recorded for those CHWs. To account for this, the calculations of scores only included in the denominator those measures that were recorded for the individual CHW. This allowed all CHWs to receive a score between 0 and 1, even though some tasks were not recorded for some CHWs.

Constructing the variables in this way meant that for each sub-domain measure, all task scores were given equal weighting (assuming the task was included in the denominator). In other words, a CHW's score for the task of "checking for the danger sign of vomiting" contributed as much to the sub-domain measure of Assessment as their scores for the tasks

of "checking for fever" and "checking for oedema". Likewise, for domain measures, all component sub-domain scores were given equal weighting, and for the measure of Overall Performance, all domain scores were given equal weighting. (A discussion of the advantages and disadvantages of this methodology is presented below in section 2.5.4.)

The results for tasks in the domain of Providing Care were different to those for the other tasks because they came from observed sick-child consultations and we therefore had multiple observations per CHW (whereas for tasks in other domains we only had one observation per CHW). We averaged the consultation-level binary results for each CHW, giving scores at the CHW level of either 1, 0.5, or 0 (a CHW scored 0.5 if they participated in two sick child consultations and scored 0 for one consultation and 1 for the other). Results for tasks in the sub-domains of Classification, Treatment, and Counselling were only recorded for consultations where the child presented with the relevant illness for that task, as classified by the re-examiner. For tasks in the sub-domain of Classification, CHWs scored correctly if the classification they gave matched the classification given by the re-examiner. For tasks in the sub-domain of Treatment, the CHW needed to prescribe the correct drug, dosage, and treatment duration - according to the iCCM treatment algorithm for the classification given by the re-examiner.

The tasks in the sub-domain of Register Quality were only recorded if a CHW actually had a register; otherwise, all of the tasks in the sub-domain of Register Quality were scored as 0.

2.3.3. <u>Analysis of summary measures</u>

We used various methods to analyze our data on CHW performance and to describe the
summary measures we had constructed, including point estimates, histograms, scatterplots,
correlation coefficients, and simple linear regression. All analyses were conducted in Stata 12
(StataCorp, 2011).

For each of our task measures and summary measures, we calculated the average score
among CHWs in our sample, and an estimate of the average score among all CHWs in the
iCCM program (the population of CHWs). Population estimates were weighted for unequal
probability of sampling and non-response, using Stata's SVY commands. For confidence
intervals associated with weighted estimates, we used the Taylor linearization method to
adjust standard errors for the effects of clustering.

For correlations of continuous variables we calculated Pearson's correlation coefficients, and
for categorical variables we calculated polychoric correlation coefficients.

To examine the associations between domain-level summary measures (which were all
continuous variables) we used simple linear regression. For each pair of summary measures
(e.g. Providing Care and Managing Commodities) we constructed two models: one model
with the first measure as the dependent variable and the second as the independent variable;
and a second model with the second measure as the dependent variable and the first as the
independent variable. Using these models we calculated regression coefficients and
associated confidence intervals for the associations between summary measures.

## 2.4. Results

We organize our results according to two overarching questions: *How well do CHWs perform at different tasks?* ("performance across tasks"); and *Is performance at one task related to performance at other tasks?* ("performance patterns"). For each question we analyze the results for individual CHWs and for districts. The results for individual CHWs tell us which specific tasks CHWs find easy or difficult, which domains of performance need attention, and how performance varies across these tasks and domains; whether CHWs generally perform well or poorly at all tasks, or whether individual CHWs perform some tasks well but other tasks poorly. The district results reveal differences in district-level performance and highlight the strengths and weaknesses of districts for different performance domains.

2.4.1.  Performance across tasks

*Individual CHWs*

Tables 2.3 to 2.5 show the performance of CHWs at all 58 tasks, grouped according to the domains and sub-domains in our framework. For each task, we show the number of observations, the average score among sampled CHWs, and the estimated average score among CHWs in the Burkina Faso iCCM program. For tasks in the domain of Providing Care, we show the results at the consultation level (one observation per consultation) and at the CHW Level (one observation per CHW, with consultation scores averaged for each CHW).

The results show that CHWs perform well at some tasks and poorly at other tasks. For example, there was wide variation in the scores for tasks in the sub-domain of Assessment. CHWs frequently check for some symptoms, but only infrequently check for other symptoms. On average, 93.2% of children are checked for fever, but only 22.0% of children are checked for oedema. Less than half of children are checked for the danger signs of inability to drink (37.1%), vomiting everything (46.1%), and convulsions (26.3%), while 71.1% are checked for lethargy and unconsciousness. In the pneumonia study arm, CHWs correctly count the breaths of children with cough or rapid/difficult breathing in 56% of consultations. The scores for tasks in other sub-domains show similar variation.

## Table 2.3. Performance scores for tasks in the domain of Providing Care

| Tasks in the domain of Providing Care | Consultation level | | CHW level (average of 1 or 2 consultations observed) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unweighted estimates | | Unweighted estimates | | | | | Weighted estimates | |
| | n | % correct (score=1) | n | % all correct (score=1) | % half correct (score=0.5) | % none correct (score=0) | Average score among sampled CHWs | Average score among all CHWs | 95% confidence interval |
| *Assessment* | | | | | | | | | |
| a1 CHW checks danger signs: able to drink | 726 | 46.7% | 379 | 35.1% | 24.3% | 40.6% | 0.47 | 0.37 | 0.33, 0.42 |
| a2 CHW checks danger signs: vomits everything | 726 | 51.5% | 379 | 37.7% | 26.6% | 35.6% | 0.51 | 0.46 | 0.41, 0.51 |
| a3 CHW checks danger signs: convulsions | 726 | 37.3% | 379 | 29.8% | 14.0% | 56.2% | 0.37 | 0.26 | 0.21, 0.31 |
| a4 CHW checks danger signs: lethargy/unconscious | 726 | 70.8% | 379 | 65.7% | 11.3% | 23.0% | 0.71 | 0.71 | 0.66, 0.76 |
| a5 CHW asks about cough | 718 | 59.2% | 379 | 45.6% | 26.1% | 28.2% | 0.59 | 0.49 | 0.44, 0.55 |
| a6 CHW asks about diarrhea | 718 | 73.3% | 379 | 59.4% | 28.5% | 12.1% | 0.74 | 0.74 | 0.70, 0.79 |
| a7 CHW asks about fever | 718 | 91.5% | 379 | 85.0% | 12.9% | 2.1% | 0.91 | 0.93 | 0.91, 0.96 |
| a8 CHW correctly measures MUAC | 663 | 65.9% | 374 | 55.6% | 19.0% | 25.4% | 0.65 | 0.60 | 0.54, 0.65 |
| a9 CHW checks odema | 663 | 19.9% | 374 | 12.8% | 12.6% | 74.6% | 0.19 | 0.22 | 0.17, 0.27 |
| a10 CHW correctly counts breaths * | 146 * | 56.2% | 103 * | 44.7% | 22.3% | 33.0% | 0.56 | 0.57 * | 0.48, 0.65 |
| *Classification* | | | | | | | | | |
| b1 CHW correctly classifies danger signs | 7 | 42.9% | 7 | 42.9% | 0.0% | 57.1% | 0.43 | 0.11 | 0.10, 0.82 ** |
| b2 CHW correctly classifies diarrhea | 324 | 77.2% | 250 | 72.4% | 9.6% | 18.0% | 0.77 | 0.76 | 0.69, 0.83 |
| b3 CHW correctly classifies fever | 481 | 76.9% | 316 | 69.3% | 14.2% | 16.5% | 0.76 | 0.80 | 0.75, 0.85 |
| b4 CHW correctly classifies pneumonia * | 83 * | 57.8% | 72 * | 54.2% | 4.2% | 41.7% | 0.56 | 0.59 * | 0.46, 0.71 |
| b5 CHW correctly classifies malnutrition | 112 | 55.4% | 99 | 54.5% | 4.0% | 41.4% | 0.57 | 0.48 | 0.37, 0.59 |
| *Treatment* | | | | | | | | | |
| c1 CHW correctly prescribes ORS | 305 | 29.2% | 236 | 22.9% | 11.0% | 66.1% | 0.28 | 0.32 | 0.25, 0.39 |
| c2 CHW correctly prescribes zinc | 305 | 34.1% | 236 | 26.7% | 12.3% | 61.0% | 0.33 | 0.26 | 0.20, 0.32 |
| c3 CHW correctly prescribes ACT | 479 | 63.0% | 316 | 54.4% | 16.5% | 29.1% | 0.63 | 0.61 | 0.55, 0.67 |
| c4 CHW correctly prescribes paracetamol | 479 | 9.6% | 316 | 6.6% | 7.0% | 86.4% | 0.10 | 0.04 | 0.02, 0.07 |
| c5 CHW correctly prescribes cotrimoxizole * | 80 * | 51.2% | 69 * | 47.8% | 7.2% | 44.9% | 0.51 | 0.51 * | 0.40, 0.62 |
| c6 CHW correctly refers child to health facility | 149 | 32.2% | 127 | 29.1% | 6.3% | 64.6% | 0.32 | 0.27 | 0.17, 0.36 |
| *Counselling* | | | | | | | | | |
| d1 CHW asks caregiver to repeat | 637 | 23.4% | 356 | 18.0% | 11.5% | 70.5% | 0.24 | 0.15 | 0.11, 0.18 |
| d2 CHW tells to drink more | 305 | 3.6% | 236 | 3.8% | 0.4% | 95.8% | 0.04 | 0.01 | 0.00, 0.02 |
| d3 CHW tells to cold wrap | 481 | 1.9% | 316 | 0.6% | 1.9% | 97.5% | 0.02 | 0.02 | 0.00, 0.04 |
| d4 CHW tells to go to health facility if still sick | 726 | 32.0% | 379 | 21.1% | 19.8% | 59.1% | 0.31 | 0.30 | 0.25, 0.34 |
| d5 CHW explains when to return | 726 | 42.0% | 379 | 29.3% | 25.6% | 45.1% | 0.42 | 0.36 | 0.31, 0.42 |

\* Applicable to pneumonia study arm only

\*\* Unweighted standard error due to limited strata in sample

**Table 2.4.  Performance scores for tasks in the domain of Managing Commodities**

| Tasks in the domain of Managing Commodities | n | Unweighted estimates Average score among sampled CHWs | Weighted estimates Average score among all CHWs | 95% confidence interval |
|---|---|---|---|---|
| *Drug Stock* | | | | |
| e1 CHW has unexpired cotrimoxizole * | 192 * | 0.71 | 0.72 * | 0.64, 0.80 |
| e2 CHW has unexpired ORS | 379 | 0.36 | 0.32 | 0.26, 0.38 |
| e3 CHW has unexpired zinc | 379 | 0.38 | 0.31 | 0.25, 0.37 |
| e4 CHW has unexpired ACT for infants | 379 | 0.36 | 0.30 | 0.24, 0.36 |
| e5 CHW has unexpired ACT for children | 379 | 0.48 | 0.40 | 0.33, 0.47 |
| e6 CHW has unexpired paracetamol | 379 | 0.64 | 0.55 | 0.48, 0.62 |
| *Equipment* | | | | |
| f1 CHW has working timer * | 192 * | 0.88 | 0.88 * | 0.83, 0.92 |
| f2 CHW has source of clean water | 379 | 0.82 | 0.77 | 0.71, 0.83 |
| f3 CHW has ORS kit | 379 | 0.76 | 0.65 | 0.59, 0.72 |
| f4 CHW has MUAC tape | 379 | 0.95 | 0.95 | 0.93, 0.98 |
| f5 CHW has consultation register | 379 | 0.85 | 0.73 | 0.67, 0.79 |
| f6 CHW has bag or box for drug kit | 379 | 0.69 | 0.67 | 0.61, 0.73 |
| f7 CHW has working bike | 379 | 0.79 | 0.86 | 0.82, 0.91 |
| *Drug Practices* | | | | |
| g1 CHW keeps drugs stored appropriately | 379 | 0.11 | 0.07 | 0.04, 0.11 |
| g2 CHW maintains a drug register | 379 | 0.48 | 0.38 | 0.33, 0.43 |
| g3 CHW does not give drugs without seeing child | 379 | 0.86 | 0.76 | 0.71, 0.82 |

* Applicable to pneumonia study arm only

**Table 2.5. Performance scores for tasks in the domain of Reporting**

| Tasks in the domain of Reporting | | n | Unweighted estimates | Weighted estimates | |
|---|---|---|---|---|---|
| | | | Average score among sampled CHWs | Average score among all CHWs | 95% confidence interval |
| *Register Use* | | | | | |
| h1 | CHW has register (and register available) | 379 | 0.83 | 0.71 | 0.65, 0.76 |
| h2 | CHW records all consultations in register | 379 | 0.54 | 0.36 | 0.30, 0.41 |
| h3 | CHW records consultations himself/herself | 379 | 0.72 | 0.59 | 0.52, 0.65 |
| *Register Quality* | | | | | |
| i1 | CHW always records date | 379 | 0.67 | 0.49 | 0.43, 0.54 |
| i2 | CHW always records child's name | 379 | 0.74 | 0.55 | 0.50, 0.61 |
| i3 | CHW always records child's age | 379 | 0.73 | 0.56 | 0.50, 0.62 |
| i4 | CHW always records child's sex | 379 | 0.66 | 0.52 | 0.46, 0.58 |
| i5 | CHW always records mom's name | 379 | 0.65 | 0.50 | 0.44, 0.56 |
| i6 | CHW always records symptoms | 379 | 0.68 | 0.53 | 0.47, 0.59 |
| i7 | CHW always records breaths per minute * | 192 * | 0.30 | 0.31 * | 0.19, 0.43 |
| i8 | CHW always records treatment | 379 | 0.67 | 0.51 | 0.45, 0.57 |
| i9 | CHW always records nutritional status | 379 | 0.53 | 0.42 | 0.36, 0.48 |
| i10 | CHW always records vitamin A status | 379 | 0.45 | 0.37 | 0.31, 0.42 |
| i11 | CHW always records immunization status | 379 | 0.45 | 0.37 | 0.31, 0.42 |
| i12 | CHW always records price of drugs | 379 | 0.51 | 0.31 | 0.26, 0.37 |
| i13 | CHW always records observations | 379 | 0.15 | 0.12 | 0.08, 0.17 |

* Applicable to pneumonia study arm only

Tables 2.6 to 2.8 show the scores for sub-domain, domain, and overall performance summary measures. The average score, lowest score, and highest score are shown for sampled CHWs, as well as the estimated average for all CHWs and a confidence interval for the estimated average. For each sub-domain summary measure we show the average number of tasks recorded per CHW.

The sub-domain-level summary measures (Table 2.6) indicate how well CHWs perform at different types of task. The estimated mean score for Drug Stock was 0.38 whereas the estimated mean score for Equipment was 0.77, suggesting that CHWs are more likely to maintain the equipment they need than keep a stock of all the drugs they need. The score for Drug Stock tells us that, on average, CHWs have only 38% of the drugs they need to treat the illnesses for which they are trained (only 8.3% of CHWs had all the drugs they need, scoring 1 for Drug Stock). The average score for Treatment was 0.33, whereas the average score for Classification was 0.77, suggesting that CHWs are better at classifying illnesses than giving the correct treatment. The sub-domain at which CHWs performed worst was Counseling, with an average score of only 0.20.

The scores for the domain measures (Table 2.7) suggest that, on average, CHWs perform equally well at Providing Care (0.46), Managing Commodities (0.52), and Reporting (0.49). CHWs don't appear to perform significantly better in any particular domain.

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**Table 2.6. Performance scores for sub-domain summary measures**

| Sub-domains | n | Unweighted estimates | | | | Weighted estimates | |
|---|---|---|---|---|---|---|---|
| | | Average number of tasks recorded (denominator) | Average score among sampled CHWs | Lowest score among sampled CHWs | Highest score among sampled CHWs | Average score among all CHWs | 95% confidence interval |
| *Providing Care* | | | | | | | |
| Assessment | 379 | 9.0 | 0.57 | 0.17 | 1.00 | 0.54 | 0.51, 0.56 |
| Classification | 369 * | 1.4 | 0.76 | 0.00 | 1.00 | 0.77 | 0.73, 0.80 |
| Treatment | 369 * | 2.5 | 0.38 | 0.00 | 1.00 | 0.33 | 0.31, 0.36 |
| Counselling | 379 | 4.0 | 0.25 | 0.00 | 0.88 | 0.20 | 0.18, 0.22 |
| *Managing Commodities* | | | | | | | |
| Drug Stock | 379 | 5.5 | 0.46 | 0.00 | 1.00 | 0.38 | 0.34, 0.42 |
| Equipment | 379 | 6.5 | 0.81 | 0.17 | 1.00 | 0.77 | 0.75, 0.80 |
| Drug Practices | 379 | 3.0 | 0.48 | 0.00 | 1.00 | 0.41 | 0.38, 0.44 |
| *Reporting* | | | | | | | |
| Register Use | 379 | 3.0 | 0.69 | 0.00 | 1.00 | 0.55 | 0.50, 0.60 |
| Register Quality | 379 | 12.5 | 0.56 | 0.00 | 1.00 | 0.43 | 0.39, 0.48 |

* 10 CHWs had no score for Classification or Treatment because the children that they saw were not diagnosed by the re-examiner as having diarrhea, fever, suspected pneumonia, malnutrition, or needing referral

**Table 2.7. Performance scores for domain summary measures**

| Domains | n | Unweighted estimates | | | Weighted estimates | |
|---|---|---|---|---|---|---|
| | | Average score among sampled CHWs | Lowest score among sampled CHWs | Highest score among sampled CHWs | Average score among all CHWs | 95% confidence interval |
| Providing Care | 379 | 0.49 | 0.05 | 0.89 | 0.46 | 0.44, 0.47 |
| Managing Commodities | 379 | 0.59 | 0.11 | 1.00 | 0.52 | 0.50, 0.54 |
| Reporting | 379 | 0.63 | 0.00 | 1.00 | 0.49 | 0.45, 0.54 |

**Table 2.8. Performance scores for the summary measure of Overall Performance**

| Overall Performance | n | Unweighted estimates | | | Weighted estimates | |
|---|---|---|---|---|---|---|
| | | Average score among sampled CHWs | Lowest score among sampled CHWs | Highest score among sampled CHWs | Average score among all CHWs | 95% confidence interval |
| Overall Performance | 379 | 0.57 | 0.11 | 0.93 | 0.49 | 0.47, 0.51 |

The distribution of scores for the sub-domain, domain, and overall performance summary measures are shown in Figures 2.3 to 2.5. All summary measures have distributions with wide spread, with some CHWs scoring above 0.8 and some scoring below 0.2. The range of scores for Overall Performance varies from 0.11 to 0.93; with 3.2% of CHWs scoring below 0.2 and 7.1% scoring above 0.8. Some measures, such as Providing Care and Managing Commodities, have distributions that approximate a normal distribution. Other distributions are skewed: Classification and Equipment are left-skewed, with most CHWs performing well; Counseling is right-skewed, with most CHWs performing poorly. The distributions for Drug Practices and Register Use are limited to four scores; these measures are constructed from only 3 tasks, so there are only four possible scores (0, 0.33, 0.67 and 1). The distribution for Register Quality is strongly bimodal, with most CHWs scoring either 0 or >0.9. This is an artefact of the way in which the Register Quality summary measure was constructed: all of the tasks contributing to Register Quality (i1-i13) required a CHW to have a patient register in order to receive a score; if a CHW did not have a patient register (29% of CHWs) then he or she automatically scored 0 for all tasks i1-i13, and therefore scored 0 for Register Quality. The bimodality of the Register Quality measure is also reflected in the Reporting and Overall Performance measures.

**Figure 2.3. Distribution of scores for sub-domain summary measures**
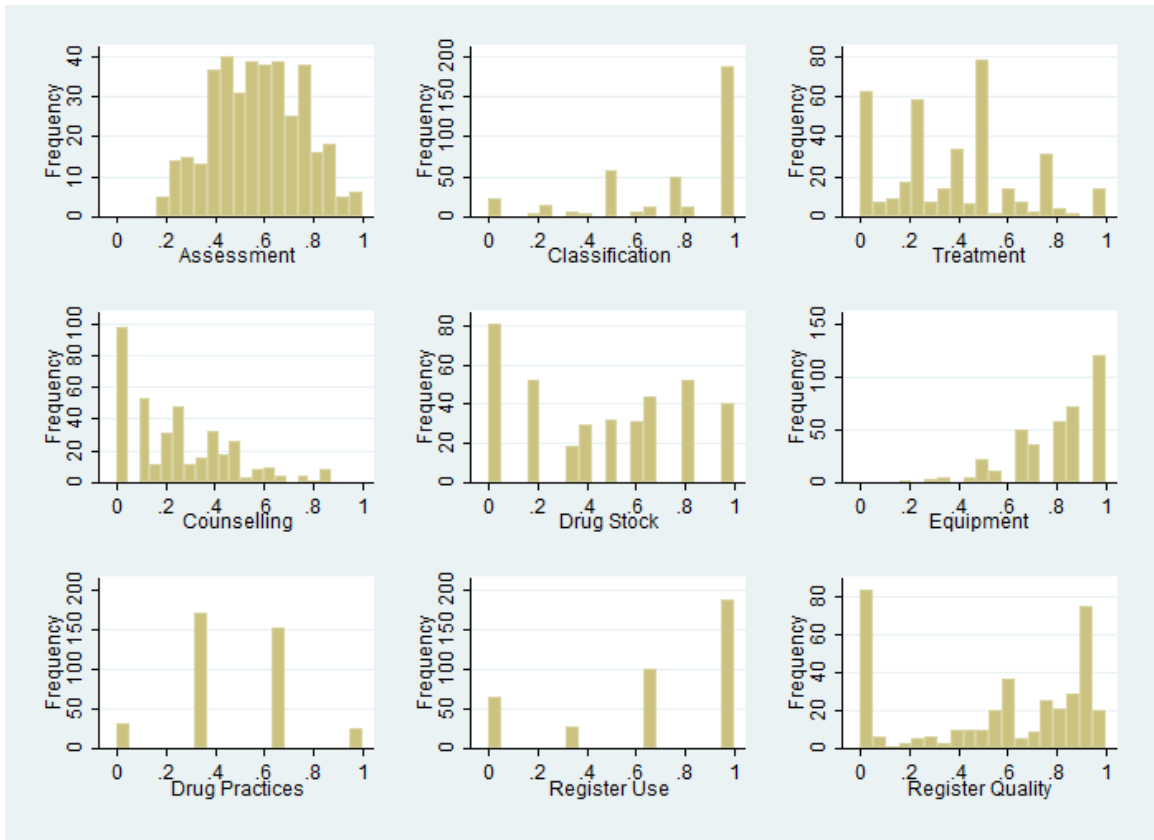


**Figure 2.4. Distribution of scores for domain summary measures**
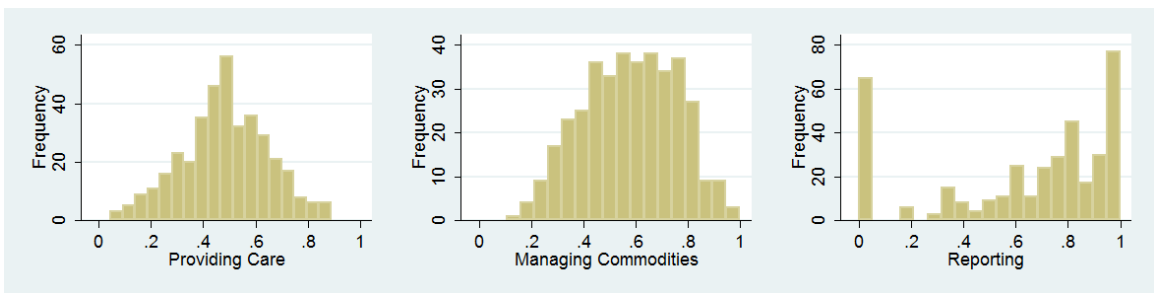


**Figure 2.5. Distribution of scores for the summary measure of Overall Performance**
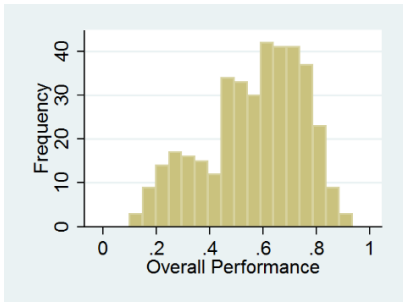
*Districts*

Table 2.9 and Figures 2.6 to 2.7 show mean performance scores by district. There was wide variation across districts for most summary measures. Barsalogho, Gourcy and Yako were the highest-performing districts overall. Boulsa and Kaya were the lowest-performing districts. The greatest variation was in the domain of Reporting, with CHWs in Boulsa and Kaya each averaging 0.22 for the domain measure of Reporting, compared to Barsalogho and Gourcy each averaging 0.75 - a range of 0.53 between district mean scores. Other domain measures had a narrower range (0.21 for Providing Care and 0.29 for Managing Commodities), though the differences across district were still noticeable, and adjusted Wald tests (Table 2.9) showed that the differences were statistically significant for all summary measures.

The districts in the pneumonia study arm (Barsalogho and Gourcy) were among the highest-performing districts. To check that these high scores did not reflect confounding from pneumonia-related tasks, we re-calculated all summary measures in such a way as to exclude the scores for these tasks. The results for these re-calculated scores were identical at 1 decimal point to those in Table 2.9.

**Table 2.9. Scores for sub-domain, domain, and overall performance summary measures by district**

| | | ALL DISTRICTS | Barsalogho | Boulsa | Gourcy | Kaya | Kongoussi | Ouahigouya | Seguenega | Titao | Yako | p-value for equality of means |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overall Performance | | 0.49 | 0.65 | 0.33 | 0.63 | 0.34 | 0.50 | 0.57 | 0.52 | 0.48 | 0.66 | <0.001 |
| Domain | Providing Care | 0.46 | 0.52 | 0.34 | 0.52 | 0.38 | 0.55 | 0.47 | 0.43 | 0.46 | 0.53 | <0.001 |
| | Managing Com. | 0.52 | 0.69 | 0.42 | 0.61 | 0.42 | 0.49 | 0.54 | 0.54 | 0.48 | 0.71 | <0.001 |
| | Reporting | 0.49 | 0.75 | 0.22 | 0.75 | 0.22 | 0.46 | 0.69 | 0.58 | 0.49 | 0.73 | <0.001 |
| Sub-domain | Assessment | 0.54 | 0.57 | 0.38 | 0.67 | 0.51 | 0.64 | 0.54 | 0.42 | 0.62 | 0.57 | <0.001 |
| | Classification | 0.77 | 0.84 | 0.70 | 0.67 | 0.73 | 0.88 | 0.74 | 0.77 | 0.71 | 0.82 | 0.001 |
| | Treatment | 0.33 | 0.44 | 0.25 | 0.40 | 0.21 | 0.34 | 0.44 | 0.26 | 0.29 | 0.48 | <0.001 |
| | Counselling | 0.20 | 0.21 | 0.06 | 0.34 | 0.09 | 0.34 | 0.15 | 0.28 | 0.26 | 0.26 | <0.001 |
| | Drug Stock | 0.38 | 0.64 | 0.27 | 0.47 | 0.18 | 0.49 | 0.35 | 0.31 | 0.24 | 0.69 | <0.001 |
| | Equipment | 0.77 | 0.87 | 0.73 | 0.83 | 0.74 | 0.69 | 0.79 | 0.82 | 0.86 | 0.80 | 0.003 |
| | Drug Practices | 0.41 | 0.57 | 0.26 | 0.53 | 0.32 | 0.30 | 0.49 | 0.49 | 0.35 | 0.63 | <0.001 |
| | Register Use | 0.55 | 0.79 | 0.35 | 0.87 | 0.21 | 0.59 | 0.69 | 0.62 | 0.55 | 0.76 | <0.001 |
| | Register Quality | 0.43 | 0.70 | 0.10 | 0.63 | 0.23 | 0.33 | 0.69 | 0.54 | 0.44 | 0.71 | <0.001 |

(p-values calculated using adjusted Wald tests for equivalence of means)

**Figure 2.6. Scores for Overall Performance by district**



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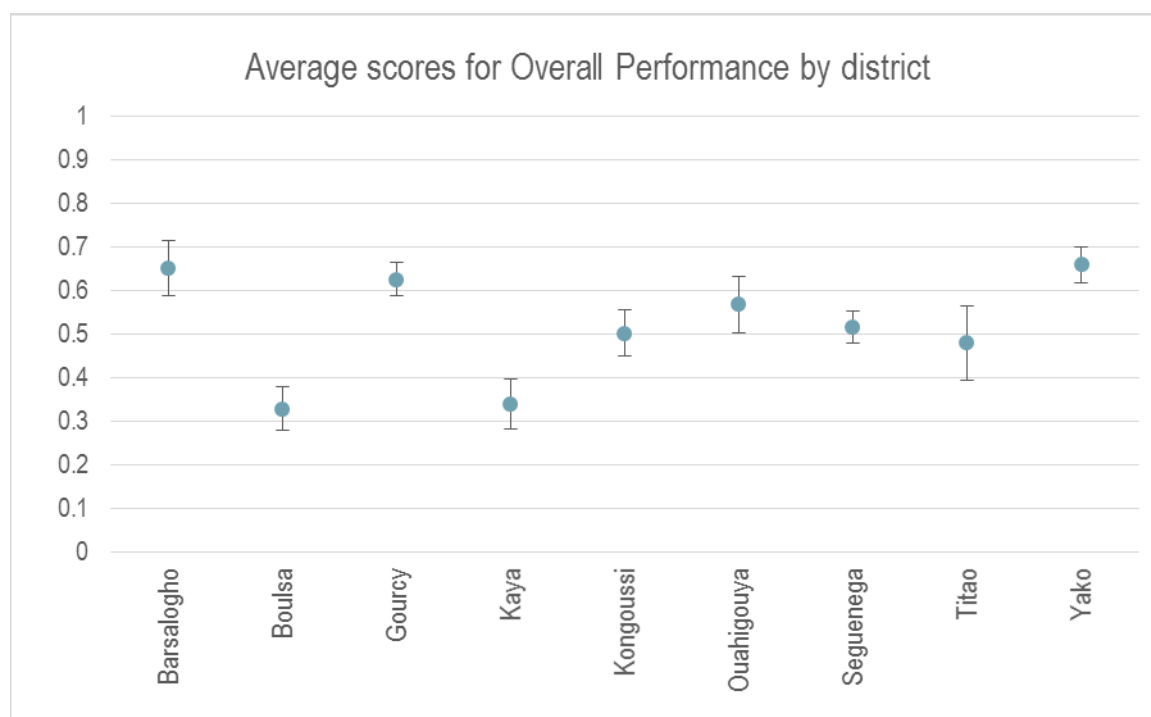
**Figure 2.7.  Scores for domain-level summary measures by district**



Average scores for domain-level summary measures by district

Legend: ■ Providing Care ▨ Managing Commodities ▨ Reporting
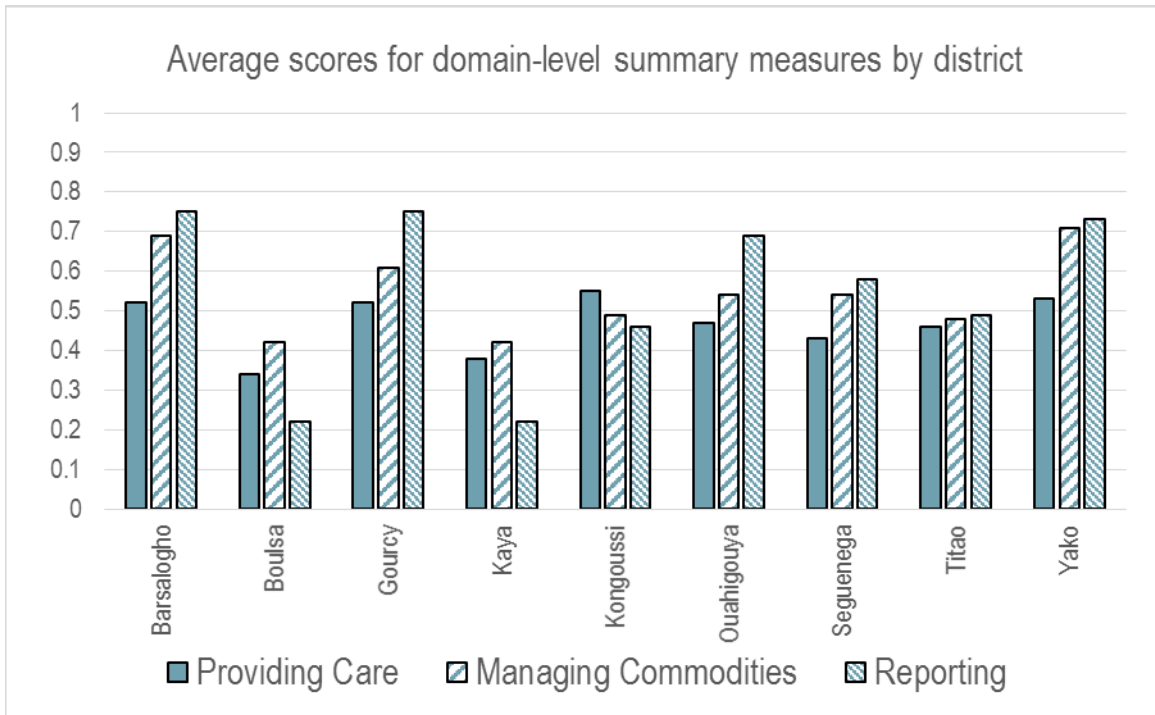
2.4.2.  <u>Performance patterns</u>

In this section we investigate the relationships between performance scores - between tasks, between sub-domains, and between domains. The results show whether performance in certain tasks is related to performance in other tasks, and reveal whether CHWs tend to perform well or poorly at all tasks (meaning that there are distinct high- and low-performing CHWs) or perform well at some tasks but poorly at other tasks. As in the previous section, we examine these relationships for individual CHWs and for districts.

*Individual CHWs*

Tables 2.10 to 2.11 show the correlations between performance scores for tasks in the sub-domains of Assessment and Drug Stock, which we highlight as illustrative examples. The pair-wise results in these correlation matrices show a CHW's likelihood of performing one task correctly if he or she performs a second task correctly (and vice versa). Table 2.10 suggests that, for many Assessment tasks, a CHW's success at one task is not strongly related to his or her success at other tasks. For example, whether a CHW checked for diarrhea (a6) does not appear to be strongly related to whether he or she checked for other symptoms (-0.16<r<0.2). The same is true for checking for oedema (a9) and for correctly counting breaths (a10). The highest correlations in this table are within the group of tasks a1-a3, which are tasks associated with checking for danger signs (0.57<r<0.61).

The correlation matrix in Table 2.11 shows stronger relationships between tasks. The results suggest that if a CHW has unexpired stock of one drug, they are more likely to have

unexpired stock of other drugs. The correlations between tasks e4-e6 (CHW has unexpired

stock of ACT infant, ACT children, and paracetamol) are all high (>0.61): this could be

because these drug types are all involved in malaria treatment.[1] The equivalent correlation

coefficient for ORS and zinc (e2-e3), which are both in the treatment regime for diarrhea, is

lower at 0.47.

One of the correlations not shown in the tables is that between "CHW correctly prescribes

ORS" (c1) and "CHW correctly prescribes zinc" (c2). The iCCM algorithm in Burkina Faso

requires children with diarrhea to be treated with both ORS and zinc, yet the correlation

coefficient for these two tasks was 0.06. In other words, many CHWs correctly prescribe

ORS when needed, but do not correctly prescribe zinc; and vice versa. By contrast, the

correlation coefficient for correctly prescribing ACT and paracetamol when needed was

0.46.

Tables 2.12 to 2.14 show the correlations between sub-domain-level summary measures.

Most of these correlations were not strong (<0.5). The strongest correlation was between

Register Use and Register Quality (0.74), though this is likely an artefact of the fact that

CHWs who did not have a patient register (Register Use) scored 0 for all the Register Quality

tasks. The weakest correlation among any of the sub-domain pairs was between Assessment

and Classification (0.07). This surprising result suggests that there was a minimal relationship

between the extent of a CHW's assessment of a child and the likelihood that the CHW

correctly diagnosed the child's illness.

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[1] Malaria was the focus of the PECADO program, a CCM program run concurrently with the "Rapid Scale-up" iCCM program that many of the same CHWs participated in. ACTs were also the treatment most accurately prescribed in our study - see Table 2.3, task c4.

**Table 2.10.  Polychoric correlations between tasks in the sub-domain of Assessment**

|  | a1 | a2 | a3 | a4 | a5 | a6 | a7 | a8 | a9 | a10 |
|---|---|---|---|---|---|---|---|---|---|---|
| a1 | 1.00 | | | | | | | | | |
| a2 | 0.60 | 1.00 | | | | | | | | |
| a3 | 0.57 | 0.61 | 1.00 | | | | | | | |
| a4 | 0.32 | 0.06 | 0.25 | 1.00 | | | | | | |
| a5 | 0.34 | 0.31 | 0.40 | -0.02 | 1.00 | | | | | |
| a6 | 0.00 | 0.20 | 0.02 | -0.14 | -0.16 | 1.00 | | | | |
| a7 | 0.17 | 0.24 | 0.17 | 0.01 | 0.32 | 0.06 | 1.00 | | | |
| a8 | 0.24 | 0.25 | 0.28 | 0.07 | 0.03 | 0.08 | 0.24 | 1.00 | | |
| a9 | 0.00 | 0.03 | 0.01 | 0.06 | 0.02 | 0.09 | 0.16 | 0.24 | 1.00 | |
| a10 | -0.05 | -0.17 | -0.10 | -0.10 | -0.19 | 0.13 | 0.10 | 0.16 | 0.22 | 1.00 |

a1: CHW checks danger signs: able to drink
a2: CHW checks danger signs: vomits everything
a3: CHW checks danger signs: convulsions
a4: CHW checks danger signs: lethargy/unconscious
a5: CHW asks about cough
a6: CHW asks about diarrhea
a7: CHW asks about fever
a8: CHW correctly measures MUAC
a9: CHW checks odema
a10: CHW correctly counts breaths

**Table 2.11.  Polychoric correlations between tasks in the sub-domain of Drug Stock**

|  | e1 | e2 | e3 | e4 | e5 | e6 |
|---|---|---|---|---|---|---|
| e1 | 1.00 | | | | | |
| e2 | 0.60 | 1.00 | | | | |
| e3 | 0.36 | 0.47 | 1.00 | | | |
| e4 | 0.48 | 0.45 | 0.36 | 1.00 | | |
| e5 | 0.73 | 0.51 | 0.28 | 0.79 | 1.00 | |
| e6 | 0.82 | 0.52 | 0.32 | 0.61 | 0.80 | 1.00 |

e1: CHW has unexpired cotrimoxizole
e2: CHW has unexpired ORS
e3: CHW has unexpired zinc
e4: CHW has unexpired ACT for infants
e5: CHW has unexpired ACT for children
e6: CHW has unexpired paracetamol

**Table 2.12. Correlations between sub-domain measures in the domain of Providing Care**

|                | Assessment | Classification | Treatment | Counselling |
|----------------|------------|----------------|-----------|-------------|
| Assessment     | 1.00       |                |           |             |
| Classification | 0.07       | 1.00           |           |             |
| Treatment      | 0.28       | 0.39           | 1.00      |             |
| Counselling    | 0.46       | 0.16           | 0.26      | 1.00        |

**Table 2.13. Correlations between sub-domain measures in the domain of Managing Commodities**

|                | Drug Stock | Equipment | Drug Practices |
|----------------|------------|-----------|----------------|
| Drug Stock     | 1.00       |           |                |
| Equipment      | 0.27       | 1.00      |                |
| Drug Practices | 0.34       | 0.17      | 1.00           |

**Table 2.14. Correlation between sub-domain measures in the domain of Reporting**

|                  | Register Use | Register Quality |
|------------------|--------------|------------------|
| Register Use     | 1.00         |                  |
| Register Quality | 0.74         | 1.00             |

Figure 2.8 shows scatterplots, correlations, and regression coefficients for the relationships between the domain measures of Providing Care, Managing Commodities, and Reporting. There are positive relationships between all of these measures, particularly between Managing Commodities and Reporting ($\beta$=1.01, r=0.55). However, the scatterplots show that many CHWs who performed well in one domain did not perform well in other domains. For example, 38 CHWs (10%) scored above 0.6 for Managing Commodities but scored below 0.4 for Providing Care.

**Figure 2.8. Scatterplots, correlations, and regression coefficients for domain summary measures**



Pearson's Correlation Coefficient = 0.322
Regression Coefficient = 0.360 (CI: 0.253, 0.467)

Pearson's Correlation Coefficient = 0.549
Regression Coefficient = 1.015 (CI: 0.859, 0.1.172)

Pearson's Correlation Coefficient = 0.306
Regression Coefficient = 0.148 (CI: 0.102, 0.195)

Pearson's Correlation Coefficient = 0.322
Regression Coefficient = 0.288 (CI: 0.203, 0.374)

Pearson's Correlation Coefficient = 0.549
Regression Coefficient = 0.297 (CI: 0.251, 0.343)

Pearson's Correlation Coefficient = 0.306
Regression Coefficient = 0.634 (CI: 0.434, 0.833)

Figure 2.9 shows the same domain-level relationships between Providing Care, Managing Commodities, and Reporting - but for districts as a whole, not individual CHWs. Each observation in the scatterplots represents a mean performance score for all CHWs in a district. These district-level relationships are strong, particularly for Managing Commodities and Reporting. All pairs of domain measures have correlation coefficients above 0.7. In other words, if the performance of a district is high for one performance domain, it is likely to be high for other performance domains as well. This suggests that there could be some underlying district characteristic, or district-associated factor, that contributes to improved CHW performance (this issue is discussed further in Chapter 3).

These district-level relationships are also apparent between sub-domain measures. For example, Figure 2.10 shows the district mean scores for Treatment and Register Use. The strong correlation (0.84) shows that district-level performance in treating children is predictive of district-level performance in using a patient register, and vice versa.

**Figure 2.9.  Scatterplots, correlations, and regression coefficients for domain summary measures when averaged for each district**



Pearson's Correlation Coefficient = 0.726
Regression Coefficient = 1.085 (CI: 0.166, 2.004)

Pearson's Correlation Coefficient = 0.900
Regression Coefficient = 1.788 (CI: 1.016, 2.560)

Pearson's Correlation Coefficient = 0.768
Regression Coefficient = 0.259 (CI: 0.066, 0.452)

Pearson's Correlation Coefficient = 0.726
Regression Coefficient = 0.485 (CI: 0.074, 0.897)

Pearson's Correlation Coefficient = 0.900
Regression Coefficient = 0.453 (CI: 0.258, 0.649)

Pearson's Correlation Coefficient = 0.768
Regression Coefficient = 2.279 (CI: 0.579, 3.979)

**Figure 2.10. Scatterplot, correlation, and regression coefficient for sub-domain measures of Treatment and Register Use when averaged for each district**



Pearson's Correlation Coefficient = 0.847
Regression Coefficient = 0.392 (CI: 0.173, 0.612)
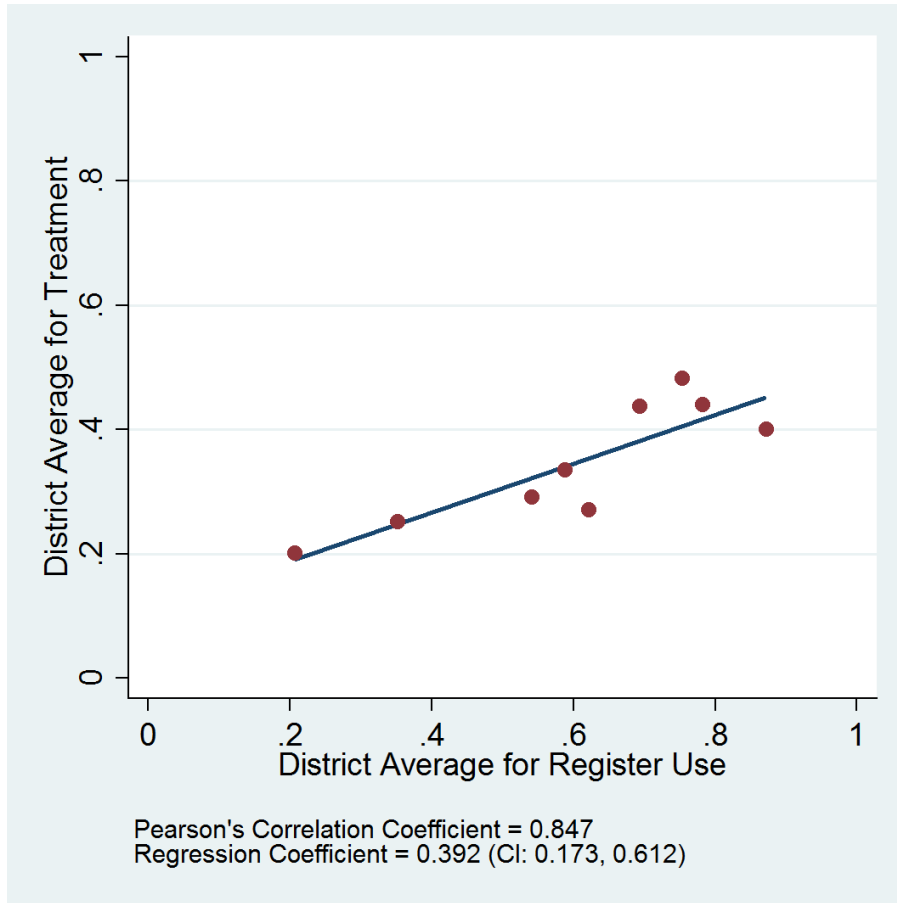
## 2.5. Discussion

First, we discuss what our results say about CHW performance in the Burkina Faso iCCM program and the implications of these findings for program implementers. In the second half of the discussion, we reflect on the process used to aggregate measures of CHW performance, and the potential utility of this process for managers and evaluators in other contexts. We propose six practical applications for summary measures of CHW performance, and discuss the feasibility of such measures given the challenges of collecting high-quality data.

2.5.1.  <u>CHW performance in the Burkina Faso iCCM program</u>

*Performance across tasks*

CHWs in the Burkina Faso iCCM program perform well at many tasks, including checking children for fever, keeping a stock of cotrimoxazole (if needed) and paracetamol, keeping a MUAC tape, and not giving a caregiver drugs unless the CHW sees the child. But at other tasks, CHWs perform very poorly: checking sick children for oedema, telling caregivers to repeat prescription instructions during a consultation, and maintaining a stock of some drugs such as ORS and zinc. CHWs perform best in the sub-domains of Classification and Equipment, and worst in the sub-domains of Treatment, Counselling, and Drug Stock. CHWs are better at classifying a child's illness than prescribing the correct treatment for a child's illness. While most CHWs correctly classify diarrhea (76%) and fever (80%), less than a third of CHWs correctly prescribe ORS (32%) and zinc for diarrhea (26%), and only 4% of

CHWs correctly prescribe paracetamol. CHWs only have an average of 38% of the drugs they are supposed to carry. Even when they do have the necessary drugs in stock, CHWs correctly prescribe only 33% of the drugs needed to successfully treat childhood illnesses.

Studies of CHW performance in other contexts suggest that CHWs are performing better elsewhere at iCCM than in Burkina Faso, particularly in the domain of Providing Care. In Malawi and Ethiopia, studies showed CHWs correctly treating and/or referring sick children for all major iCCM illnesses in 62% and 64.2% of cases, respectively (Gilroy *et al.*, 2013; Miller *et al.*, 2014), while in our study correct treatment and/or referral was given for all illnesses in only 11.6% of consultations. By contrast, the issue of poor drug stock is not unique to Burkina Faso; several studies have reported CHWs' not having sufficient drugs to provide appropriate care (Stekelenburg *et al.*, 2003; Blanas *et al.*, 2013).

The performance of CHWs varies greatly across the Burkina Faso cadre of CHWs, both in aggregate (with scores for Overall Performance ranging from 0.11 to 0.93), and within individual domains and sub-domains. Some CHWs have all of the drugs they need, some have none; some CHWs systematically assess a child for all symptoms, others check for only one or two symptoms; some CHWs record all information in their patient registers, some CHWs don't have a register at all. This variation is also noticeable at the district level. There are marked differences in the average performance of tasks across districts. The districts of Barsalogho, Gourcy, and Yako had mean Overall Performance scores of 0.65, 0.63, and 0.66, while Boulsa and Kaya had mean scores of 0.33 and 0.34.

For individual CHWs, performance in one domain is not highly correlated to performance in other domains. Many CHWs perform poorly at some tasks but perform well at other tasks, and vice versa. This was particularly noticeable for the relationship between the sub-domain measures of Assessment and Classification (r=0.07). A CHW's efforts in assessing a sick child is only weakly related to their success at classifying the child's illness. One reason for this could be that children with obvious illnesses are only "assessed" for the symptoms relating to their perceived illness - i.e. CHWs do not systematically check for other symptoms, oedema, or count breaths when they have already identified the CHW's illness - so a CHW seeing a child with obvious symptoms is likely to score highly on Classification but poorly on Assessment.

No other studies have analyzed the correlation between CHW performance at different tasks in this way, so it is difficult to say to what extent these results are typical or exceptional. The studies from Malawi and Ethiopia analyzed clinical error pathways in CHWs' assessment, classification, and treatment of sick children, and showed that CHWs do often assess poorly but classify correctly, or classify incorrectly but treat correctly, though in both these studies there appeared to be stronger relationships between assessment, classification, and treatment than in our results (Gilroy *et al.*, 2013; Miller *et al.*, 2014).

In contrast to the individual CHW results, when the performance scores are averaged by district we see strong correlations between domains and sub-domains. High-performing districts perform well across all domains, and low-performing districts perform poorly across

all domains. In other words, while it is not true that individual CHWs who perform well in one domain will also perform well in other domains, it is true that – as a whole – a district that performs well in one task will likely perform well at other tasks. Once again, this supports the hypothesis that a CHW's district is a likely determinant of their performance. This district-level relationship is so strong that a summary measure such as Register Use is highly predictive of Treatment: if a district is such that all CHWs are using a patient register, they are more likely to provide higher quality of care.

2.5.2.   Implications for the Burkina Faso iCCM program

Several urgent issues emerge from these results. Overall, CHWs did not perform well in our assessment. If the iCCM program is to achieve its anticipated impact, the Burkina Faso Ministry of Health (MoH) needs to take steps to improve CHW performance.

First, the MoH needs to improve the understanding and adherence of CHWs to treatment regimens. Particular attention should be paid to ORS and zinc for diarrhea, the drug dosage for paracetamol, and appropriate referral for severely sick children. The MoH could reinforce this knowledge through refresher trainings, supervision, and the development and distribution of easy-to-understand job guides with drugs and dosages clearly indicated.

Second, the MoH should investigate the issue of drug stockouts. It is unclear from our data whether the problem is health facility stockouts preventing CHWs from restocking when needed, or whether CHWs themselves are not able or willing to restock. The MoH could

collect and compare data on the nature and timing of health facility stockouts and CHW stockouts.

Third, the MoH could reconsider the way in which CHWs are trained and supervised to assess for symptoms. Although CHWs are mostly successful in classifying illnesses, the data show that their assessment of children is inconsistent, and that CHWs often overlook danger signs and symptoms of severe illness. The MoH could reinforce the need for CHWs to check for all possible symptoms, particularly danger signs, to prevent CHWs overlooking co-morbidities or not referring children to health facilities when needed.

Fourth, the MoH should monitor more carefully the performance of district health offices in implementing the iCCM program. Our findings revealed profound differences in district-level CHW performance. Given the important role that district health offices play in implementing the iCCM program in Burkina Faso (organizing recruitment and training of CHWs, overseeing facility-level supervision, ensuring the flow of drugs and supplies to health facilities), the actions of these health offices may be responsible for the differences in performance, at least in part. Some districts perform much better than other districts, proving that high performance is possible. National-level program managers should pay particular attention to the efforts of poor-performing districts, and perhaps organize co-learning sessions where district staff from high-performing districts share experiences and strategies with staff from other districts.

2.5.3. Utility of task measures and summary measures

In this paper we took a new approach to synthesizing and presenting CHW performance data that, to our knowledge, has not been tried or reported before. We constructed summary measures for domains and sub-domains of performance by averaging performance scores for sets of tasks. For our analysis of Burkina Faso data, summary measures yielded rich findings that would not have been seen if data had only be reported as task-level indicators. We suggest that similar approaches could be useful for program managers and evaluators in and other contexts, and offer six potential applications.

*(a) To ensure that all aspects of CHW performance are considered in program assessments*

One of the tenets of this paper is that CHW performance is multi-faceted. For a CHW program to be successful, CHWs need to perform well at all aspects of their role. It is insufficient for CHWs to be excellent at treating sick children, if no community members are aware that CHWs offer this service; or for CHWs to have a full stock of drugs, but not know how to use the drugs. Establishing a performance framework with multiple domains of performance, and summary measures that reflect those domains, can prompt program managers and evaluators to collect information on all aspects of CHW performance (or at least be mindful of the information they are not collecting), thereby preventing a misreading of data.

*(b) To identify tasks or functions at which CHWs are not performing well, so as to improve training, supervision, and other supports*

Lower-level performance measures show the performance of CHWs at particular tasks. Knowing that CHWs are not successfully performing certain tasks allows program managers to redesign training curricula, emphasize relevant aspects of supervision, or address bottlenecks in supply chain. Analyses of the relationships *between* these measures (what we called *performance patterns*) can also reveal useful information. For example, weak correlations between tasks in the sub-domain of Assessment might prompt program managers to encourage CHWs to be more systematic in their assessment of children, perhaps involving a shift in the way CHWs are taught. Similar relationships in task measures could be analyzed for treatment regimens involving multiple drugs, such as the treatments for diarrhea (ORS and zinc) and suspected malaria (ACTs and paracetamol). If task measures show that ORS and zinc are not being prescribed systematically, this could lead to changes in the way CHWs are trained and supervised, or how drugs are packaged.

*(c) To identify groups of CHWs who are not doing well, so as to better allocate resources and support, or alter CHW recruitment protocols*

Summary measures can show which CHWs are performing well and in which areas. In our Burkina Faso study we saw that the CHWs in the districts of Boulsa and Kaya, on average, performed worse than those in Barsalogho, Gourcy, and Yako. Similar measures could be useful for national or regional program managers in other contexts, allowing managers to track district performance over time, better allocate resources, and work with problematic districts to address shortcomings. Although we didn't present an example in our results,

summary measures could also reveal which sub-groups of CHWs are performing better in which domains.

*(d) As metrics for supervisors to evaluate and understand performance of individual CHWs*

The task measures and summary measures in our example came from a sample survey of CHWs, so we did not have information for all CHWs in the iCCM program. However, the same system of data aggregation could be applied to routine data collected at the health facility level. CHW supervisors typically use supervision checklists when they meet with CHWs. These checklists guide the content of supervision and enable the supervisor to record pertinent information, such as the extent of the CHW's unexpired drug stock and the quality of the CHW's patient register. In theory, these checklists, and the questions contained in them, give supervisors an indication of a CHW's performance, yet often the data in these checklists is hard to interpret. The utility of these checklists could be improved by aggregating the information that is collected on an individual CHW, so that supervisors can see - at a glance - how well a CHW is performing at different aspects of the job, and how a CHW's performance varies over time. The feasibility of this is discussed below. Aggregation could be conducted nationally and fed back to CHW supervisors, or could happen locally at the health facility through simple computer programs. Even reconfiguring supervision checklists in such a way as to enable on-the-spot summary measures (e.g. by summing scores for three or four questions per domain) could enhance the utility of supervision checklists, and provide a more rigorous way for supervisors to monitor the performance of multiple CHWs over time.

*(e) To inform the use of proxy measures*

Understanding the relationships between performance domains could allow program managers to use certain performance measures as a proxy for other performance measures. This could be especially useful when program managers do not have complete data. For example, in Burkina Faso we saw that district-level performance in some areas was highly correlated to district-level performance in other areas; meaning that if regional or national managers saw that a district was performing poorly in one domain, it would not be unreasonable to assume that CHWs are performing poorly across the board.

*(f) To enable more advanced analyses of CHW performance*

Summary measures open the door to more advanced analyses that require a single variable of CHW performance. For example, in Chapter 3 we investigate determinants of CHW performance using regression analysis, which requires a single outcome variable to represent CHW performance. We could have done this with an individual variable such as treatment, but using summary measures such as this enables us to analyze all aspects of a CHW's work using domain measures or a single measure of Overall Performance. Even if an analysis focuses on a particular aspect of implementation or quality of care, such as treatment, calculating sub-domain summary measures enables us to analyze CHWs across a range of illnesses (i.e. aggregating quality of care measures despite the fact that different CHWs were observed in consultation with children who had different illnesses). The equations we used also allow for the synthesis of data across different cadres of CHWs; for example,

aggregating information from CHWs who do and do not provide iCCM services for pneumonia. Standardized summary measures might also be used to compare performance across different CHW programs, or in the same program across different points in time.

2.5.4.  Alternative methods for constructing summary measures

The process described above was one of several methods we could have used to construct summary measures. Even if we had kept the same framework of CHW performance (Table 2.2) and the same hierarchy of summary measures (Figure 2.1), we could have used other methods to calculate the summary measures themselves. Three alternatives approaches are as follows:

*(a) A priori assumptions for weighting components.* In our analytical methods for this analysis, all summary measures are constructed as the sum of available component scores, divided by the number of components. This gives equal weight to all components. An alternative approach would be to weight components unequally, according to pre-established decisions on the perceived relative importance of each component.

*(b) Factor analysis for weighting and/or including components.* Another approach would be to use factor analysis to examine the extent to which each of the summary measures represents a latent factor; and then use factor analysis or principal components analysis (PCA) to determine which of the candidate component variables contribute the most to an item score for that latent variable, and weight or include/exclude the components accordingly. This might mean that only some of the available components are used. This approach changes

the nature of the analysis, as it implies that each domain and sub-domain represents a single latent factor (a true quality possessed by the CHW) and that the purpose of the component scores is to arrive at a true score for that latent factor. The summary measures in our paper, by contrast, do not claim to represent any latent quality of "assessment" or "register use" that a CHW might have. Our summary measures have meaning because of the components we chose to include, not vice versa.

*(c) Decision rules or proxy measures.* A third approach would be to use binary or categorical variables based on decision rules, for all levels of summary measures. For example, a sub-domain measure for Drug Stock could be computed as 0 ("low") if none of the component task scores were correct, 1 ("moderate") if at least 4 tasks scores were correct, or 2 ("high") if all 6 task scores were correct. It is hard to see how this approach would be more meaningful than the approach we outline in this paper, though it might simplify the definition of the summary measure, and therefore make its interpretation easier.

Ultimately we chose our method of constructing summary measures because we believed it to be the most transparent and accessible for program managers. One implication of using this equal-weighting method is that some of the task measures may have had more of an influence on higher-level summary measures than they deserve. For example, a CHW's score for correctly prescribing drugs for malaria is given equal weight as their score for whether or not they always records a child's age in their patient register. In some cases, this might mean that poor performance at tasks such as the management and correct prescription of drugs is masked by high performance at seemingly less important tasks, such as how drugs are stored or whether or not a CHW has a bike. Future studies could explore more complicated

methods for constructing summary measures, and the strengths and weaknesses of those methods.

### 2.5.5. Feasibility of summary measures

It is one thing for summary measures to be useful, another thing for them to be feasible. The data for our summary measures came from an Implementation Snapshot and Quality of Care Assessment in Burkina Faso: a sample survey of 386 CHWs among a population of 4281 CHWs. These were both resource-intensive surveys that took several months to plan and execute, and involved training and supervising 26 data collectors, including 13 IMCI-trained clinicians. This is not something that every country is able to do on a regular basis. Even with the extensive dataset from Burkina Faso, some of our summary measures were constructed using limited information (e.g. Drug Practices). Moreover, we were not able to construct any summary measures for the domain of Building Community Relationships, which is arguably one of the most important domains for an iCCM program, and a domain that would be vital for understanding overall performance.

It stands to reason that the usefulness of summary measures depends on the quality and extent of available data. With less information, or less accurate information, any measures of performance, including summary measures, will be weak. However, some information may be better than none. In many CHW programs, program managers are already collecting routine data for which summary measures could be created (Hazel *et al.*, 2014; MCHIP, 2014). Routine data often gets collected but not used (Mitsunaga *et al.*, 2013) - synthesizing and aggregating this raw data could add enormous value. Only by *using* routine data will more

attention be given to how it is collected (Hotchkiss *et al.*, 2012). AbouZahr and Boerma have argued that program implementers have an obligation to invest in, or support, the development and use of health information systems in the long term, even if gains aren't apparent in the short term (AbouZahr and Boerma, 2005). In this sense, a commitment to reporting summary measures of CHW performance, despite current barriers, would be valuable for entire health systems.

One difficult question is how to collect information for Building Community Relationships. This aspect of CHW performance is crucial to the success of most CHW programs, and likely requires different skills to Providing Care, Managing Commodities, and Reporting. But community relationships are hard to quantify. Methods such as social network analysis could be used to measure a CHW's connectedness with other community members (Hurley *et al.*, 2013), but the process of conducting such an analysis is complex and may not be an option, even for large-scale sample surveys. Simpler ways to get at Building Community Relationships might include self-reported measures of the tasks CHWs undertake to build relationships, such as the number of community meetings a CHW organizes, the number of home visits a CHW makes, or other efforts by the CHW to raise awareness of their services. As part of routine data collection, supervisors may be able to get a sense of a CHW's relationship-building efforts by talking with mothers who come to a health facility for care, or by doing their own *ad hoc* surveys.

Once data have been collected, the process of constructing summary measures should not be difficult. Program managers could develop tools for facilitating or automating these calculations. One could imagine an mHealth initiative whereby supervisors collect data on

CHW performance on mobile phones during each supervision encounter with a CHW (with basic questions/fields covering all domains) with national summary measures automatically generated and disaggregated by region, district, and health facility.

## 2.6. Limitations

Arguably the biggest limitation of this paper is the absence of summary measures for Building Community Relationships, one of the four domains outlined in our framework for CHW performance (Table 2.2). To some extent, this undermines the goal of constructing summary measures that represent the multi-faceted nature of CHW performance, especially as Building Community Relationships is an area that might involve different skills to the other three domains. In our analysis we show that, at the district level, there are strong correlations between CHW performance across domains, but if we had included scores for Building Community Relationships, this might not have been the case. Despite this shortcoming, we believe our paper still makes a valuable contribution by describing the performance of CHWs in Burkina Faso in Providing Care, Managing Commodities, and Reporting, and by highlighting the potential utility of summary measures. Even with data for only three domains, our results yield many insights into the nature of CHW performance in the Burkina Faso iCCM program.

A second limitation concerns the tasks that contribute as components to each of the sub-domain measures. Our decisions on which tasks to include for each sub-domain were largely determined by the availability of data. For example, the three variables for Drug Practices are somewhat arbitrary. We thought these variables captured worthwhile information, though other researchers may have chosen to include different variables. Future studies could design questionnaires and methods using pre-established domains and sub-domains of

performance, to ensure that sufficient and appropriate data is collected for each summary measure.

Third, it is problematic that the summary measure for Register Quality is strongly bimodal, due to CHWs needing to have a register to score more than 0 on any task. Other studies may be able to generate more nuanced measures that capture a CHW's performance at reporting even in the absence of a patient register; though for this Burkina Faso study, it is hard to see how CHWs could be given a non-zero score for reporting if they do not have a patient register at all. There doesn't seem to be an easy way around this issue, although it does have implications. In our analysis, the summary measure of Reporting contributes as much as Providing Care and Managing Commodities to the higher measure of Overall Performance. An alternative analysis might allocate less weight to Reporting, given the strong effect that a CHW's possession of a patient register has on his or her score for Overall Performance.

Finally, the data that were used for this analysis may have limitations. In the domain of Providing Care, for example, task measures were recorded during observations of sick-child consultations. While data collectors were trained as thoroughly as possible, it may be that there were errors in how observers recorded certain tasks, particularly tasks surrounding the assessment of children.

## 2.7. Conclusions

Program managers and evaluators need measures of CHW performance that synthesize diverse information in meaningful ways. In this paper we investigated the performance of CHWs in a Burkina Faso iCCM program, using a framework for CHW performance that identified four domains of performance: Building Community Relationships, Providing Care, Managing Commodities, and Reporting. While CHWs are mostly successful at classifying illnesses, they are unsuccessful at treating those illnesses correctly. Most CHWs do not have an adequate stock of drugs to provide to caregivers in the first place. Variability of performance across CHWs was wide, with some CHWs performing very well and some very poorly, but the nature of this variability was unpredictable: some CHWs provide care well but do not have a patient register; some keep a full stock of drugs but do not prescribe those drugs appropriately. At the district level, differences in CHW performance were marked, highlighting opportunities to improve CHW performance in several districts.

Our analysis shows the practicality and value of summary measures that report CHW performance across domains and sub-domains of performance. Such summary measures are useful for program managers to inform decision making and resource allocation, for supervisors as metrics to understand the performance of CHWs in their catchment area, and for evaluators and researchers to answer policy questions and enable analyses of the relationship between CHW performance and other factors. We know that data collected on CHW performance through sample surveys and routine sources has limitations, but we can and should make greater use of this data. Broader use of simple aggregating techniques, such as those described in this paper, could aid program managers in real time, open the door to

more complex analyses, and contribute to greater effectiveness of CHW programs around the world.

# Chapter 3.  Determinants of Community Health Worker Performance in an Integrated Community Case Management Program in Burkina Faso: a Quantitative Analysis (Paper 2)

## 3.1.  Abstract

BACKGROUND: Integrated community case management (iCCM) is a task-shifting strategy for reducing child mortality in low-income settings. The effectiveness of iCCM programs depends on the performance of community health workers (CHW); a better understanding the factors that influence CHW performance will therefore help to design and implement iCCM programs that achieve greater impact. Given resource shortages in health systems around the world, it is imperative that attempts to improve CHW performance are based on evidence and not speculation. This paper investigates the determinants of CHW performance in an iCCM program in Burkina Faso.

METHODS: 386 CHWs were interviewed using a structured questionnaire, and observed in consultation with 1 or 2 sick children (726 consultations, with children re-examined by a clinician for a gold standard assessment of the illness). Wald tests and multi-linear regression analysis were used to assess the association of four outcome measures of CHW performance with hypothesized determinants of performance such as CHW age, sex, education, training, supervision, district, and distance to health facility.

RESULTS: Age, education, literacy, and district were important determinants of CHW performance in the domains of Providing Care, Managing Commodities, and Reporting. The frequency and timing of training and supervision did not appear to affect performance, though we believe the *quality* of training and supervision may be important. Much of the variation in CHW drug stock and reporting was explained by CHWs having different supervisors or belonging to different health facilities.

CONCLUSIONS: Many of the factors that have been shown to influence CHW performance in other settings are also important in the Burkina Faso iCCM program. Policy makers should consider selection criteria and recruitment strategies to favor CHW candidates who have formal schooling and literacy. More attention should be given to the quality of training and supervision, and how iCCM policies are put into practice at district level.

## 3.2. Introduction

As CHW programs become increasingly important components of national health systems, we need to know which types of CHW program are most effective, and how to maximize their impact (UNICEF, 2006, 2012c; Perry *et al.*, 2014). For CHW programs to have an impact, CHWs must perform well at their job - provide high quality care and build sufficient trust and awareness among the community so that community members utilize their services (Lehmann and Sanders, 2007; Kok *et al.*, 2014). To improve and maintain CHW performance, we need to understand what drives CHW performance. CHW programs are complex, with many component factors. Understanding these factors, and their influence on the performance of CHWs, can help us design and implement programs that achieve more positive outcomes for communities.

People have speculated about the drivers of CHW performance since CHW programs first came into prominence. In 1989, WHO launched a report from a study group on CHW performance titled "Strengthening the performance of community health workers in primary health care" (WHO, 1989). The report lists factors that are still thought to be important today: political will, health system functioning, community involvement, the CHW's range of tasks, selection strategies, training, supervision, financial incentives, and monitoring and evaluation (WHO, 1989). In a 2012 study involving interviews with "thought leaders" on Integrated Community Case Management (iCCM), a strategy that involves training and equipping CHWs to diagnose and treat sick children, the respondents cited similar factors: recruitment, training, supervision, incentives, community involvement and ownership,

information and data management, and mHealth (Strachan *et al.*, 2012). Many recent attempts to reflect on CHW performance highlight the same issues (Winch *et al.*, 2003; Lehmann and Sanders, 2007; USAID, 2011, 2012; Kok *et al.*, 2014). While all these factors likely play a part in CHW performance, for policy makers and program managers, such a list can be too long to be helpful and, for some contexts, may not be accurate. The effect of factors will likely be different for different programs in different settings. What implementers need, and what research can provide, is data and analyses to understand the determinants that are particularly influential in specific contexts. Given resource shortages in health systems around the world, it is imperative that attempts to improve CHW performance are based on evidence and not speculation.

In this paper we attempt to identify determinants of performance in a Burkina Faso CHW program. In 2009, the Burkina Faso Ministry of Health (MoH) recruited and trained CHWs to deliver iCCM for children aged 2 to 59 months as part of a four-year "Rapid Scale-up" (RSU) program to reduce maternal, newborn, and child mortality in the North and Center-North regions of the country (MoH Burkina Faso, 2010; ISSP and IIP-JHU, 2014). In nine intervention districts, two CHWs per village were trained to provide ORS and zinc to children with diarrhea, ACTs and paracetamol to children with suspected malaria, and to screen and refer children for acute malnutrition. In two of these districts, CHWs were also trained to provide cotrimoxazole to children with suspected pneumonia. In some villages, existing CHWs were trained to deliver iCCM; in other villages, new CHWs were recruited. The CHWs were not given a salary for their work, but were authorized to sell drugs for iCCM at a mark-up for a profit (at their own discretion). The CHWs were to be supervised for iCCM by health workers at first-level health facilities. The *Institut Supérieur des Sciences de la*

*Population* (ISSP) and the Institute for International Programs at Johns Hopkins University (IIP-JHU) conducted an independent evaluation of the RSU program (Munos *et al.*, 2015). The evaluation included an Implementation and Quality of Care Assessment in March-April 2013 to assess the implementation strength of the iCCM component of the RSU program and assess the quality of care provided by CHWs to sick children aged 2-59 months (ISSP and IIP-JHU, 2014).

In Chapter 2 we constructed summary measures of CHW performance in the Burkina Faso iCCM program. Using these measures we saw that CHW performance varied widely, with some CHWs performing extremely well and others poorly, highlighting the great opportunity to improve program performance. This paper uses the summary measures developed in Chapter 2 to examine the *determinants* of CHW performance in the Burkina Faso iCCM program. We establish a framework of determinants of performance, and use data from the Implementation and Quality of Care Assessment to examine the association of these determinants with performance outcomes. The MoH in Burkina Faso has repeatedly expressed its interest in better understanding the variability of CHW performance in the iCCM program and what it can do to improve performance (IIP-JHU, 2014). We hope that the results from this study will inform strategies for improving and maintaining the performance of CHWs in Burkina Faso, and in similar contexts around the world.

### 3.2.1. A framework for the determinants of CHW performance

To guide our analysis we developed a framework for the determinants of CHW performance, shown in Figure 3.1.[2] The framework views CHW performance in terms of four domains: Building Community Relationships, Providing Care, Managing Commodities, and Reporting. We suggest that in all CHW programs, the tasks that a CHW needs to undertake fall into one of these domains, and that individual CHWs may have stronger competencies or motivation in some domains than others. Indeed, our analysis in Chapter 2 showed that an individual CHW's performance in one domain was only weakly predictive of their performance in other domains. (Further explanation and justification for these domains is given in Chapter 2.)

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[2] This is a simplified version of the full framework presented in Chapter 1. In the full framework we include mediating factors as links between determinants and performance domains: knowledge, skills, attitudes; motivation; the enabling environment. These mediating factors are discussed in Chapter 4 but not in this chapter.

**Figure 3.1. A framework for the determinants of CHW performance**
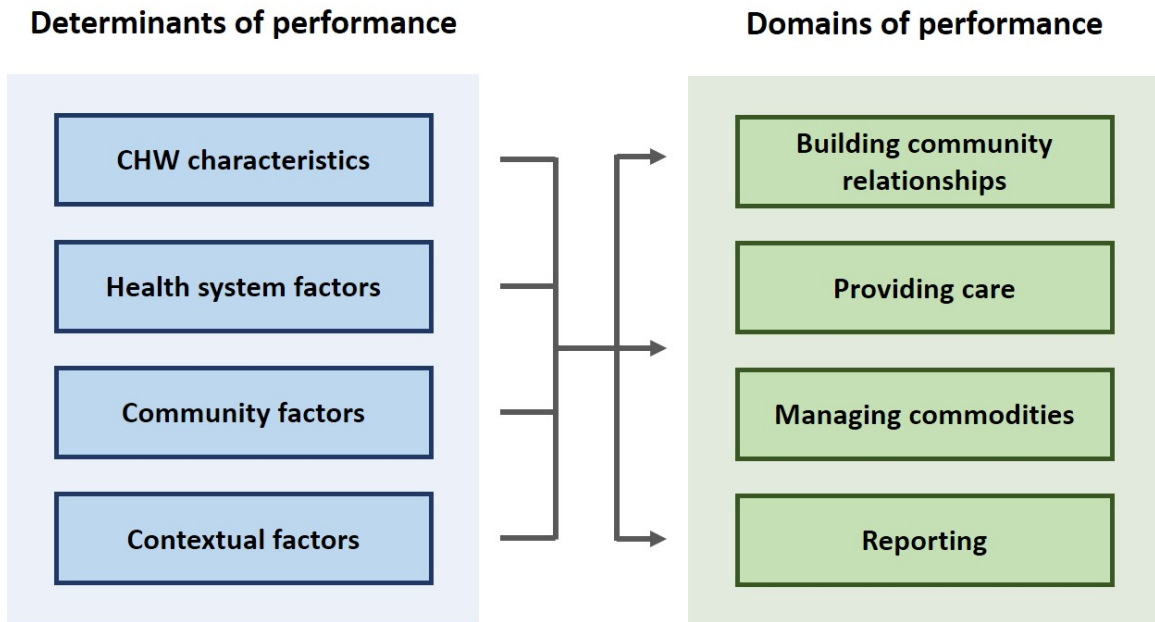


Determinants of performance are also divided into four categories in the framework: CHW characteristics, health system factors, community factors, and contextual factors. This division of determinants echoes frameworks used in other studies (Dieleman *et al.*, 2009; Gopalan *et al.*, 2012; Kok *et al.*, 2014; Naimoli *et al.*, 2014). Table 3.1 lists examples of specific factors for each category, taken from the literature. Previous studies have highlighted the importance of a CHW's socio-demographic characteristics for their performance, including age and sex (Stekelenburg et al., 2003; Crispin et al., 2012; Kawakatsu et al., 2012; Lopes et al., 2014), the CHW's experience, including total time worked (Ronaghy et al., 1976; Oxford Policy Management, 2009; Maji et al., 2010), and the CHW's reason for becoming a CHW (Yasuoka et al., 2010; Javanparast et al., 2011). Other studies have highlighted the role of health system factors, such as the training of CHW (Curtale et al., 1995; Kelly et al., 2001; Oxford Policy Management, 2009; Maji et al., 2010), the supervision of CHWs (Curtale et al.,

1995; Kelly et al., 2001; Oxford Policy Management, 2009; Maji et al., 2010; Jaskiewicz and Tulenko, 2012), financial and non-financial incentives (Bhattacharyya et al., 2001; Alam et al., 2012), and health system functioning, including the availability of drugs and materials (Ronaghy et al., 1976; Stekelenburg et al., 2003; Callaghan-Koru et al., 2012; Gopalan et al., 2012; Jaskiewicz and Tulenko, 2012; Medhanyie et al., 2012). Naimoli et al. highlight the interplay between health system functioning and community systems (Naimoli *et al.*, 2014). Some studies have shown a link between CHW performance and the existence of community health committees (Oxford Policy Management, 2009; Javanparast et al., 2011; Callaghan-Koru et al., 2012; Gopalan et al., 2012; Jaskiewicz and Tulenko, 2012). Although no studies yet document the role of contextual factors on CHW performance, we believe that contextual factors might also play a role in CHW performance; for example, if a particular geographical region has higher incidence of malaria, CHWs in that region may perform better at the assessment of malaria than CHWs in other regions, or conversely may over-diagnose malaria.

In using our framework, we aim to conduct a more detailed study of CHW performance than those conducted in the past. Previous studies of CHW performance have been limited by the number of determinants analyzed, and the variables taken to represent performance itself. Most quantitative analyses of determinants of performance have used binary variables to represent CHW performance (Stekelenburg *et al.*, 2003; Maji *et al.*, 2010; Crispin *et al.*, 2012; Kawakatsu *et al.*, 2012). By exploring multiple determinants, and multiple variables to represent overall performance and domains of performance, we take a comprehensive approach to analyzing CHW performance that recognizes and examines the many competencies required for the CHW role.

**Table 3.1.  Categories of potential determinants of CHW performance**

| CHW characteristics | <ul><li>Demographic characteristics, such as the CHW's age, sex, and ethnicity</li><li>Personality traits, such as the CHW's social competencies</li><li>Education, including literacy and numeracy</li><li>Status in the community, including any formal or informal roles, and ties to village members or village leaders</li><li>Location in the community, including whether the CHW resides inside or outside the village</li></ul> |
|---|---|
| Health system factors | <ul><li>Training, including initial basic training, formal refresher training, and ongoing skills development by supervisors or other staff</li><li>Supervision provided by health system staff, including mentoring, problem solving</li><li>Tangible/intangible incentives, such as encouragement and respect from health system staff, financial payments, in-kind gifts (bags, bicycles)</li><li>Supply chain functioning, the availability of drugs at village level</li><li>Demand generation, including activities run by health system staff (not the CHW) to increase awareness of CHW services</li></ul> |
| Community factors | <ul><li>Tangible/intangible incentives, such as praise and encouragement, money, and in-kind goods/services from community members</li><li>Community participation, including community supervision, and oversight and involvement from village committees</li><li>Security and safety in the village</li></ul> |
| Contextual factors | <ul><li>Geography, such as the distance from the village to the health facility, and the accessibility of terrain during different seasons</li><li>Social-political context, such as traditional care-seeking behaviors, and cultural attitudes to health services</li><li>Disease burden of relevant childhood illnesses</li></ul> |

## 3.3. Methods

### 3.3.1. Data collection: the Implementation and Quality of Care Assessment

The Implementation and Quality of Care Assessment involved a cross-sectional survey of CHWs in the 9 districts of the Burkina Faso iCCM program. A sample of 420 CHWs were interviewed using a structured questionnaire on CHW characteristics, training, supervision, and work practices. Data collectors inspected each CHW's drug kit, equipment, and patient register, and CHWs were observed in consultation with sick children (1 to 2 consultations per CHW), with sick children re-examined by a trained clinician for a gold standard assessment of the illness. Details of the Implementation and Quality of Care Assessment, including study design, sampling, and data collection, are described in Chapter 2.

### 3.3.2. Data analysis

We used Stata 12 (StataCorp, 2011) to conduct statistical tests to examine the association between determinants of CHW performance (predictor variables) and summary measures of CHW performance (outcome variables). We conducted **bivariate analyses** of categorical predictor variables on outcome measures, using adjusted Wald tests for equality of means, and analysis of variance (ANOVA); and **multi-linear regression** of categorical and continuous predictor variables on continuous outcome measures, using post-estimation Wald tests for categorical predictors, as described below.

*Predictor variables*

During the Implementation and Quality of Care Assessment we collected data on CHW characteristics, health system factors, and community factors. Using our framework (Figure 3.1 and Table 3.1), we developed a list of potential determinants of CHW performance, and a list of predictor variables from among our data to represent those determinants. For some determinants, we created variables with different definitions and/or different response categories. For example, for supervision, we created predictor variables for *ever been supervised*, *supervised in the past 3 months*, and *time since last supervision*. For *time since last supervision*, we created a continuous variable (months) and a categorical variable (with response options for "within 3 months", "3-11 months", "1+ years"). The predictor variables that were included in our multi-linear regression model are discussed below.

We did not include contextual factors in our list of determinants. We examined data on geography and disease burden, but for the intervention districts of the Burkina Faso iCCM program these data were too homogenous to warrant analysis. Variables for *district* and *distance to health facility* were included as health system factors.

*Outcome variables*

For outcome variables we used four summary measures of CHW performance that we developed in Chapter 2: Overall Performance, Providing Care, Managing Commodities, and Reporting. The first of these is a measure of overall performance, synthesizing data on the

observed performance of CHWs at 58 tasks that were observed during the Implementation and Quality of Care Assessment. The other three outcome variables are domain-level summary measures, corresponding to a CHW's observed performance at tasks related to three of the domains in our performance framework.[3] The logic and construction of these summary measures is discussed in detail in Chapter 2.

In Chapter 2 we constructed these four summary measures as continuous variables with scores between 0 and 1 ("raw scores"). For this paper, we converted the raw scores to z-scores, to enable a more meaningful interpretation of regression coefficients and other test results. We calculated z-scores using the estimated mean and standard deviation for all CHWs who provide iCCM services, using the following equation:

z-score = ("observed score" - "estimated mean score for all CHWs") / ("estimated standard deviation for all CHWs")

The z-scores represent the position of each individual CHW's score within an assumed normal distribution of scores for all CHWs in the iCCM program, if all CHWs had been assessed in the same way. Thus if an individual CHW in our sample has a z-score of 0.74 for Providing Care, it means that if all CHWs in the iCCM program had been assessed for Providing Care in the same way, this individual CHW's score would be 0.74 standard deviations above the mean.

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[3] We did not have data to construct a summary measure for Building Community Relationships, so this domain is not included as part of our analysis. We discuss this in the Limitations section.

*Bivariate analyses*

We conducted **bivariate analyses** of categorical predictor variables on each of the four outcome measures, using adjusted Wald tests. We used Stata's SVY command with the Taylor linearization method to account for unequal sampling probability and non-response, and to adjust standard errors for the effects of clustering. Adjusted Wald tests for equality of means were performed for each the predictor variables.

To test the relationship between a CHW's health facility and a CHW's performance, we conducted an analysis of variance (ANOVA). We ran four ANOVA analyses, with "performance" as the continuous variable (either Overall Performance, Providing Care, Managing Commodities, or Reporting), and "health facility" as the categorical variable.

*Multi-linear regression models*

We constructed one multi-linear regression model for each of our four continuous outcome variables (Overall Performance, Providing Care, Managing Commodities, and Reporting). We used the same set of predictor variables for each of the models, to facilitate comparison. We aimed to include one predictor variable for every determinant of interest, although we limited the predictor variables in our models to those for which we had observations for at least 375 (99%) of the 379 CHWs who participated in the Implementation and Quality of Care Assessment. (Other predictor variables, mainly on supervisor characteristics, were only obtained for 333, 307, or 297 CHWs; these variables were excluded from our primary

models, but were included in secondary analyses that are reported in Appendix 3.2.) We included predictor variables on training, so we excluded CHWs that reported no iCCM training at all (n=4) to avoid collinearity. Thus our sample size for regression models was n=375.

The final set of determinants that we included in our models was: *age*, *sex*, *education*, *literacy*, *district*, *distance to health facility*, *time since last supervision*, *ethnicity*, *time since becoming a CHW*, *time since initial training in iCCM*, *number of refresher trainings*, *time since last training*, *clinical practice during initial iCCM training*, *trained for PECADO*, *current participation in PECADO*, *time since visiting health facility*, *time lived in current village*, *received bike for iCCM program*, *CHW cites "respect" as an advantage of being a CHW*, and *CHW cites "receiving blessings" as an advantage of being a CHW*.

For many of these determinants we had different options for coding the variable, either as a continuous or categorical variable. To decide which variable to use for each determinant, we constructed multiple models for the outcome of Overall Performance, using different variable permutations, and we chose the set of predictor variables from the model with the highest r-squared (and adjusted r-squared) and for which the determinants were most clearly specified (lowest p-value). The resulting model was as follows:

E[Overall Performance|x] = $\beta_0$ + $\beta_1$*(age:50+) + $\beta_2$*(sex:female) + $\beta_3$*(education:primary) + $\beta_4$*(education:secondary) + $\beta_5$*(literacy:Frenchonly) + $\beta_6$*(literacy:Mossionly) + $\beta_7$*(literacy:both) + $\beta_8$*(district:Boulsa) + $\beta_9$*(district:Gourcy) + $\beta_{10}$*(district:Kaya) + $\beta_{11}$*(district:Kongoussi) + $\beta_{12}$*(district:Ouahigouya) + $\beta_{13}$*(district:Seguenega) + $\beta_{14}$*(district:Titao) + $\beta_{15}$*(district:Yako) + $\beta_{16}$*distancetoHF + $\beta_{17}$*(timesincesupervision:3-11months) + $\beta_{18}$*(timesincesupervision:11+months) + $\beta_{19}$*(ethnicity:Peulh) + $\beta_{20}$*(ethnicity:other) + $\beta_{21}$*(timechw) + $\beta_{22}$*(timeccmcat) + $\beta_{23}$*(numberrefresher) +

$\beta_{24}$*(timelasttraining) + $\beta_{25}$*(clinical) + $\beta_{26}$*(pecadotraining) + $\beta_{27}$*(pecadoparticipation) + $\beta_{28}$*(hfmonths) + $\beta_{29}$*(timevillage) + $\beta_{30}$*(bike) + $\beta_{31}$*(respect) + $\beta_{32}$*(blessings)

We used these same predictor variables in the models for Providing Care, Managing Commodities, and Reporting. We kept all predictors in all models regardless of their observed influence on the outcome variable. We did this in order to facilitate comparison across models, and because we were as interested in understanding which predictors *were not* associated with CHW performance, as those which were.

For multi-linear regression analyses we did not use the SVY command, due to the effect that this command has on regression coefficients, and the fact that *district* (the variable by which CHWs were stratified) was included in regression models as a predictor variable.

For each model, we tested the assumptions of multi-linear regression: that there is a linear relationship between predictor and outcome variables, that the residuals of the model (the error term) have a normal distribution, and that the variance of errors is the same for all fitted values (heteroskedasticity). Scatterplots of residuals versus individual predictor variables showed a linear relationship between all outcome variables and continuous predictors. Histograms and kernel density estimates confirmed the normality of residuals.

The only assumption that was not strongly met was that of heteroskedasticity, with scatterplots of residuals versus fitted values showing slight differences in variance across fitted values for the models for Overall Performance and Reporting (which for both models was a result of bimodality in the distribution of Reporting scores). The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was significant for both of these models

(p=0.033 for Overall Performance and p=0.003 for Reporting) but was not significant for the other models. The scatterplot of residuals versus fitted values for the Overall Performance model is provided for reference in Appendix 3.3. To test the possible effects of slight heteroskedasticity, we ran regression models with robust standard errors (Appendix 3.4), but these models did not show any differences in significance levels, for any of our predictor variables, compared to the models without robust standard errors.

We examined the values of r-squared and adjusted r-squared for each model (shown at the bottom of Table 3.8). R-squared was highest for the Overall Performance model (r-squared=0.53 and adjusted r-squared=0.49) and lowest for the Providing Care model (r-squared=0.27 and adjusted r-squared=0.21). The value of r-squared represents the proportion of the total variability of the outcome variable that can be accounted for by predictor variables. Our test statistics suggest that over half of the variability in performance was unaccounted for by the predictor variables in our models (over three-quarters in the case of Providing Care).

Finally, we tested for collinearity among the predictors in our models. The highest variance inflation factor (VIF) score for any predictor was 3.85 (for *literacy in both French and Mossi*), and the mean VIF for all predictors was 1.78, suggesting no issues with collinearity.

## 3.4. Results

### 3.4.1. Predictor variables

Tables 3.2 to 3.4 show the CHW characteristics, health system factors, and community factors that were predictor variables in the regression analysis. The results in these tables are weighted estimates of the mean values among all CHWs in the Burkina Faso program who provide iCCM services.

For most variables in the tables, the sample size was 379, representing all CHWs who were interviewed and observed in at least one sick-child consultation. Of the 420 sampled CHWs we found only 339 CHWs (a result of district CHW lists being out-of-date or CHWs being absent from the village on the day of the assessment). Of the 339 CHWs who were found, only 231 CHWs said they delivered iCCM services. For the 189 CHWs who were not found or who said they did not deliver iCCM services, we found 155 replacement CHWs who said they delivered iCCM services, making a total of 386 CHWs who were successfully interviewed. For 7 of these CHWs we were not able to find sick children for observation or re-examination, thus we have complete data for 379 CHWs.

For some variables in Table 3.3 and 3.4 we only have data for a subset of CHWs. These include: variables on iCCM training, which were only collected from CHWs who had ever been trained (n=375); *time since last supervision*, which was only collected from CHWs who had

ever been supervised (n=333); variables which used data collected from supervisors

themselves (n=297), because it was not possible to interview all supervisors; and variables on

the number of CHWs in each village (n=307), because only pre-sampled CHWs were asked

these questions, not CHWs who were selected to replace unfound CHWs.

The two variables concerning PECADO refer to a malaria CCM program implemented in

the same geographical area as the RSU iCCM program (the program evaluated for this

study). As Table 3.3 shows, approximately two-thirds of CHWs in our sample were trained

for, and participating in, both the PECADO program and the RSU iCCM program.

**Table 3.2. Individual CHW characteristics**

| | Weighted estimate for all CHWs who provide iCCM services | | Unweighted frequency | Sample size (n) |
|---|---|---|---|---|
| | Point estimate | 95% CI | | |
| CHW age | | | | |
| Age (years) | 44.8 | 43.2, 46.3 | -- | 379 |
| Under 50 | 63.5% | 57.1%, 69.4% | 262 | 379 |
| 50+ | 36.5% | 30.6%, 42.9% | 117 | |
| 20-29 | 12.0% | 8.1%, 17.3% | 55 | |
| 30-39 | 25.5% | 20.3%, 31.6% | 116 | |
| 40-49 | 26.0% | 20.5%, 32.2% | 91 | 379 |
| 50-59 | 23.9% | 18.6%, 30.1% | 78 | |
| 60-69 | 11.8% | 8.3%, 16.7% | 36 | |
| 70+ | 0.8% | 0.2%, 2.9% | 3 | |
| CHW sex | | | | |
| Male | 81.5% | 76.1%, 86.0% | 288 | 379 |
| Female | 18.5% | 14.0%, 23.9% | 91 | |
| CHW ethnicity | | | | |
| Mossi | 87.5% | 83.0%, 91.0% | 336 | |
| Peulh | 10.6% | 7.5%, 14.7% | 37 | 379 |
| Other | 1.9% | 0.8%, 4.8% | 6 | |
| CHW marital status | | | | |
| Married/in union | 96.9% | 93.9%, 98.4% | 367 | |
| Single | 0.6% | 0.2%, 2.5% | 4 | 379 |
| Widowed | 2.5% | 1.1%, 5.4% | 8 | |
| CHW education | | | | |
| Any school | 49.0% | 42.7%, 55.4% | 208 | 379 |
| No school | 51.0% | 44.6%, 57.3% | 171 | |
| Primary | 34.8% | 29.0%, 41.2% | 150 | 379 |
| Secondary 1st cycle | 14.2% | 10.2%, 19.3% | 58 | |
| Secondary 2nd cycle | 0.0% | -- | 0 | |
| Years of education | 2.8 | 2.4, 3.3 | -- | 379 |
| CHW literacy | | | | |
| Full or partial French literacy | 60.8% | 54.8%, 66.6% | 247 | 379 |
| Full or partial Mossi literacy | 69.3% | 62.9%, 75.0% | 293 | 379 |
| No literacy in French or Mossi | 21.2% | 16.4%, 26.9% | 57 | |
| Literacy in French only | 9.6% | 6.5%, 13.8% | 29 | 379 |
| Literacy in Mossi only | 18.0% | 13.5%, 23.5% | 75 | |
| Literacy in French and Mossi | 51.3% | 45.1%, 57.4% | 218 | |

**Table 3.3. Health system factors**

| | Weighted estimate for all CHWs who provide iCCM services | | Unweighted frequency | Sample size (n) |
|---|---|---|---|---|
| | Point estimate | 95% CI | | |
| **District** | | | | |
| Barsalogho | 6.4% | 5.2%, 7.8% | 90 | |
| Boulsa | 12.3% | 11.3%, 13.5% | 24 | |
| Gourcy | 5.5% | 4.5%, 6.7% | 102 | |
| Kaya | 13.0% | 11.7%, 14.5% | 24 | |
| Kongoussi | 14.2% | 12.1%, 16.7% | 27 | 379 |
| Ouahigouya | 18.7% | 17.3%, 20.1% | 28 | |
| Seguenega | 9.1% | 7.0%, 11.8% | 30 | |
| Titao | 8.3% | 7.0%, 9.7% | 25 | |
| Yako | 12.4% | 11.0%, 14.0% | 29 | |
| **Study Arm** | | | | |
| Pneumonia Study Arm | 11.9% | 10.4%, 13.6% | 192 | 379 |
| Non-Pneumonia Study Arm | 88.1% | 86.4%, 89.6% | 187 | |
| Distance to health facility (kilometers) | 7.8 | 7.0, 8.6 | -- | 379 |
| Time since becoming a CHW (years) | 11.5 | 10.4, 12.6 | -- | 379 |
| Received bike for iCCM | 38.5% | 32.3%, 45.1% | 197 | 379 |
| Ever trained in iCCM | 98.8% | 96.3%, 99.6% | 375 | 379 |
| Time since initial iCCM training (years) | 2.5 | 2.4, 2.6 | -- | 375 |
| Time since initial iCCM training (category) | | | | |
| Within last 2 years | 0.104 | 7.2%, 15.0% | 41 | 375 |
| At least 2+ years ago | 0.896 | 85.0%, 92.8% | 334 | |
| Number of refresher trainings | 2.2 | 2.0, 2.4 | -- | 375 |
| Time since last training (years) | 0.7 | 0.6, 0.8 | -- | 375 |
| Clinical practice during initial iCCM training | 56.3% | 49.8%, 62.5% | 267 | 375 |
| Trained for PECADO | 57.1% | 51.0%, 63.0% | 204 | 379 |
| Current participation in PECADO | 68.6% | 62.9%, 73.8% | 212 | 379 |
| Ever been supervised | 80.5% | 74.4%, 85.5% | 333 | 379 |
| Supervised in the last three months | 48.0% | 41.8%, 54.2% | 199 | 379 |
| Time since last supervision (months) | 10.6 | 8.7, 12.6 | -- | 333 |
| Time since last supervision (category) | | | | |
| Within last 3 months | 48.0% | 41.8%, 54.2% | 199 | |
| Between 3-11 months | 20.0% | 15.4%, 25.7% | 86 | 379 |
| 12+ months (or never) | 32.0% | 26.4%, 38.1% | 94 | |
| Time since last visit to health facility (months) | 1 | 0.7, 1.2 | -- | 379 |
| Supervisor age | 33.9 | 33.2, 34.6 | -- | 297 |
| Supervisor sex | | | | |
| Male | 91.3% | 85.8%, 94.8% | 262 | 297 |
| Female | 8.7% | 5.2%, 14.2% | 35 | |
| Time supervisor has been at health facility (months) | 28.1 | 24.0, 32.3 | -- | 297 |
| Supervisor trained in IMCI | 83.2% | 76.8%, 88.2% | 247 | 297 |
| Supervisor trained in iCCM | 71.4% | 63.4%, 78.2% | 225 | 297 |
| Number of CHWs the supervisor supervises | 15.9 | 14.3, 17.6 | -- | 297 |
| Number of CHWs the supervisor supervises (category) | | | | |
| Low (1-10 supervisees) | 35.2% | 27.8%, 43.4% | 116 | |
| Medium (11-20 supervisees) | 40.0% | 31.8%, 48.8% | 127 | 297 |
| High (21+ supervisees) | 24.8% | 17.6%, 33.8% | 54 | |

**Table 3.4. Community factors**

| | Weighted estimate for all CHWs who provide iCCM services | | Unweighted frequency | Sample size (n) |
|---|---|---|---|---|
| | Point estimate | 95% CI | | |
| Number of CHWs in the village | 2.8 | 2.6, 3.0 | -- | 307 |
| Number of CHWs in the village who provide iCCM services | 1.7 | 1.6, 1.8 | -- | 307 |
| Time the CHW has spent in the village (years) | 30.6 | 28.6, 32.6 | -- | 379 |
| CHW reports 'being respected' as an advantage of the CHW role | 28.6% | 23.2%, 34.6% | 85 | 379 |
| CHW reports 'receiving blessings' as an advantage of the CHW role | 30.5% | 24.5%, 37.2% | 107 | 379 |

3.4.2.  Outcome variables

We analyzed the relationship between predictor variables and four outcome measures:
Overall Performance, Providing Care, Managing Commodities, and Reporting. Table 3.5
shows the mean scores for these outcome measures among the 379 sampled CHWs, and the
estimated mean scores for all CHWs who provide iCCM services in the Burkina Faso
program.

**Table 3.5.  Outcome measures of CHW performance**

| Outcome variable | n | Unweighted estimates | | | Weighted estimates | | Z-scores for outcome measures | |
|---|---|---|---|---|---|---|---|---|
| | | Average score among sampled CHWs | Lowest score among sampled CHWs | Highest score among sampled CHWs | Average score among all CHWs | 95% confidence interval | Lowest z-score among sampled CHWs | Highest z-score among sampled CHWs |
| Overall Performance | 379 | 0.57 | 0.11 | 0.93 | 0.49 | 0.47, 0.51 | -1.99 | 2.33 |
| Providing Care | 379 | 0.49 | 0.05 | 0.89 | 0.46 | 0.44, 0.47 | -2.73 | 2.90 |
| Managing Commodities | 379 | 0.59 | 0.11 | 1.00 | 0.52 | 0.50, 0.54 | -2.20 | 2.59 |
| Reporting | 379 | 0.63 | 0.00 | 1.00 | 0.49 | 0.45, 0.54 | -1.32 | 1.36 |

The relationships between Overall Performance and the domain measures of Providing
Care, Managing Commodities, and Reporting are shown in Figure 3.2. Despite the strong
correlations between Overall Performance and the three other outcome variables, there is
noticeable residual variation for all pairs, particularly Overall Performance and Providing
Care.

**Figure 3.2. Scatterplots, correlations, and regression coefficients for Overall Performance and other outcome variables**



Pearson's Correlation Coefficient = 0.600
Regression Coefficient = 0.694 (CI: 0.601, 0.788)

Pearson's Correlation Coefficient = 0.775
Regression Coefficient = 0.805 (CI: 0.738, 0.871)

Pearson's Correlation Coefficient = 0.899
Regression Coefficient = 0.859 (CI: 0.817, 0.901)
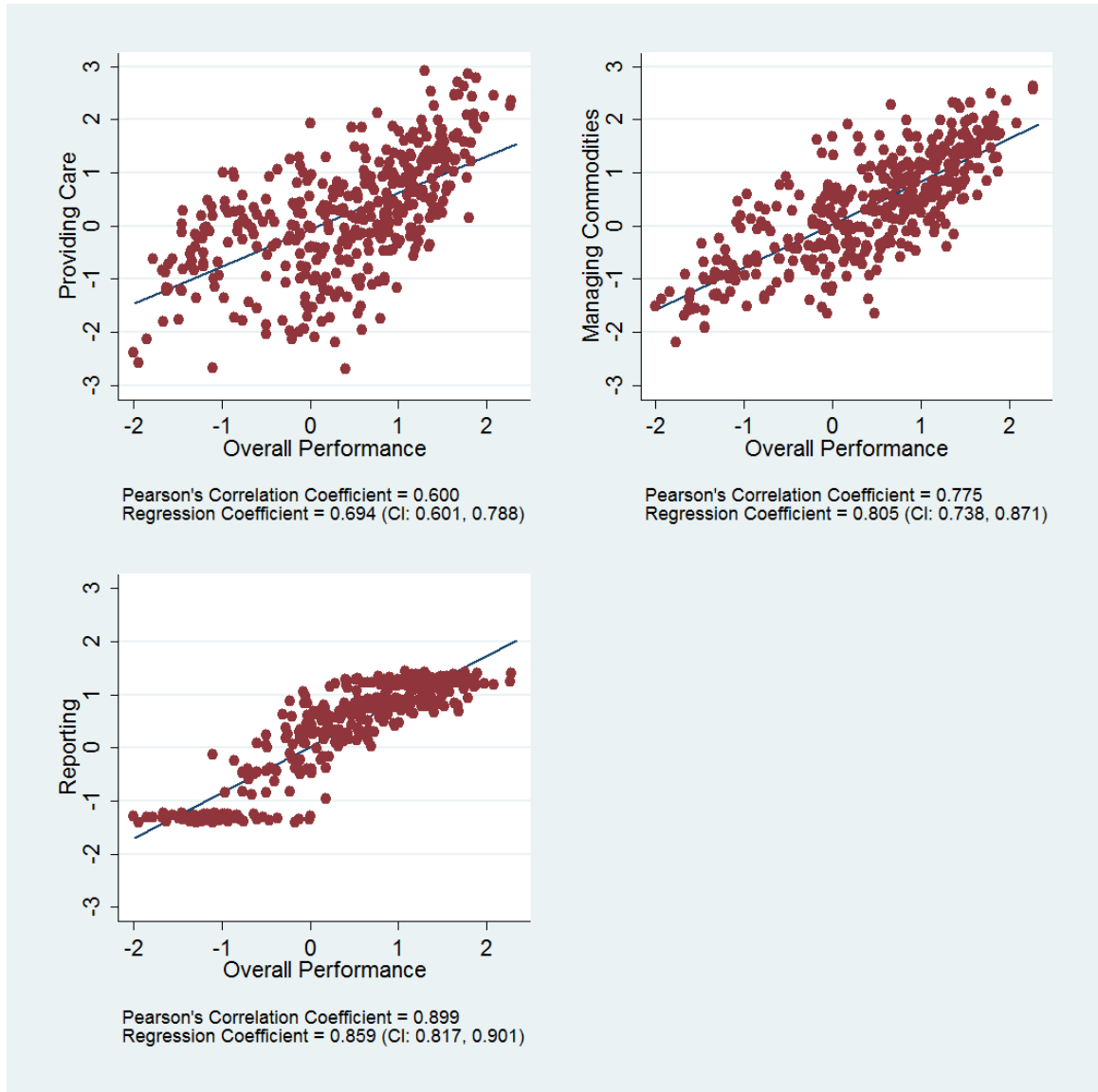
3.4.3.   <u>Bivariate analyses</u>

0 shows the mean scores for Overall Performance, Providing Care, Managing Commodities, and Reporting, disaggregated for each categorical predictor variable. The results show that many of the bivariate relationships between predictor variables and outcome variables are statistically significant at alpha=0.05 (those in bold in 0). Some predictor variables have statistically significant relationships with all four outcome variables; others have significant relationships with only certain outcome variables.

The CHWs who provide care in the Burkina Faso iCCM program have a wide range of ages, and in bivariate analyses with Overall Performance, *age* was a strong predictor of performance. The average Overall Performance z-score for CHWs under age 50 was 0.154 (CI: 0.001, 0.307), while the average z-score for CHWs over age 50 was -0.248 (CI: -0.435, -0.060). These *age* differences were also apparent to a lesser extent for Providing Care and Reporting, but were not at all apparent for Managing Commodities. CHWs of all age categories scored similarly for Managing Commodities, except for CHWs over age 70.

The majority of CHWs who provide care in the Burkina Faso iCCM program are men (81.5%). The estimated mean score for Overall Performance was 0.245 z-scores lower for women than for men, but this result was not statistically significant.

Both *education* and *literacy* (all variable types) were statistically significant for all measures of performance. CHWs with any schooling had a mean score for Overall Performance that was

0.669 z-scores higher than for CHWs with no schooling. CHWs with any literacy in either French or Mossi had a mean score for Overall Performance that was 1.104 z-scores higher than for CHWs with no literacy in either language.

The mean performance of CHWs across districts varied greatly for all outcome measures. Mean scores for Overall Performance varied from 0.849 (CI: 0.520, 1.179) for Barsalogho (the highest-performing district) to -0.845 (CI: -1.108, -0.583) for Boulsa (the lowest performance district), a range of 1.694 z-scores. Similar differences by district were seen for Providing Care (a range of 1.127 z-scores), Managing Commodities (a range of 1.573 z-scores), and Reporting (a range of 1.419 z-scores). Significant differences were also seen for CHWs in different study arms (the link between *district* and *study arm* is discussed below).

We tested four categorical predictor variables related to iCCM training: *ever trained in iCCM, time since initial iCCM training*, and *clinical practice during initial training*. The variable for *ever trained in iCCM* only showed a statistically significant difference for Managing Commodities, though this may be due to the small number of CHWs who had not received iCCM training. The variable for *clinical practice during initial training* was predictive of all outcome variables in binary analyses, even for non-clinical performance domains such as Managing Commodities and Reporting. In fact, the differences in mean scores for CHWs who did and did not have clinical practice during training was *more* pronounced for Managing Commodities and Reporting than for Providing Care.

Mean performance scores were higher for CHWs who had last seen their supervisor more recently, and these relationships were statistically significant for all outcome variables. For

the variable *time since last supervision*, CHWs who had been supervised in the last 3 months had

Overall Performance scores that were 0.701 z-scores higher than CHWs who had been

supervised over one year ago: 0.276 (CI: 0.102, 0.449) compared to -0.425 (CI: -0.657, -

0.192), respectively. The variables of *supervisor trained in iCCM* and *supervisor trained in IMCI*

both had significant bivariate relationships with Overall Performance; although the

relationship for *supervisor trained in IMCI* was the reverse of what we had expected, in that

CHWs with supervisors trained in IMCI performed *worse* than CHWs with supervisors not

trained in IMCI (by 0.359 z-scores).

**Table 3.6. Outcome variables disaggregated by categorical predictor variables**

| | Overall Performance | | Providing Care | | Managing Commodities | | Reporting | | n |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | 95% CI | Mean | 95% CI | Mean | 95% CI | Mean | 95% CI | |
| **CHW Characteristics** | | | | | | | | | |
| CHW age category | | | | | | | | | |
| 20-29 | 0.236 | -0.061, 0.533 | 0.122 | -0.121, 0.365 | -0.135 | -0.425, 0.154 | 0.381 | 0.012, 0.751 | 55 |
| 30-39 | 0.238 | -0.026, 0.501 | 0.156 | -0.116, 0.429 | 0.136 | -0.112, 0.383 | 0.235 | -0.025, 0.495 | 116 |
| 40-49 | 0.042 | -0.225, 0.309 | 0.115 | -0.105, 0.334 | 0.019 | -0.262, 0.301 | 0.009 | -0.267, 0.284 | 91 |
| 50-59 | -0.197 | -0.449, 0.055 | -0.151 | -0.423, 0.121 | -0.047 | -0.334, 0.241 | -0.22 | -0.453, 0.014 | 78 |
| 60-69 | -0.329 | -0.636, -0.021 | -0.336 | -0.708, 0.036 | -0.057 | -0.349, 0.235 | -0.342 | -0.666, -0.018 | 36 |
| 70+ | -0.648 | -1.566, 0.271 | -0.257 | -0.701, 0.187 | -0.552 | -1.502, 0.398 | -0.618 | -1.510, 0.274 | 3 |
| CHW age category 2 | | | | | | | | | |
| Under 50 | 0.154 | 0.001, 0.307 | 0.132 | -0.012, 0.277 | 0.037 | -0.122, 0.195 | 0.166 | 0.004, 0.327 | 262 |
| 50+ | -0.248 | -0.435, -0.060 | -0.213 | -0.421, -0.005 | -0.059 | -0.273, 0.155 | -0.266 | -0.449, -0.083 | 117 |
| CHW sex | | | | | | | | | |
| Male | 0.045 | -0.079, 0.168 | 0.024 | -0.105, 0.153 | 0.052 | -0.089, 0.194 | 0.033 | -0.094, 0.160 | 288 |
| Female | -0.201 | -0.524, 0.122 | -0.108 | -0.415, 0.199 | -0.236 | -0.545, 0.073 | -0.148 | -0.488, 0.192 | 91 |
| CHW ethnicity | | | | | | | | | |
| Mossi | 0.056 | -0.058, 0.171 | 0.001 | -0.120, 0.122 | 0.061 | -0.069, 0.192 | 0.056 | -0.068, 0.180 | 336 |
| Peulh | -0.256 | -0.709, 0.197 | 0.16 | -0.296, 0.616 | -0.382 | -0.735, -0.029 | -0.268 | -0.695, 0.160 | 37 |
| Other | -0.912 | -1.612, -0.212 | -0.869 | -1.521, -0.216 | -0.458 | -1.564, 0.649 | -0.827 | -1.490, -0.163 | 6 |
| CHW marital status | | | | | | | | | |
| Married/in union | 0.031 | -0.079, 0.141 | 0.014 | -0.103, 0.131 | 0.036 | -0.088, 0.160 | 0.025 | -0.093, 0.142 | 367 |
| Single | 0.808 | 0.411, 1.205 | 0.527 | 0.105, 0.949 | 0.699 | 0.200, 1.199 | 0.683 | 0.458, 0.909 | 4 |
| Widowed | -1.235 | -1.661, -0.810 | -0.576 | -1.107, -0.045 | -1.381 | -2.050, -0.712 | -0.981 | -1.493, -0.470 | 8 |
| CHW any school | | | | | | | | | |
| No | -0.313 | -0.473, -0.153 | -0.217 | -0.381, -0.054 | -0.197 | -0.371, -0.024 | -0.296 | -0.458, -0.134 | 171 |
| Yes | 0.356 | 0.181, 0.531 | 0.247 | 0.070, 0.424 | 0.225 | 0.040, 0.409 | 0.336 | 0.148, 0.525 | 208 |
| CHW school level | | | | | | | | | |
| No school | -0.313 | -0.473, -0.153 | -0.217 | -0.381, -0.054 | -0.197 | -0.371, -0.024 | -0.296 | -0.458, -0.134 | 171 |
| Primary | 0.399 | 0.197, 0.601 | 0.246 | 0.020, 0.471 | 0.241 | 0.018, 0.463 | 0.396 | 0.190, 0.601 | 150 |
| Secondary 1st cycle | 0.248 | -0.093, 0.590 | 0.25 | -0.024, 0.551 | 0.185 | -0.183, 0.486 | 0.19 | -0.141, 0.686 | 58 |
| CHW full or partial French literacy | | | | | | | | | |
| No | -0.493 | -0.675, -0.311 | -0.397 | -0.594, -0.200 | -0.268 | -0.465, -0.071 | -0.466 | -0.650, -0.281 | 132 |
| Yes | 0.35 | 0.205, 0.495 | 0.282 | 0.138, 0.425 | 0.19 | 0.027, 0.353 | 0.331 | 0.177, 0.485 | 247 |
| CHW full or partial Mossi literacy | | | | | | | | | |
| No | -0.434 | -0.654, -0.213 | -0.375 | -0.620, -0.130 | -0.306 | -0.534, -0.078 | -0.364 | -0.577, -0.152 | 86 |
| Yes | 0.203 | 0.065, 0.340 | 0.175 | 0.046, 0.305 | 0.143 | -0.007, 0.294 | 0.17 | 0.022, 0.319 | 293 |

| | Overall Performance | | Providing Care | | Managing Commodities | | Reporting | | n |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | 95% CI | Mean | 95% CI | Mean | 95% CI | Mean | 95% CI | |
| Literacy category | | | | | | | | | |
| No literacy in French or Mossi | -0.765 | -1.004, -0.526 | -0.619 | -0.911, -0.327 | -0.446 | -0.708, -0.183 | -0.706 | -0.927, -0.485 | 57 |
| Literacy in French only | 0.414 | 0.096, 0.732 | 0.25 | -0.089, 0.588 | 0.053 | -0.388, 0.495 | 0.51 | 0.170, 0.851 | 29 |
| Literacy in Mossi only | -0.158 | -0.440, 0.123 | -0.123 | -0.370, 0.124 | -0.049 | -0.356, 0.259 | -0.17 | -0.479, 0.139 | 75 |
| Literacy in French and Mossi | 0.339 | 0.184, 0.493 | 0.288 | 0.133, 0.442 | 0.215 | 0.045, 0.385 | 0.298 | 0.134, 0.462 | 218 |
| **Health System Factors** | | | | | | | | | |
| District | | | | | | | | | |
| Barsalogho | 0.849 | 0.520, 1.179 | 0.404 | 0.098, 0.710 | 0.928 | 0.565, 1.291 | 0.682 | 0.405, 0.959 | 90 |
| Boulsa | -0.845 | -1.108, -0.583 | -0.77 | -1.074, -0.466 | -0.539 | -0.914, -0.164 | -0.723 | -1.015, -0.432 | 24 |
| Gourcy | 0.713 | 0.515, 0.911 | 0.409 | 0.156, 0.663 | 0.485 | 0.265, 0.705 | 0.691 | 0.510, 0.872 | 102 |
| Kaya | -0.786 | -1.084, -0.488 | -0.498 | -0.818, -0.178 | -0.564 | -0.887, -0.241 | -0.728 | -1.085, -0.371 | 24 |
| Kongoussi | 0.062 | -0.215, 0.340 | 0.629 | 0.374, 0.884 | -0.149 | -0.541, 0.242 | -0.082 | -0.342, 0.179 | 27 |
| Ouahigouya | 0.408 | 0.073, 0.743 | 0.077 | -0.245, 0.399 | 0.126 | -0.164, 0.417 | 0.533 | 0.204, 0.862 | 28 |
| Seguenega | 0.14 | -0.049, 0.328 | -0.189 | -0.475, 0.097 | 0.105 | -0.098, 0.308 | 0.238 | 0.040, 0.436 | 30 |
| Titao | -0.055 | -0.499, 0.390 | 0.033 | -0.411, 0.476 | -0.203 | -0.562, 0.156 | 0.004 | -0.445, 0.453 | 25 |
| Yako | 0.886 | 0.666, 1.106 | 0.524 | 0.237, 0.810 | 1.009 | 0.709, 1.309 | 0.65 | 0.327, 0.973 | 29 |
| Study Arm | | | | | | | | | |
| Pneumonia Study Arm | 0.792 | 0.583, 1.001 | 0.406 | 0.199, 0.613 | 0.742 | 0.508, 0.977 | 0.686 | 0.508, 0.863 | 192 |
| Non-Pneumonia Study Arm | 0.107 | -0.227, 0.013 | -0.055 | -0.182, 0.072 | -0.1 | -0.235, 0.034 | -0.093 | -0.221, 0.036 | 187 |
| Ever trained in iCCM | | | | | | | | | |
| No | -0.364 | -0.763, 0.035 | -0.365 | -0.926, 0.197 | -1.22 | -1.690, -0.750 | 0.192 | -0.864, 1.249 | 4 |
| Yes | 0.005 | -0.106, 0.117 | 0.005 | -0.111, 0.122 | 0.018 | -0.107, 0.143 | -0.003 | -0.118, 0.112 | 375 |
| Time since initial iCCM training | | | | | | | | | |
| Less than 1 year | -0.114 | -0.890, 0.662 | 0.039 | -0.371, 0.448 | 0.278 | 10.440, 0.996 | -0.329 | -1.225, 0.568 | 11 |
| 1 year | -0.121 | -0.533, 0.292 | -0.227 | -0.543, 0 .089 | -0.043 | -0.416, 0.331 | -0.074 | -0.511, 0.364 | 30 |
| 2 years | 0.264 | 0.069, 0.460 | 0.365 | 0.165, 0.564 | 0.167 | -0.048, 0.382 | 0.177 | -0.021, 0.376 | 149 |
| 3 years | -0.071 | -0.269, 0.127 | -0.194 | -0.4, 0.012 | -0.016 | -0.215, 0.183 | -0.024 | -0.229, 0.182 | 141 |
| 4+ years | -0.367 | -0.709, -0.025 | -0.266 | -0.589, 0.057 | -0.289 | -0.625, 0.048 | -0.314 | -0.664, 0.035 | 44 |
| Time since initial iCCM training category | | | | | | | | | |
| Within last 2 years | -0.119 | -0.483, 0.245 | -0.154 | -0.415, 0.106 | 0.045 | -0.292, 0.383 | -0.144 | -0.546, 0.258 | 41 |
| At least 2+ years ago | 0.019 | -0.104, 0.141 | 0.022 | -0.105, 0.150 | 0.015 | -0.120, 0.151 | 0.012 | -0.112, 0.136 | 334 |
| Clinical practice during initial iCCM training | | | | | | | | | |
| No | -0.302 | -0.486, -0.117 | -0.148 | -0.338, 0.042 | -0.228 | -0.425, -0.031 | -0.291 | -0.480, -0.102 | 108 |
| Yes | 0.28 | 0.124, 0.435 | 0.142 | -0.013, 0.298 | 0.238 | 0.071, 0.404 | 0.255 | 0.093, 0.416 | 267 |
| Trained for PECADO | | | | | | | | | |
| No | -0.141 | -0.317, 0.036 | -0.186 | -0.356, -0.015 | -0.093 | -0.276, 0.090 | -0.096 | -0.289, 0.097 | 175 |
| Yes | 0.105 | -0.058, 0.267 | 0.138 | -0.027, 0.303 | 0.069 | -0.110, 0.248 | 0.071 | -0.088, 0.231 | 204 |

| | Overall Performance | | Providing Care | | Managing Commodities | | Reporting | | n |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | 95% CI | Mean | 95% CI | Mean | 95% CI | Mean | 95% CI | |
| **Current participation in PECADO** | | | | | | | | | |
| No | **0.287** | **0.039, 0.535** | 0.04 | -0.174, 0.253 | 0.167 | -0.081, 0.414 | **0.342** | **0.100, 0.584** | 167 |
| Yes | **-0.113** | **-0.251, 0.025** | -0.016 | -0.157, 0.126 | -0.066 | -0.220, 0.088 | **-0.135** | **-0.280, 0.011** | 212 |
| **Ever been supervised** | | | | | | | | | |
| No | **-0.385** | **-0.696, -0.075** | **-0.36** | **-0.635, -0.085** | **-0.354** | **-0.635, -0.074** | -0.272 | -0.597, 0.053 | 46 |
| Yes | **0.1** | **-0.023, 0.223** | **0.093** | **-0.038, 0.225** | **0.092** | **-0.048, 0.232** | 0.071 | -0.057, 0.198 | 333 |
| **Supervision in the last three months** | | | | | | | | | |
| No | **-0.232** | **-0.396, -0.067** | **-0.189** | **-0.349, -0.030** | **-0.234** | **-0.402, -0.066** | **-0.164** | **-0.337, 0.009** | 180 |
| Yes | **0.276** | **0.102, 0.449** | **0.225** | **0.037, 0.413** | **0.278** | **0.093, 0.463** | **0.195** | **0.018, 0.372** | 199 |
| **Time since last supervision** | | | | | | | | | |
| Within last 3 months | **0.276** | **0.102, 0.449** | **0.225** | **0.037, 0.413** | **0.278** | **0.093, 0.463** | **0.195** | **0.018, 0.372** | 199 |
| 3-11 months | **0.078** | **-0.167, 0.323** | **0.104** | **-0.183, 0.391** | **0.096** | **-0.140, 0.333** | **0.03** | **-0.230, 0.291** | 86 |
| 1+ years (or never) | **-0.425** | **-0.657, -0.192** | **-0.356** | **-0.552, -0.176** | **-0.398** | **-0.644, -0.216** | **-0.312** | **-0.529, -0.030** | 92 |
| **Supervisor trained in iCCM** | | | | | | | | | |
| No | **-0.261** | **-0.533, 0.012** | -0.212 | -0.508, 0.084 | -0.212 | -0.502, 0.079 | -0.21 | -0.482, 0.062 | 72 |
| Yes | **0.09** | **-0.069, 0.250** | 0.008 | -0.148, 0.164 | 0.067 | -0.106, 0.239 | 0.102 | -0.066, 0.270 | 225 |
| **Supervisor trained in IMCI** | | | | | | | | | |
| No | **0.285** | **-0.006, 0.575** | -0.151 | -0.520, 0.219 | **0.387** | **0.101, 0.673** | 0.305 | -0.005, 0.616 | 50 |
| Yes | **-0.074** | **-0.219, 0.071** | -0.039 | -0.180, 0.102 | **-0.097** | **-0.256, 0.063** | -0.05 | -0.200, 0.100 | 247 |
| **Supervisor number of CHW supervisees category** | | | | | | | | | |
| Low (1-10 supervisees) | 0.037 | -0.212, 0.286 | -0.103 | -0.323, 0.118 | 0.113 | -0.115, 0.341 | 0.042 | -0.224, 0.307 | 116 |
| Medium (11-20 supervisees) | 0.057 | -0.168, 0.282 | 0.075 | -0.133, 0.283 | 0.001 | -0.241, 0.244 | 0.057 | -0.162, 0.277 | 127 |
| High (21+ supervisees) | -0.185 | -0.481, 0.111 | -0.197 | -0.551, 0.157 | -0.206 | -0.522, 0.110 | -0.103 | -0.402, 0.196 | 54 |
| **Received bike for BMG program** | | | | | | | | | |
| No | -0.053 | -0.199, 0.094 | 0 | -0.154, 0.154 | -0.079 | -0.249, 0.092 | -0.042 | -0.198, 0.114 | 182 |
| Yes | 0.093 | -0.129, 0.315 | 0 | -0.192, 0.192 | 0.139 | -0.066, 0.343 | 0.074 | -0.145, 0.293 | 197 |
| **Community Factors** | | | | | | | | | |
| **CHW reports 'being respected' as an advantage of being a CHW** | | | | | | | | | |
| No | -0.011 | -0.143, 0.120 | -0.039 | -0.164, 0.086 | 0.034 | -0.115, 0.183 | -0.019 | -0.162, 0.124 | 294 |
| Yes | 0.029 | -0.229, 0.286 | 0.097 | -0.179, 0.373 | -0.085 | -0.316, 0.145 | 0.048 | -0.214, 0.309 | 85 |
| **CHW reports 'receiving blessings' as an advantage of being a CHW** | | | | | | | | | |
| No | -0.011 | -0.160, 0.139 | -0.043 | -0.182, 0.096 | 0.034 | -0.122, 0.189 | -0.016 | -0.169, 0.137 | 272 |
| Yes | 0.024 | -0.178, 0.226 | 0.096 | -0.152, 0.344 | -0.075 | -0.288, 0.138 | 0.035 | -0.179, 0.250 | 107 |

One other bivariate relationship that we tested was that between performance and a CHW's health facility. In the Burkina Faso iCCM program, a CHW only has one supervisor, and this supervisor is attached to the health facility closest to the CHW; so in this regard, the effect of a CHW's health facility on their performance might be explained by the effect of a CHW's supervisor on their performance, though it might also be explained by other factors such as the facility's supply chain functioning, or the engagement of other health workers at the facility. In our sample, the number of sampled CHWs per health facility ranged from 1 to 13, with a mean of 1.93 sampled CHWs per health facility. We ran ANOVA analyses to test the hypothesis that variation in CHW performance was related to a CHW's *health facility*. The results are shown in Table 3.7. The analyses showed that variation in Overall Performance was at least partly explained by variation in *health facility* (r-squared=0.7358, adjusted r-squared=0.4495), suggesting that there is indeed a relationship between *health facility* and performance. (In the absence of any relationship at all, we would expect r-squared to be 0.5 and adjusted r-squared to be 0.0.) Interestingly, while the adjusted r-squared values for ANOVA analyses on Managing Commodities and Reporting were 0.4280 and 0.4449, the adjusted r-squared value for Providing Care was -0.0242, meaning that *health facility* was unrelated to a CHW's performance in Providing Care.

**Table 3.7. Test results for the effect of health facility on CHW performance**

| | | Overall Performance | Providing Care | Managing Commodities | Reporting | Expected value if there was no relationship between performance and *health facility* | Test with a normally distributed random variable with mean of 0 and std. dev. of 1 |
|---|---|---|---|---|---|---|---|
| ANOVA | r-squared | 0.7358 | 0.5085 | 0.7255 | 0.7336 | 0.5 | 0.5020 |
| | adjusted r-squared | 0.4495 | -0.0242 | 0.4280 | 0.4449 | 0.0 | -0.0376 |
| | p-value | p<0.0001 | p=0.6250 | p<0.0001 | p<0.0001 | p>0.05 | p=0.6896 |
| Post-estimation Wald tests for *health facility* in full regression models | | p=0.0361 | p=0.9672 | p=0.0026 | p=0.0019 | p>0.05 | p=0.7726 |

### 3.4.4. Multi-linear regression models

Table 3.8 shows the coefficients and test statistics generated by our four primary regression models. The Stata output for these models is provided in Appendix 3.1. We used post-estimation Wald tests to test the significance of categorical predictors. Predictor variables for which there were statistically significant relationships with the outcome variable, at alpha=0.05, are shown in bold in Table 3.8.

Table 3.8. **Results from primary regression models for the four outcome variables**

| | Overall Performance | | Providing Care | | Managing Commodities | | Reporting | |
|---|---|---|---|---|---|---|---|---|
| | **Beta** | **95% CI** | **Beta** | **95% CI** | **Beta** | **95% CI** | **Beta** | **95% CI** |
| CHW is 50+ years of age | **-0.2057** | **-0.4079, -0.0035** | **-0.6060** | **-0.8983, -0.3136** | 0.0515 | -0.1795, 0.2826 | -0.0997 | -0.3108, 0.1113 |
| CHW is female | **-0.2288** | **-0.4191, -0.0384** | -0.2189 | -0.4940, 0.0563 | -0.2153 | -0.4327, 0.0022 | -0.1571 | -0.3557, 0.0416 |
| Education (base = "no school") | | | | | | | | |
| Primary | **0.3391** | **0.1170, 0.5612** | 0.2880 | -0.0331, 0.6091 | **0.3109** | **0.0571, 0.5647** | 0.2514 | 0.0196, 0.4832 |
| Secondary (any cycle) | **0.1944** | **-0.0995, 0.4883** | 0.0714 | -0.3534, 0.4962 | **0.3341** | **-0.0017, 0.6698** | 0.1041 | -0.2026, 0.4107 |
| Literacy (base = "no literacy in French or Mossi") | | | | | | | | |
| Literacy in French only | **0.5499** | **0.1837, 0.9160** | 0.2393 | -0.2900, 0.7685 | 0.0402 | -0.3781, 0.4585 | **0.7293** | **0.3472, 1.1113** |
| Literacy in Mossi only | **0.5027** | **0.2376, 0.7678** | 0.4029 | 0.0197, 0.7861 | 0.3599 | 0.0571, 0.6628 | **0.4325** | **0.1559, 0.7091** |
| Literacy in French and Mossi | **0.5521** | **0.2763, 0.8278** | 0.4658 | 0.0671, 0.8644 | 0.2031 | -0.1119, 0.5182 | **0.5612** | **0.2735, 0.8490** |
| District (base = "Barsalogho") | | | | | | | | |
| Boulsa | **-1.3032** | **-1.6947, -0.9116** | **-0.8737** | **-1.4397, -0.3077** | **-1.0189** | **-1.4662, -0.5716** | **-1.1467** | **-1.5553, -0.7381** |
| Gourcy | **-0.4293** | **-0.6695, -0.1892** | **-0.2632** | **-0.6104, 0.0839** | **-0.5415** | **-0.8159, -0.2672** | **-0.2852** | **-0.5359, -0.0346** |
| Kaya | **-1.4999** | **-1.8771, -1.1227** | **-0.7291** | **-1.2743, -0.1838** | **-1.3407** | **-1.7716, -0.9098** | **-1.3467** | **-1.7403, -0.9531** |
| Kongoussi | **-1.1122** | **-1.4792, -0.7452** | -0.0160 | -0.5465, 0.5145 | **-1.3380** | **-1.7572, -0.9187** | **-1.0370** | **-1.4199, -0.6540** |
| Ouahigouya | **-0.5130** | **-0.8332, -0.1929** | -0.3598 | -0.8226, 0.1029 | **-0.8054** | **-1.1711, -0.4396** | **-0.2441** | **-0.5781, 0.0900** |
| Seguenega | **-0.7334** | **-1.0423, -0.4244** | **-0.6913** | **-1.1379, -0.2447** | **-0.7386** | **-1.0916, -0.3857** | **-0.4835** | **-0.8059, -0.1611** |
| Titao | **-0.6657** | **-1.0503, -0.2812** | -0.2503 | -0.8062, 0.3056 | **-0.8618** | **-1.3011, -0.4225** | **-0.4943** | **-0.8956, -0.0931** |
| Yako | **-0.2377** | **-0.5716, 0.0963** | -0.0539 | -0.5366, 0.4289 | -0.0787 | -0.4602, 0.3028 | **-0.3045** | **-0.6530, 0.0439** |
| Distance to health facility | -0.0040 | -0.0156, 0.0075 | -0.0049 | -0.0216, 0.0118 | -0.0016 | -0.0148, 0.0116 | -0.0035 | -0.0155, 0.0086 |
| Time since last supervision (base = "Within 3 months") | | | | | | | | |
| 3-11 months | **-0.0393** | **-0.2251, 0.1464** | **-0.1111** | **-0.3796, 0.1574** | **-0.1503** | **-0.3625, 0.0619** | 0.0587 | -0.1352, 0.2525 |
| 1+ years (or never) | **-0.3130** | **-0.5159, -0.1101** | **-0.4574** | **-0.7507, -0.1642** | **-0.3481** | **-0.5799, -0.1164** | -0.1251 | -0.3368, 0.0866 |
| Ethnicity (base = "Mossi") | | | | | | | | |
| Peulh | -0.1372 | -0.4083, 0.1339 | 0.2663 | -0.125, 0.6576 | -0.1389 | -0.4482, 0.1705 | -0.2481 | -0.5301, 0.0340 |
| Other | 0.0037 | -0.5781, 0.5855 | -0.1279 | -0.9677, 0.7119 | 0.3207 | -0.3432, 0.9845 | -0.1027 | -0.7080, 0.5026 |

| | Overall Performance | | Providing Care | | Managing Commodities | | Reporting | |
|---|---|---|---|---|---|---|---|---|
| | Beta | 95% CI | Beta | 95% CI | Beta | 95% CI | Beta | 95% CI |
| Time since becoming a CHW (years) | 0.0021 | -0.0095, 0.0138 | 0.0097 | -0.0071, 0.0266 | 0.0069 | -0.0065, 0.0202 | -0.0040 | -0.0162, 0.0081 |
| Trained in iCCM 2+ years ago | **0.5545** | **0.3069, 0.8020** | **0.4763** | **0.1185, 0.8341** | **0.4177** | **0.1349, 0.7005** | **0.4540** | **0.1957, 0.7123** |
| Number of refresher trainings | 0.0171 | -0.0311, 0.0653 | -0.0076 | -0.0773, 0.0620 | 0.0403 | -0.0147, 0.0954 | 0.0092 | -0.0410, 0.0595 |
| Time since last training (years) | -0.0463 | -0.1520, 0.0593 | -0.0476 | -0.2003, 0.1051 | -0.0385 | -0.1592, 0.0822 | -0.0330 | -0.1433, 0.0772 |
| Clinical practice during initial iCCM training | 0.0058 | -0.1897, 0.2014 | -0.0989 | -0.3816, 0.1837 | 0.0348 | -0.1886, 0.2582 | 0.0312 | -0.1729, 0.2352 |
| Trained for PECADO program | **0.1910** | **0.0080, 0.3740** | 0.2252 | -0.0393, 0.4897 | 0.1454 | -0.0636, 0.3545 | 0.1312 | -0.0597, 0.3222 |
| Current participation in PECADO program | -0.0476 | -0.2514, 0.1563 | 0.0510 | -0.2437, 0.3456 | -0.0627 | -0.2955, 0.1702 | -0.0623 | -0.275, 0.1504 |
| Time since visiting health facility (months) | **-0.0422** | **-0.0747, -0.0096** | 0.0258 | -0.0213, 0.0729 | **-0.0914** | **-0.1286, -0.0542** | -0.0296 | -0.0636, 0.0043 |
| Time lived in current village (years) | -0.0021 | -0.0081, 0.0039 | 0.0006 | -0.0081, 0.0093 | -0.0036 | -0.0105, 0.0033 | -0.0017 | -0.008, 0.0046 |
| Received bike for iCCM program | -0.0554 | -0.2165, 0.1058 | 0.0082 | -0.2247, 0.2412 | -0.0404 | -0.2245, 0.1437 | -0.0683 | -0.2364, 0.0999 |
| Respect as advantage of CHW role | 0.0129 | -0.1786, 0.2045 | 0.0075 | -0.2694, 0.2844 | 0.0337 | -0.1851, 0.2525 | 0.0001 | -0.1998, 0.200 |
| Blessings as advantage of CHW role | 0.0928 | -0.0748, 0.2603 | 0.2179 | -0.0243, 0.4601 | -0.0750 | -0.2664, 0.1164 | 0.0928 | -0.0820, 0.2677 |
| _cons | -0.0696 | -0.7492, 0.6100 | 0.0777 | -0.9048, 1.0601 | 0.1439 | -0.6325, 0.9203 | -0.2095 | -0.9187, 0.4997 |

| Test Statistics | | | | |
|---|---|---|---|---|
| Observations | 375 | 375 | 375 | 375 |
| R-squared | 0.5303 | 0.2726 | 0.4249 | 0.4386 |
| Adjusted R-squared | 0.4894 | 0.2091 | 0.3748 | 0.3897 |

*Age* was a significant predictor of Overall Performance and Providing Care, with younger

CHWs performing 0.206 and 0.606 z-scores higher than those over 50 years of age, all other

factors being equal. The association of *age* with Reporting was significant in bivariate

analysis, but not at all significant in the multi-variate regression analysis ($\beta$ = -0.010, CI: -

0.311, 0.111). There was an association between *sex* and Overall Performance ($\beta$ = -0.206,

CI: --0.408, -0.003), and between *sex* and Managing Commodities ($\beta$ = 0.051, CI: -0.179,

0.283): when all other factors are held constant, women have scores for Overall Performance

and Managing Commodities that are 0.229 and 0.215 z-scores lower than for men,

respectively. *Education* was significant as a predictor of Overall Performance and Managing

Commodities. Holding other factors constant, CHWs with primary school education have

performance scores for Overall Performance and Managing Commodities that are 0.339 (CI:

0.117, 0.561) and 0.311 (CI: 0.057, 0.565) z-scores higher than CHWs with no schooling.

The models for Providing Care and Reporting showed similar results, though the

significance of *education* in these models was not as strong. *Literacy* was also predictive of

Overall Performance and Reporting: our model suggested that, holding other factors

constant, French literacy increases a CHW's Reporting score by 0.729 (CI: 0.347, 1.111) z-

scores, compared to no literacy in any language.


*District* was highly predictive for all performance measures. In the model for Overall

Performance, coefficients for some districts were as extreme as -1.5 (Kaya), suggesting that,

if all other factors were equal in both districts, CHWs in Kaya would perform 1.5 (CI: -

1.877, -1.123) z-scores worse than in the base district of Barsalogho. Statistically significant

coefficients of similar magnitude were also seen in the models for Providing Care, Managing

Commodities, and Reporting. It could have been the case that this variation among districts

was explained by *study arm* (pneumonia study arm, non-pneumonia study arm). We could not include both *district* and *study arm* as regression predictors at the same time due to collinearity. However, in the regression model for Overall Performance we see that there is a statistically significant association for the district of Gourcy versus the base district of Barsalogho (the two districts in the pneumonia study arm), suggesting that a CHW's district acts as a determinant beyond the effect of *study arm*. The same is true for districts in the non-pneumonia study arm. Appendix 3.5 shows the same model for Overall Performance but with the district of Boulsa as the base district.

The average distance to health facility was 7.8 km for all CHWs who provide iCCM services, ranging from 0 km to 50 km for sampled CHWs. In our models, *distance to health facility* had no relationship with any outcome variable, with coefficients of 0.0 in all cases.

The only variable concerning training that showed an association with any performance measure was *time since initial training*. Our model suggests that CHWs who were trained more than 2 years ago have Overall Performance scores that are 0.554 (CI: 0.307, 0.802) z-scores above those for CHWs trained more recently, holding other factors constant. *Clinical practice during initial training* showed no associations at all for any outcome variables in our multi-variate regression models, with a coefficient of -0.099 (CI: -0.387, 0.184) in the model for Providing Care. *Number of refresher trainings since initial training* also was not associated with any performance measure.

*Time since last supervision* was associated with Overall Performance, Providing Care, and Managing Commodities. Regression coefficients for the categories of "3-11 months" and

"1+ years" were increasingly negative against the base category of "within 3 months": -0.039 (CI: -0.225, 0.146) and -0.313 (CI: -0.516, -0.11) respectively for Overall Performance. We created other variables for CHW supervision (such as *supervisor's age, supervisor's sex, time since the supervisor arrived at the health facility, supervisor trained in iCCM, supervisor trained in IMCI, number of CHWs being supervised by the supervisor*), but we did not include these variables in our regression models due to their limited number of observations. The secondary analyses in Appendix 3.2 suggest that none of these variables are associated with CHW performance, except for *supervisor's age*. The secondary model for Overall Performance suggests that a CHW's performance increases by 0.038 (CI: 0.015, 0.062) z-scores with every additional year of supervisor's age.

Only two other variables had significant associations with any outcome variables: *time since visiting a health facility* and *trained for PECADO program*. *Time since visiting a health facility* was associated with the outcome variables of Overall Performance and Managing Commodities. Our model suggests that, all other factors held constant, the Overall Performance of CHWs changes by -0.042 (-0.075, -0.01) z-scores for every month that a CHW does not visit a health facility. This relationship is even stronger for Managing Commodities: a CHW's score for Managing Commodities changes by -0.091 (CI: -0.129, -0.054) z-scores for every month not visiting a health facility; a decrease of 1.1 z-scores for every year. The variable of *trained for PECADO program* was also associated with Overall Performance. Our model predicts that a CHW who is trained as part of the PECADO program (a malaria CCM program run in the same districts as the evaluated iCCM program) will have an Overall Performance score that is 0.191 (CI: 0.008, 0.374) z-scores higher than a CHW not trained for the PECADO program, all other factors being equal.

In order to validate the results from our ANOVA analyses of the relationship between a CHW's health facility and their performance, we tested the influence of *health facility* as a series of indicator variables in our models. The post-estimation Wald test statistics for *health facility* in the regression models for Overall Performance, Managing Commodities, and Reporting were p=0.0361, p=0.0026, and p=0.0019, but for Providing Care it was p=0.9672. These results are shown above in 0.

## 3.5. Discussion

Previous research in other settings suggests that many factors play a role in CHW performance, such as the demographic profile of CHWs, the presence or absence of health system supports, financial and non-financial incentives, and other environmental conditions. Our results confirm the importance of many of these factors, at least in the context of the Burkina Faso iCCM program. In the following section we discuss our results further, to say not just which factors are important, but why, and the implications for CHW programs.

3.5.1.   What factors are important for CHW performance?

*CHW characteristics*

In meetings and qualitative interviews, stakeholders of the Burkina Faso iCCM program, such as national and district MoH staff, have said repeatedly that CHWs perform better if they are educated and literate. Although the evidence for these assertions has, until now, been limited, our results suggest that CHW profile does play a role. *Age*, *sex*, *education*, and *literacy* all had a statistically significant associations with our outcome variable of Overall Performance, and in some cases with Providing Care (*age*), Managing Commodities (*education*), and Reporting (*literacy*).

Some of these relationships are logical and explainable. Being literate will help a CHW to write reports and complete a patient register, and to read drug labels, descriptions, use-by dates, and package instructions. Literacy might also improve a CHW's experience of training (involving written print materials), improving their understanding of the CHW role and their knowledge and skills to carry out the role. Other relationships that we see in our results are more difficult to explain, such as the effect of *age* and *education* on performance. How does education improve CHW performance, beyond the effect of literacy? Perhaps *education* improves critical thinking, and therefore improves a CHW's decision making, or comprehension and retention of the iCCM algorithm. *Education* might also reflect more advanced numeracy skills, which may be important for Managing Commodities and Reporting; for example, checking expiration dates, or recording numbers of patients. Likewise, what explains the effect of *age*? In our model, CHWs who are over 50 perform 0.606 z-scores lower than other CHWs in Providing Care, beyond the effects of *literacy* and *education*. Perhaps younger CHWs, once trained, follow the iCCM algorithm more faithfully, whereas older CHWs rely on more entrenched heuristics for treating illnesses from previous eras. In qualitative studies conducted on the Burkina Faso iCCM program at the same time as our quantitative assessment, district managers and supervisors spoke about the need for CHWs who are literate - not as a need for specific skills, but rather as a need for CHWs who "understand", who "get it", as if education and literacy reflected an underlying cultural or generational difference (IIP-JHU, 2014). *Age* and *education* might therefore be confounders for a more important, unmeasured latent factor concerning a CHW's attitudes or values.

The association of *sex* with Overall Performance ($\beta$ = -0.229, CI: -0.419, -0.038) is perhaps explainable in terms of the role that male and female CHWs traditionally assumed before the

launch of the iCCM program. In the years prior to 2009, female CHWs were typically only

tasked with accompanying pregnant women to a health facility for delivery; while male

CHWs played more diverse roles, such as assisting health workers to weigh children for food

distribution programs, assisting with vaccination campaigns, or helping to raise awareness of

other health interventions. During data collection for our study, many data collectors heard

anecdotally that male CHWs were prioritized for the iCCM program; female CHWs were

also trained for iCCM, but in practice community members didn't expected them to deliver

iCCM if there was also a male CHW in the village. If, for this reason, female CHWs were not

as experienced, confident, or well-trained as male CHWs, this may explain why women did

not perform as well men in our study.


*Health system factors*


Our results on health system factors are more difficult to interpret. Among our predictor

variables, *time since last supervision* was important for all domains of performance. CHWs who

hadn't seen their supervisor for over a year performed worse than those who had seen their

supervisor in the past 3 months. Although supervision is clearly important, it is hard to know

what it is about supervision that makes it important. Is it that the knowledge and skills of

CHWs are improved by supervision? Is it that CHWs are motivated because of their

interactions with supervisors, which in turn improves their performance? Or is *time since last*

*supervision* a confounder for another factor such as the supervisor's or CHW's commitment

to the iCCM program? Our study did not incorporate information on supervision quality,

but from the literature we know that the content and quality of supervision varies

considerably (Hill *et al.*, 2014; Roberton *et al.*, 2015a). Further research should be conducted

in Burkina Faso, as elsewhere, to examine the quality of supervision and its effect on performance, using quantitative and qualitative methods.

Beyond supervision itself, we saw a more general link between a CHW's supervisor (or health facility) and the CHW's performance. Differences in *health facility* were responsible for a large portion of the variation in CHW performance. The fact that this relationship was strong for Managing Commodities and Reporting, but not present at all for Providing Care, suggests that supervisors (or someone at the health facility) may play a significant role in improving a CHW's performance at tasks that can be closely and directly supervised, such as filling in required paperwork and collecting drugs, but supervisors do not play such a role for a CHW's (typically unobserved) assessment, classification, and treatment of sick children in the village. In qualitative interviews (discussed in Chapter 4), CHWs frequently reported drug stockouts at their health facility, which would also explain the relationship between a CHW's health facility and his or her performance at Managing Commodities.

*Time since initial iCCM training* was important as a determinant, but as with supervision, this finding is difficult to interpret. *Time since most recent training* was not associated with performance differences, so it doesn't seem to be the case that CHW performance increases or diminishes over time in the absence of training. In multi-linear regression models, CHWs who received *clinical practice during initial training* performed as well as other CHWs. *Number of refresher trainings* wasn't significant either, so the quantity of training doesn't appear to make a difference (although the quality of these refresher trainings, not captured in our data, may be influential). These results confirm results from other studies that found refresher training to be <u>ineffective</u> in improving and maintaining CHW performance (Rowe *et al.*, 2007). So what

is it about *time since initial iCCM training* that matters? CHWs who were trained 2+ years ago would have been among the first CHWs to be trained for the iCCM program. *Time since initial iCCM training* could reflect qualitative differences in the way various cohorts of CHWs were trained; with CHWs trained at the start of the iCCM program (in 2009 and 2010) having different experiences to those trained in 2011 or later. Or there may be other factors associated with the different cohorts - perhaps CHWs that were recruited at the start of the Burkina Faso program were told things that motivated them to perform better as CHWs. As with supervision, it would be good to explore the quality of training further, as this seems to be the critical factor.

Other determinants that we had thought might affect performance did not seem to play a role. Prior to our study, *distance to health facility* was thought by many stakeholders in Burkina Faso to be a determinant of CHW performance. In our models, however, *distance to health facility* was not an issue for any performance domain. We had expected this to affect Managing Commodities, and possibly other domains due to its implications for supervision and oversight, but there were no associations.

The predictor variable that had the most notable effect on CHW performance in our models was *district*. We expected some associations between performance and *district*, but our models showed striking associations that were stronger for *district* than for any other predictor variable. It is not clear what explains this relationship. Differences such as *ethnicity* and *distance to health facility* were accounted for by other variables. Perhaps the reason again lies with qualitative differences. Our models did not include any variables on the quality of training or supervision, and this is something that could be determined at the district level. We also did

not include intangible factors such as the attitudes and values of district MoH staff. Perhaps district-level attitudes affect health facility staff, which in turn affect CHWs. If this is the case, it is interesting that such an effect is seen despite the fact that health workers in Burkina Faso are often transferred from one health facility to another health facility. Either supervisors are quickly taking on district-level attitudes, and that in turn is influencing CHWs, or there is some other district-level factor that has a direct link to CHWs.

*Community factors*

In our models we tested three predictor variables related to community factors: time lived in current village, CHW cites "respect" as an advantage of being a CHW, and CHW cites "receiving blessings" as an advantage of being a CHW. None of the variables showed an association with any of our outcome measures. However, given the limited scope of these predictor variables, we hesitate to draw conclusions about the influence of community factors on performance. Future studies could collect and test more robust data on community factors, such as the level and nature of community participation in the CHW program, and the tangible and intangible support provided by community members to CHWs.

### 3.5.2. <u>What can be done to improve performance?</u>

Given that many factors seem to play a role in CHW performance, how can policy makers use this information to improve programs? We divide the following section into a discussion on recruitment, facility-level supports, and national-, regional-, and district-level supports.

*Recruitment*

In June 2014, after much discussion on the profile of CHWs in the Burkina Faso iCCM program, the MoH instituted a policy requiring all CHWs to have a certificate of primary school education, to be literate in French, and to be between the ages of 20 and 50 (MoH Burkina Faso, 2014). Given our results showing the importance of CHW characteristics for performance, this policy seems to be a step in the right direction. In terms of literacy, the MoH might have instead chosen to change program elements, for example, to conduct trainings in local languages, use simplified reporting registers, and develop simplified drug packaging. These steps may still be worthwhile, as our results show that it isn't only reading and writing that is important for CHW performance. We hypothesized that higher education and younger age could enable higher performance through better critical thinking, information retention, decision-making, and attitudes that are concordant with modern medicine and iCCM. While a CHW doesn't need to be a certain age or have a certain level of education to exhibit these traits, it makes sense to use age and education as a marker - and to this end, the new policy in Burkina Faso makes sense.

However, simply adopting a policy to select CHWs on the basis of age, education, and literacy isn't enough. First, we need to balance these characteristics against those that are favorable for Building Community Relationships, which, although untested in this paper, may be different than those for other domains of performance. The people in the village with the highest education and literacy may not be the people with the strongest skills for establishing trust with other village members, and vice versa. Second, the recruitment process itself needs careful attention. Who in the village or at the health facility decides what balance of characteristics is needed from a shortlist of CHW candidates? What if there are no people in the village who meet the MoH's criteria at all? And what happens when the existing CHWs in the village don't meet the criteria, would disbanding or replacing them would create tension? These issues are discussed further in Chapter 5.

*Facility-level supports*

Our findings showed that a CHW's relationship with their supervisor is predictive of performance. CHW's who saw their supervisor more recently performed better at all aspects of their job, and variation in *health facility* was responsible for a significant portion of the variation in CHW performance for Managing Commodities and Reporting. This suggests that a supervisor has agency to affect a CHW's performance, perhaps by encouraging CHWs to keep their drugs up-to-date or ensuring that CHWs complete their patient registers. Other studies have also shown a link between supervision and CHW performance (Kelly *et al.*, 2001; Maji *et al.*, 2010; Kalyango *et al.*, 2012). If the MoH in Burkina Faso wants to improve CHW performance, they could enhance the support offered to supervisors; for example, providing training or incentives for supervisors so that supervisors have greater competence

and motivation to follow up with CHWs. This might involve new approaches to supervision, such as "supportive supervision", that emphasize the problem-solving and relational aspects of supervision, rather than report-checking or verification (Marquez and Kean, 2002; Djibuti *et al.*, 2009).

The MoH should also consider the quality of training provided to CHWs. In our models, CHWs with more training, and more recent training, did not perform better than those without, but we did see that CHWs who were trained in the initial iCCM cohort of CHWs performed better than those trained later. For all newly recruited CHWs, the MoH should take time to provide a thorough training and induction to the program, rather than simply provide catch-up or on-the-job training.

*National-, regional-, and district-level supports*

Finally, the MoH should look carefully at the differences in CHW performance across districts. Our results in this paper show that the district itself is responsible for a considerable proportion of the variation in CHW performance, compared to the make-up of CHWs within each district, or the availability of health system supports. In Chapter 2 we highlighted the value of using summary measures of performance to monitor district-level CHW performance. Our findings in this paper reinforce the need for such measures.

Arguably the first thing the MoH should do to address these differences is more research. Without further information, it is hard to say what exactly it is about a district that affects CHW performance. It could be the competence of district-level staff, or the attitudes of

district-level staff, or both. The fact that Barsalogho and Gourcy were the best districts is not surprising - these same districts were chosen for pneumonia CCM, and so more attention was paid to them.[4] The MoH might consider greater oversight for other districts as well; for example, making sure that all districts are supporting supervisors to take an active interest in the work of CHWs, making sure that the content and quality of training is the same in each district, and in general, making sure that all district personnel have encouraging attitudes and are supportive of the iCCM program.

## 3.6. Limitations

Our study has several limitations. First, our analysis only included results for CHWs who were actively providing iCCM services. Of the 339 CHWs in our sampling frame that we found and spoke to, only 231 (68%) were providing iCCM services. While our study examines how well these active CHWs perform at their role, it doesn't explain why some CHWs are not providing care in the first place - which itself is an indicator of performance.

Second, we did not collect data on Building Community Relationships, meaning that we could not explore the determinants of this aspect of performance. While this does not weaken our findings for other performance domains, we cannot say whether the determinants for Providing Care, Managing Commodities, and Reporting are the same or different to those for Building Community Relationships, which would be important to understand.

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[4] To ensure that pneumonia CCM was not a confounder for performance, we ran analyses that excluded all pneumonia-related variables from our measures of performance. Even in these analyses, Barsalogho and Gourcy did better than other districts.

Third, some of the data used for this analysis may have limitations. Most of the predictor variables were self-reported by CHWs, including *time since last supervision*, *clinical practice during initial training*, *number of refresher trainings*. Some CHWs may not have been able to accurately recall this information. Moreover, the variables themselves are limited. For example, we did not have data on the quality of training and supervision, only on the frequency and timing of training and supervision. Clearly a single variable of when supervision took place doesn't capture the nature, content, or intensity of supervision, which are likely important determinants of performance. Data for the outcome variables are also potentially problematic. The summary measure of Providing Care, for example, uses data recorded during observations of sick-child consultations. While every effort was taken to train data collectors as best as possible, it may be that there were errors in how observers recorded certain tasks.

Fourth, the values of r-squared and adjusted r-squared for our models were not particularly strong, suggesting that a large portion of the variability of CHW performance is unaccounted for by our models. Although we expect there to be variability in the performance scores of CHWs beyond our model (since not all CHWs with the same characteristics will have similar performance scores; and even the exact same CHWs will have different performance scores over repeated observations), it may be that there are other true determinants of performance that are missing from our models. While this is an issue, it does not undermine the relevance of our models, since the purpose of our models was not to *predict* CHW performance, but rather to distinguish between factors that are associated and unassociated with higher or lower CHW performance.

Finally, this paper is limited by the quantitative nature of its analyses. Our results suggest that training and supervision *quality* may be important determinants of performance, yet we don't have information to explain or describe this relationship in any detail. It would be valuable to use qualitative methods to explore this further.

## 3.7. Conclusions

The results of this study come at an important time for the Burkina Faso iCCM program and other CHW programs around the world, which are receiving growing attention and becoming increasingly embedded into national health systems (Singh and Sachs, 2013). Better understanding of the drivers of CHW performance will help policy makers to design strategies and initiatives to improve CHW performance, and thereby increase program effectiveness. Researchers have studied CHW performance in the past, but in only a few contexts and with limited analytical methods. This paper investigates outcome measures for multiple domains of performance, including a comprehensive measure of Overall Performance, and examines the effect of more than 20 predictor variables using bivariate and multi-variate analyses.

Our findings reveal the effect of various CHW characteristics and health system factors on CHW performance, and their relationships with specific domains of CHW performance. Factors such as age, sex, education, and literacy proved to be important determinants, as did a CHW's district. The frequency and timing of training and supervision did not appear to affect performance, though we believe the *quality* of training and supervision may be extremely important. Much of the variation in CHW drug stock and reporting was explained by CHWs having different supervisors or belonging to different health facilities.

Our study has wide-reaching implications for implementers of the Burkina Faso iCCM program and other programs. Policy makers should review policies on CHW recruitment - both selection criteria and the process of recruitment itself. Careful attention should be given

to the quality of training and supervision. National- and regional-level actors should more closely monitor and support the actions of district-level staff in managing supervisors and CHWs. It may be that intangible factors at the district level have concrete effects on the success of CHWs and their ability to provide life-saving care for children.

# Chapter 4.  Determinants of Community Health Worker Performance in an Integrated Community Case Management Program in Burkina Faso: a Qualitative Analysis (Paper 3)

## 4.1.  Abstract

BACKGROUND: Integrated community case management (iCCM) has received growing attention strategy for reducing child mortality in low-income settings. The effectiveness of iCCM programs depends on the performance of community health workers (CHW), yet the factors that influence CHW performance are not well understood. Qualitative research has the potential to capture attributes related to CHW performance that traditional quantitative methods cannot.

METHODS: Matched quantitative and qualitative data were collected for CHWs, supervisors, and caregivers in 27 villages in the Burkina Faso iCCM program. Quantitative data on CHW performance were collected using a structured questionnaire, inspection of drug kits and patient registers, and observation and re-examination of sick children (1 or 2 consultations per CHW). Qualitative data were collected from CHWs, supervisors, and caregivers using in-depth interviews and focus groups. Summary measures of CHW performance were constructed using quantitative data, and used to identify the 5 highest-performing CHWs and 5 lowest-performing CHWs. The qualitative data for each of these

high- and low-performing cases was compared and contrasted to identify factors related to CHW performance.

RESULTS: CHWs with more positive attitudes, stronger intrinsic motivation, and who are more often present in the village, appear to perform better. Proactive supervision from motivated supervisors has a profound, personal effect on CHW motivation and performance. Challenges such as drug stockouts and broken promises do not explain the variability in CHW performance, but could be mitigated to improve the performance of all CHWs.

CONCLUSIONS: The pathways by which determinants affect CHW performance are often complicated. Improving CHW performance requires a meaningful understanding of these determinants and pathways. Strategies to improve CHW performance should emphasize the *quality* of program processes, and how these processes are perceived and felt by the CHWs and caregivers for whom they are implemented.

## 4.2. Introduction

Community health worker (CHW) programs are considered a promising strategy to reduce child mortality in low-resource settings (Haines *et al.*, 2007; Perry *et al.*, 2014). One example of a CHW program that is gaining traction is integrated community case management (iCCM) (George *et al.*, 2012; Lainez *et al.*, 2012; Rasanathan *et al.*, 2014). For iCCM programs to have an impact, CHWs must perform well at a variety of tasks: build trust among community members, keep a well-stocked drug kit, and correctly assess, classify, and treat illnesses. By understanding how well CHWs perform at these tasks, and which factors are associated with higher or lower performance, we can better ensure that iCCM programs will achieve their intended impact.

Various factors are typically considered to influence CHW performance (Lehmann and Sanders, 2007; USAID, 2011, 2012). In a study of the drivers of health worker and CHW performance, Winch et al. cite recruitment and selection, competency-based training, job aids, monetary and non-monetary incentives, the availability of required equipment and supplies, and supportive supervision and coaching (Winch *et al.*, 2003). In a study involving interviews with "thought leaders" in iCCM, the respondents mentioned similar factors: recruitment, training, supervision, incentives, community involvement and ownership, information and data management, and mHealth (Strachan *et al.*, 2012). A recent systematic review of "intervention design factors" and their influence on the performance of CHWs found that financial and non-financial incentives, clearly defined CHW roles, supervision and

continuous training, and the embedment of CHWs in community and health systems all helped to enhance performance (Kok *et al.*, 2014).

While all of these factors likely influence performance in most CHW programs, studies show that the effect of these factors varies in different contexts. A study of CHWs in West Bengal found supervision to be a significant driver of performance (Maji *et al.*, 2010), while a study in Zambia found supervision to have no impact (Stekelenburg *et al.*, 2003). A study in Kisumu West district of Kenya found older age (>40 years) to be a strong predictor of CHW productivity (Kawakatsu *et al.*, 2012), while the opposite was true in Guinea-Bissau (Lopes *et al.*, 2014). These seemingly contradictory studies highlight the importance of context, the diversity of CHW programs, and the need to go beyond simple predictors of performance such as "supervision" and "age" to a more nuanced discussion of determinants and the pathways by which they operate. Indeed, Kok et al. recently examined the literature on context and CHW performance, finding that "research on CHW programs often does not capture or explicitly discuss the context in which interventions take place" (Kok *et al.*, 2015). We found two studies that used qualitative methods to examine the factors affecting CHW performance (Javanparast *et al.*, 2011; Kalyango *et al.*, 2012), and another study that explored motivating and demotivating factors for CHWs (Callaghan-Koru *et al.*, 2012). While these qualitative studies did not test or quantify the influence of performance factors, they revealed dynamics that might otherwise have been overlooked in a quantitative study, such as the importance of the *manner* in which health workers supervise CHWs (Javanparast *et al.*, 2011), and CHW *perceptions* of the support the receive from community leaders and the health system (Glenton *et al.*, 2011; Callaghan-Koru *et al.*, 2012; Kalyango *et al.*, 2012).

In this paper we explore determinants of performance of CHWs in an iCCM program in Burkina Faso. In 2009, the Burkina Faso Ministry of Health (MoH) recruited and trained CHWs to deliver iCCM for children aged 2 to 59 months as part of a four-year "Rapid Scale-up" (RSU) program to reduce maternal, newborn, and child mortality in the North and Center-North regions of the country (MoH Burkina Faso, 2008, 2010, 2011; Seck and Valéa, 2011; ISSP and IIP-JHU, 2014). Details of this program are provided in Chapter 1.

The MoH in Burkina Faso has repeatedly expressed its interest in better understanding the variability of CHW performance and what it can do to improve this performance. In Chapter 2 we constructed summary measures of CHW performance in the Burkina Faso iCCM program, which confirmed the wide variation in CHW performance and highlighted the potential to improve program effectiveness. In Chapter 3 we examined *determinants* of performance, using quantitative data, statistical methods, and a framework of determinants including CHW characteristics, health system factors, and community factors. In this chapter (Chapter 4) we use the same framework from Chapter 3, but analyze the role of determinants using qualitative methods instead of quantitative methods. We use the summary measures developed in Chapter 2 to identify high- and low-performing CHWs, and use qualitative data from CHWs, supervisors, and caregivers to compare the experiences of respondents across high- and low-performing cases. Our goal was to reveal qualitative factors that might explain the variation in performance, and in doing so, to uncover opportunities for improving CHW performance and the impact of the iCCM program as a whole.

### 4.2.1. A framework for the determinants of CHW performance

To guide our analysis we developed a framework for CHW performance and its
determinants, shown in Figure 4.1. The framework views CHW performance in terms of
four domains: Building Community Relationships, Providing Care, Managing Commodities,
and Reporting. Determinants of performance are likewise divided into four categories: CHW
characteristics, health system factors, community factors, and contextual factors. These
categories echo frameworks used in other studies on the determinants of health worker
performance (Dieleman *et al.*, 2009; Gopalan *et al.*, 2012; Kok *et al.*, 2014; Naimoli *et al.*,
2014). Finally, we include three "mediating factors" as part of our framework, reflecting the
pathways by which determinants influence performance. We propose that every determinant
of CHW performance affects either a CHW's *ability* to do their job (their *knowledge, skills and
attitudes* or *the enabling environment*), or a CHW's *willingness* to do their job (their *motivation*).
These concepts come from the literature on occupational psychology (Anderson and Butzin,
1974; Locke *et al.*, 1978; Blumberg and Pringle, 1982; Mitchell, 1982). Further explanation
and justification for the framework is provided in Chapter 1.

**Figure 4.1. A framework for the determinants of CHW performance**
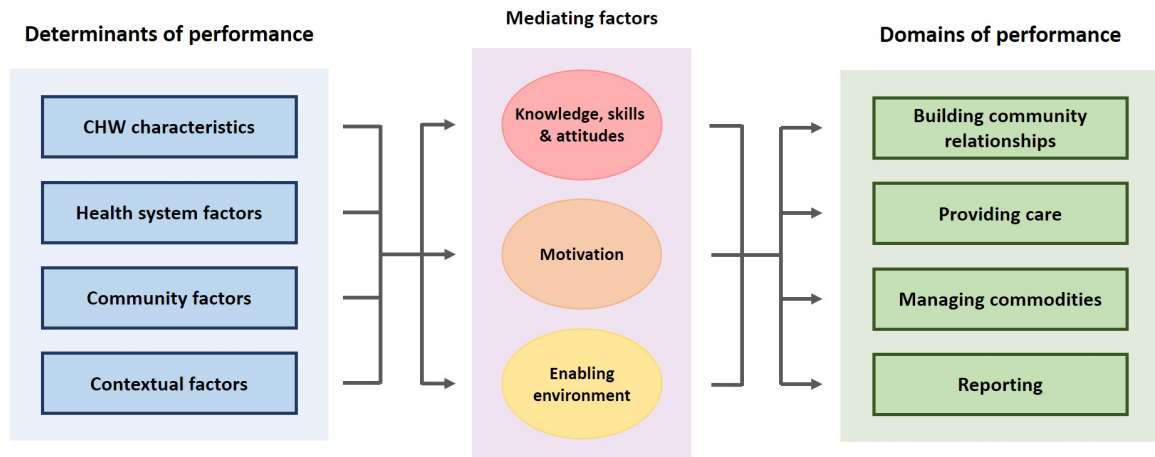
## 4.3. Methods

### 4.3.1. Study design

This paper involves a mixed methods study design, with quantitative data used to select 10 CHWs as case studies of high and low CHW performance (5 high-performing, 5 low-performing), and qualitative data used to describe the experiences of CHWs, supervisors, and caregivers for each of those cases. The study resembles a mixed-methods *explanatory design*, in that quantitative data were used to select and order qualitative data, with the qualitative data being the focus of the analysis (Creswell and Plano Clark, 2011). We used matched quantitative and qualitative data for 27 candidate CHWs: quantitative data on the performance of the CHWs, and qualitative transcripts of interviews and focus groups conducted with the same CHWs, with their supervisors, and with caregivers in the CHWs' villages.

The study design originated as a multiple case study, with the goal being to describe the "within case" experiences and interactions of CHWs, supervisors, and caregivers in 10 villages (5 villages with high-performing CHWs and 5 villages with low-performing CHWs), and then to compare and contrast these experiences between cases, to identify explanations for the variability in CHW performance. Having collected and reflected on the data, we chose instead to compare the experiences of respondents in *all of the 5 high-performing cases* with the experiences of respondents in *all of the 5 low-performing cases* - a collective case study design. In other words, we compared the experiences of CHWs, supervisors, and caregivers

in villages where CHWs performed well, with the experiences of CHWs, supervisors, and caregivers in villages where CHWs did not perform well. We changed our approach because the within-case descriptions of cases proved to be limited and largely homogenous. For confidentiality reasons during interviews and focus groups, supervisors and caregivers were not asked to discuss their experiences with specific CHWs, and in data analysis this made it difficult to characterize the interactions between respondents. The experiences of respondents were also similar across high and low performing cases, reducing the value of within-case descriptions. Thus we chose to focus on the between-case differences for high- and low-performing cases *as a whole*.

In this sense, our study adopted what Khan and VanWynsberghe describe as a "variable-oriented approach" to analysis, rather than the cross-case approach typically employed in collective case studies: "Variable-oriented approaches to cross-case comparison tend to pay greater attention to the variables across cases rather than the case itself. ... The complexity and context of individual cases is not at the center of variable-oriented approaches" (Khan and VanWynsberghe, 2008).

4.3.2.   Data collection

The data come from two studies conducted in February-April 2013 in the context of the Burkina Faso iCCM program: an Implementation and Quality of Care Assessment ("quantitative assessment") and a Qualitative Study ("qualitative study"). The main findings of these studies have been reported elsewhere (ISSP and IIP-JHU, 2014): we used only a subset of the data from these studies for the analysis described in this paper.

*Implementation and Quality of Care Assessment*

The Implementation and Quality of Care Assessment involved a cross-sectional survey of CHWs in the 9 districts of the Burkina Faso iCCM program. A sample of 420 CHWs were interviewed using a structured questionnaire on CHW characteristics, training, supervision, and work practices. Data collectors inspected each CHW's drug kit, equipment, and patient register, and CHWs were observed in consultation with sick children (1 to 2 consultations per CHW), with sick children re-examined by a trained clinician for a gold standard assessment of the illness. Details of the Implementation and Quality of Care Assessment, including study design, sampling, and data collection, are described in Chapter 2.

*Qualitative Study*

The Qualitative Study involved in-depth interviews and focus groups with CHWs, supervisors, and caregivers, to understand their perceptions of the Burkina Faso iCCM program. CHWs were asked about their role and responsibilities, training, supervision, drug supply, incentives and disincentives, the challenges of delivering iCCM in their community, and their relationships with fellow village members and their supervisor at the health facility. Supervisors were asked about the role of CHWs, their relationship with CHWs, the nature of the supervision they offer to CHW, and their overall perception of the iCCM program. (Supervisors were not asked to talk about specific CHWs, so their responses referred to all CHWs in their catchment area.) Caregivers were asked about the role and key tasks of CHWs, the accessibility of CHWs and iCCM services, the quality of care offered by CHWs,

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and the reasons why they do or do not take their children to a CHW when their children are sick. (As with supervisors, caregivers were asked to talk about CHWs in general.)

The qualitative interviewers visited a total of 27 villages. For each of the 9 districts in the iCCM program, 3 villages were selected at random by systematic sampling from the list of villages where CHWs were sampled for the Implementation and Quality of Care Assessment. In each of these 27 villages, data collectors sought to interview the following participants: two caregivers of young children aged 2-59 months; two CHWs in the village who had been trained to provide iCCM (including the CHW who was sampled for the quantitative assessment); and the supervisor of the CHWs (a health worker at the nearest health facility). In 9 of the 27 villages, the qualitative team conducted focus groups with caregivers (with approximately 8 to 12 people per focus group), rather than in-depth interviews with caregivers. For each village, the CHW and supervisor were selected by default, and the two caregivers were selected using purposive sampling.

Four qualitative interviewers with bachelor degrees in sociology were trained as the data collection team. Interviews and focus groups were recorded, with participant consent, using digital audio recorders and were transcribed by the same interviewer who had led the discussion. Interviews and focus groups took place in French (for supervisors) and Mossi local language (for CHWs and caregivers). Conversations in Mossi were translated into French during the transcription process.

The Implementation and Quality of Care Assessment and the Qualitative Study both received ethical clearance from the *Comité d'Éthique pour la Recherche en Santé* (Ethics

Committee for Heath Research) in Burkina Faso, and from the Johns Hopkins School of Public Health Institutional Review Board.

### 4.3.3. Selection of cases

We selected the 5 highest-performing CHWs and 5 lowest-performing CHWs from among our 27 candidate CHWs using quantitative measures of performance. Scores for 58 indicators of performance were collected during the quantitative assessment and were used to create the following summary measures of performance:

- Overall Performance: a summary measure of a CHW's overall performance that combines all available scores, across all domains of performance;

- Providing Care: a summary measure of a CHW's ability to provide care (i.e. quality of care), using scores on assessment, classification, treatment, and counselling;

- Managing Commodities: a summary measure of a CHW's ability to maintain a drug kit and equipment, using scores on drug stock, equipment, and work practices;

- Reporting: a summary measure of a CHW's ability to complete their patient register, using scores on register use and register quality.

The process used to construct these summary measures is described in Chapter 2. We selected CHWs based on their score for Overall Performance (the 5 highest scores and 5 lowest scores). We used the summary measures of Providing Care, Managing Commodities, and Reporting to verify that the choice of CHWs made sense and did not reflect a bias due to extreme scores in a single domain.

### 4.3.4. Data analysis

Having selected cases, we used qualitative analytical methods to code the transcripts for each of the selected cases (5 transcripts per case, 50 transcripts in total), using Atlas.ti software (Scientific Software Development, 2014). We took a deductive approach to coding, using the determinants in our conceptual framework as initial codes (e.g. "education", "supervision", "training", "community support"). We chose not to examine contextual factors as determinants due to the homogeneity of contextual factors across districts in the study area. As data analysis progressed, we refined these codes and complemented them with codes developed inductively that were not in our framework (e.g. "being present and accessible in the village", "loving the community", "reasons for becoming a CHW").

Once we had coded all transcripts, we compared the coded data for high-performing cases with that for low-performing cases, to identify implicit differences and similarities between the comments and experiences of respondents in high- and low-performing cases. We then synthesized the findings and organized the synthesized results under the headings of CHW characteristics, health system factors, and community factors. While the focus of our analysis was on the differences and similarities across high- and low-performing cases, where possible we noted relevant within-case interactions to further develop our understanding of factors affecting performance – including identifying and seeking to explain concordant or discordant perspectives among respondents in the same case.

## 4.4. Results

### 4.4.1. Participant response and eligibility

Table 4.1 summarizes the data collected in each of the 27 villages sampled for this study. Table 4.1(part A) shows the villages where pre-selected or replacement CHWs were found and assessed as part of the quantitative assessment. Quantitative data were collected in only 24 of the 27 villages. Table 4.1(part B) shows where qualitative interviews and focus groups were conducted with CHWs, supervisors, and caregivers for the qualitative study. In order to be eligible for our analysis, a village needed both quantitative and qualitative data. Three villages were ineligible because we had no quantitative data for any CHW. Three other villages were ineligible because a qualitative interview was not conducted with the CHW for whom we had quantitative data. Table 4.1(part C), shows the resulting 21 villages that were eligible as candidate cases.

**Table 4.1. Participant response for qualitative data, quantitative data, eligibility, and performance scores for each of the 27 candidate CHWs**

| | | A | | B | | | | | C | D | | | | | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Quantitative | | Qualitative | | | | | Eligibility | Performance scores for QoC-Assessed CHW | | | | | Highest / Lowest |
| District | Village | Preselected CHW | Replacement CHW | Interview with preselected CHW | Interview with other CHW | Interview with supervisor | Interview with caregiver | Focus group with caregivers | Village eligible for mixed methods analysis? | Overall Performance (z-score) | Overall Performance (rank) | Providing Care (z-score) | Managing Commodities (z-score) | Reporting (z-score) | Use in mixed methods paper |
| Barsalogho | 1 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | -0.79 | 19 | -0.17 | 0.32 | -1.32 | Low performing |
| | 2 | Not found | Found and provided care | 1 | 2 | 1 | 0 | 1 | Yes | 1.07 | 7 | 0.35 | 1.13 | 0.95 | |
| | 3 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | 1.89 | 1 | 1.80 | 1.69 | 1.36 | High performing |
| Boulsa | 4 | Found but didn't provide care | Found and provided care | 1 | 1 | 1 | 2 | 0 | Yes | 0.66 | 10 | 0.92 | 1.27 | 0.02 | |
| | 5 | Found but didn't provide care | Found and provided care | 1 | 0 | 1 | 3 | 0 | No * | | | | | | |
| | 6 | Found and provided care | Not needed | 1 | 1 | 1 | 1 | 1 | Yes | -0.67 | 17 | -0.01 | -1.25 | -0.43 | Low performing |
| Gourcy | 7 | Found and provided care | Not needed | 1 | 1 | 1 | 0 | 2 | Yes | 1.03 | 8 | -0.26 | 1.48 | 0.95 | |
| | 8 | Found and provided care | Not needed | 1 | 1 | 0 | 2 | 1 | Yes | 1.33 | 4 | 2.63 | -0.06 | 1.05 | High performing |
| | 9 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | 1.16 | 6 | 1.65 | -0.02 | 1.16 | |
| Kaya | 10 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | 0.21 | 13 | -1.25 | 0.01 | 0.80 | |
| | 11 | Found and provided care | Not needed | 1 | 1 | 1 | 1 | 1 | Yes | -0.77 | 18 | 0.30 | 0.01 | -1.32 | Low performing |
| | 12 | Found but didn't provide care | Found and provided care | 1 | 1 | 1 | 2 | 0 | No * | | | | | | |
| Kongoussi | 13 | Found but didn't provide care | Not found | 1 | 1 | 1 | 2 | 0 | No ** | | | | | | |
| | 14 | Found but didn't provide care | Found and provided care | 1 | 1 | 1 | 0 | 2 | Yes | 1.24 | 5 | 1.15 | 1.33 | 0.80 | High performing |
| | 15 | Found and provided care | Not needed | 1 | 0 | 1 | 3 | 0 | Yes | 0.63 | 11 | 0.31 | 0.97 | 0.36 | |
| Ouahigouya | 16 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | -0.93 | 20 | -0.41 | 0.07 | -1.32 | Low performing |
| | 17 | Found but didn't provide care | Found and provided care | 1 | 1 | 1 | 0 | 2 | Yes | 0.89 | 9 | 0.45 | -0.11 | 1.25 | |
| | 18 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | -0.05 | 15 | -0.49 | -0.29 | 0.25 | |
| Seguenega | 19 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | -0.22 | 16 | -0.31 | -0.05 | -0.20 | |
| | 20 | Found but didn't provide care | Found and provided care | 1 | 1 | 1 | 2 | 0 | Yes | 0.25 | 12 | 0.30 | -0.65 | 0.58 | |
| | 21 | Found and provided care | Not needed | 1 | 1 | 1 | 0 | 2 | Yes | 0.06 | 14 | -1.06 | -0.41 | 0.69 | |
| Titao | 22 | Found but didn't provide care | Not found | 1 | 1 | 1 | 2 | 0 | No ** | | | | | | |
| | 23 | Not found | Not found | 1 | 1 | 1 | 0 | 2 | No ** | | | | | | |
| | 24 | Found but didn't provide care | Found and provided care | 0 | 2 | 1 | 2 | 0 | Yes | -1.31 | 21 | -0.94 | -0.71 | -1.32 | Low performing |
| Yako | 25 | Found and provided care | Not needed | 1 | 1 | 1 | 2 | 0 | Yes | 1.79 | 2 | 1.61 | 1.99 | 1.14 | High performing |
| | 26 | Found and provided care | Not needed | 1 | 1 | 1 | 0 | 2 | Yes | 1.34 | 3 | 1.23 | 0.67 | 1.25 | High performing |
| | 27 | Found and provided care | Not needed | 0 | 1 | 1 | 3 | 0 | No * | | | | | | |

\* no qualitative interview conducted with the CHW who was assessed for quanitative assessment

\*\* no CHW was assessed for quanitative assessment

4.4.2.   Quantitative results: selecting the 10 cases


Table 4.1(part D) shows the quantitative results for the assessed CHWs in each of the 21

eligible villages. The table shows each CHW's score for Overall Performance, Providing

Care, Managing Commodities, and Reporting. The units for these performance measures are

the estimated z-scores for the CHW among all CHWs in the iCCM program, if all CHWs

had been assessed in the same way. The process for constructing these measures, and the

point estimates, distribution, and correlation of the resulting scores, are discussed in Chapter

2. The process for converting raw scores to z-scores is described in Chapter 3.


We ranked the CHWs according to their Overall Performance scores, and using this ranking

we chose the 5 highest-performing CHWs and the 5 lowest-performing CHWs, shown in

Table 4.1(part E). While the 5 high-performing CHWs were unmistakably high-performing,

with high performance scores in all domains, the performance of the 5 low-performing

CHWs was mixed, with most CHWs performing above average in at least one domain. The

5 highest-performing CHWs all had Overall Performance scores of 1.24 or above, and the

domain scores for these CHWs were also above average. (The one exception to this was the

CHW ranked 4th who received a score of -0.06 for Managing Commodities.) By contrast, the

5 lowest-performing CHW had Overall Performance scores as high as -0.67, which some

might argue wasn't especially bad. Four of the 5 lowest-performing CHWs had at least one

domain score that was average, or even above average. The worst low-performer, ranked

21st, was the only truly obvious low-performer. The implications of this are discussed in our

Limitations section. We debated whether to include the 15th or 16th ranked CHW in our pool

of low-performers, instead of the 17th or 18th ranked CHW, but ultimately we stuck to our

system of selecting CHWs according to their Overall Performance score. Table 4.2 shows

demographic data for the 10 final CHWs who were selected for analysis.

**Table 4.2.  Characteristics of the 10 selected high- and low-performing CHWs**

| Case Number | High/Low performing | Performance rank among eligible CHWs | District | Age | Sex | Ethnicity | Marital Status | School Level | Years of Education | Literacy |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | High | 1 | Barsalogho | 32 | Male | Mossi | Married | Secondary 1st cycle | 9 | Both |
| 2 | High | 2 | Yako | 53 | Male | Mossi | Married | Primary | 6 | Both |
| 3 | High | 3 | Yako | 42 | Female | Mossi | Married | Primary | 6 | French only |
| 4 | High | 4 | Gourcy | 33 | Female | Mossi | Married | Secondary 1st cycle | 7 | Both |
| 5 | High | 5 | Kongoussi | 57 | Male | Mossi | Married | No schooling | 0 | Both |
| Average for 5 high-performing CHWs | | | | 43.4 | 60% Male | 100% Mossi | 100% Married | 80% Any schooling | 5.6 | 100% French literacy |
| 6 | Low | 17 | Boulsa | 49 | Male | Mossi | Married | No schooling | 0 | Mossi only |
| 7 | Low | 18 | Kaya | 29 | Female | Mossi | Married | Secondary 1st cycle | 8 | Both |
| 8 | Low | 19 | Barsalogho | 37 | Male | Mossi | Married | No schooling | 0 | Mossi only |
| 9 | Low | 20 | Ouahigouya | 50 | Female | Peulh | Married | No schooling | 0 | Neither |
| 10 | Low | 21 | Titao | 47 | Male | Mossi | Married | Secondary 1st cycle | 7 | Both |
| Average for 5 low-performing CHWs | | | | 42.4 | 60% Male | 80% Mossi | 100% Married | 40% Any schooling | 3.0 | 40% French literacy |
| Average among all CHWs in the iCCM program | | | | 44.8 | 81.8% Male | 87.8% Mossi | 96.9% Married | 49.0% Any schooling | 2.2 | 60.8% French literacy |

4.4.3.   Qualitative results

In our framework of CHW performance we identified four categories of determinants: (i)

CHW characteristics, (ii) health system factors, (iii) community factors, and (iv) contextual

factors. We used these categories to organize the results of our analysis. As mentioned

above, we chose not to examine contextual factors in this paper, so our results are limited to

CHW characteristics, health system factors, and community factors. Under each of these

headings, we describe the comments made by CHWs, supervisors, and caregivers regarding

factors that might affect CHW performance. We highlight comments that explicitly or

implicitly suggest the influence of determining factors: *explicitly*, when respondents state an

opinion about performance or its determinants; *implicitly*, when the comments and

experiences of respondents in high-performing villages differ from those in low-performing

villages.

## CHW characteristics

In our framework we proposed that performance could be affected by the individual

characteristics of a CHW, such as their demographic profile, personality traits, education and

literacy, status in the community, and location in the community. Many of these factors were

mentioned by respondents in our study, and the opinions of respondents on these factors

were similar across all cases.

When asked what qualities a CHW needed to carry out their role effectively, all CHWs and supervisors immediately said that a good CHW needed to be literate, including CHWs who could only speak the local language but not French. Many CHWs, male and female, said their ability to read and write was the main reason they had been selected as a CHW. For some CHWs, literacy meant a local language; for other CHWs and all supervisors, literacy meant French. (All 5 high-performing CHWs could read French, compared to only 2 of the low performers.)

> In all the village, among all the people of my generation, I am the only one who knows how to read and write a little, even if it's in the local language… This played a big role in my recruitment. (CHW, male, 49, literate in Mossi only, low-performing case 6)

Demographic characteristics such as age and sex were rarely mentioned by respondents. When pressed, all CHWs and supervisors said that men and women could both make good CHWs. Some caregivers said that female CHWs were better, because they were more likely to stay in the village and had a greater understanding of children.

> Women are more stable than men. They're present, while men move a lot. When you need [a CHW] because your child has fever, you go and the man is absent. This is why women are better. (Caregiver, female, high-performing case 3)

> Women are best placed to understand the suffering of children. (Caregiver, female, low-performing case 10)

One supervisor of a high-performing CHW gave a detailed list of desirable qualities in a CHW. His list emphasized the need for the CHW to have a range attributes related to accessibility and relationship-building with other community members.

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First, the CHW must be known in the village. Second, they need to be someone who is willing to work voluntarily in the village, because at the moment there is no remuneration for CHWs. Third, the CHW needs to be liked in the village, and there can't be any parts of the village where the CHW can't go, because the villages are in clans… Finally, the CHW needs to be someone who is permanently present, someone who is stable. (Supervisor, male, high-performing case 3)

The permanent presence of a CHW in a village was a frequent theme of interviews with caregivers. Many caregivers said that good CHWs can be found when needed, will stop their other duties to provide iCCM when necessary, and are available at night in case of an emergency. This was why some caregivers said that women make better CHWs - because they are more "stable".

Truly the CHWs do a lot… At whatever time, you arrive and they will take care of the child and give medications… at any time, day or night. (Caregiver, female, high-performing case 1)

A good CHW is one who is capable of abandoning what he is doing to take care of a patient at any time. (Caregiver, female, low-performing case 10)

The attribute of "availability" could be either a determinant or an outcome of performance. It may be that CHWs are available *because* they are good CHWs and they make themselves available. But it could also be that a CHW's status or location in the community influences their performance. As many supervisors and caregivers said, if a CHW works in a mine site outside of the village (which some CHWs do), it will be difficult for them to provide iCCM services when needed.

One difference between high- and low-performing cases was in the level of detail that CHWs used to describe their responsibilities. High-performing CHWs gave more nuanced descriptions of their role. Some low-performing CHWs described their role simply as a drug seller (in case 7, both CHWs and caregivers described the CHW role as selling drugs). High-performing CHWs spoke with a greater sense of enthusiasm about their role, and about what was needed for a CHW to do a good job. For example, high-performing CHWs were more likely to talk about the need for demand-generation activities, to encourage caregivers to utilize their iCCM services.

> You need to be someone who accepts criticism from people, who accepts the advice given by health workers and puts it into practice. You need to be sociable and concerned about people's health. … The CHW must love his community. (CHW, male, 53, high-performing case 2)

> I continue to be a CHW to raise the awareness of people. I want one hundred percent of people, or at least ninety-nine percent of people, to know to bring their children to me [when they are sick] or to the health facility. (CHW, male, 32, high-performing case 1)

As with the issue of availability, these attitudes could be a determinant or an outcome of performance. A CHW who receives more attention from supervisors or other community members might be motived to work harder. Alternatively, more positive attitudes could reflect underlying personality traits that are independent of other factors. Some CHWs may have a more conscientious disposition, and this underlying disposition may drive their higher performance.

There were also subtle differences in the way that high- and low-performing CHWs articulated their reasons for continuing to work as a CHW (their reasons for starting to work in the first place are discussed later). High-performing CHWs more frequently said they enjoyed being a CHW or expressed a sense of intrinsic motivation.

> The advice and knowledge that I have received benefits me and my family, so I like my work as a CHW… I really love to work as a CHW. (CHW, male, 53, high-performing case 2)

> As people like to say, I am an honest citizen. [Being a CHW] is my way of participating in the development of my village… I am a son of the village and I live here. So contributing to the progress of my village is something I should do. (CHW, male, 57, high-performing case 5)

It could be that CHWs enjoy their work because they are successful at it, or it could be that they are successful at it because they enjoy it and want to do a good job. In any case, our results are consistent with (or at least do not contradict) the idea that a CHW's underlying personality traits, attitudes, and values are important.

## Health system factors

Our framework listed five health system factors that might influence CHW performance: training, supervision, supply chain functioning, financial/non-financial incentives, and demand generation. We have no results on health system-led demand generation, because this was not part of the iCCM program, but we do have data on the other health system factors.

### Training

All CHWs spoke highly of the training they had received and said that acquiring health knowledge was one of the main benefits of being a CHW. Both high- and low-performing CHWs said they would like more training in the future. Most CHWs said that the person who had initially trained them in iCCM was their supervisor (either their current or previous supervisor).

Although there were no explicit differences in their descriptions of training, the comments made by CHWs suggest that some CHWs experienced training differently to others. For example, one CHW said she didn't know how to fill in her patient register, because she took over from another CHW and didn't receive the same training that the previous CHW had received (this echoes what we saw in Chapter 3 about different cohorts of CHWs receiving different training).

> I would like them to redo the training on community case management, so I can relearn how
> to treat illnesses and how to fill in the register, so I can fill in the register by myself. Before I

[became a CHW] someone else filled in the register, but now that it's me I don't know how to do it well. If they could redo the training I would be able to do it myself. (CHW, female, 29, low-performing case 7)

*Supervision*

As with training, the comments that CHWs and supervisors made about supervision were mostly very similar. All CHWs said that during supervision their supervisor reviews their patient register, checks to see whether they have the drugs they are supposed to have, and asks questions to determine whether they are treating children correctly. All supervisors, including those for low-performing CHWs, said they tried to find ways to assess the CHW and correct any errors they were making; for example, by observing the CHW in consultation (when possible) or following up a sample of patients. Supervisors said they checked the CHW's drug kit to determine if they had the appropriate drugs, and checked the CHW's patient register to see if they were correctly recording the details of consultations.

> During a supervision the supervisor looked at our register and saw that the drugs were expired. He asked us to return these drugs and take others. Supervision happens once a month. He observes us providing care for a child and corrects us when needed. (CHW, male, 47, low-performing case 10)

One way that supervisors monitor the performance of CHWs is by talking to caregivers. Supervisors of both high- and low-performing CHWs said they often ask caregivers at the health facility if they went to the CHW before coming to the health facility, and, if so, what treatment and counseling the CHW provided.

We know if a CHW does his job well when a woman comes with her child to the health facility. We find out from the woman if she went to the CHW and if she has a referral sheet or drugs prescribed by the CHW. (Supervisor, male, low-performing case 8)

Although the core activities undertaken by supervisors seem to be similar across cases, comments by CHWs and supervisors suggest that the intensity and quality of supervisors' efforts could be different. Two high-performing CHWs said their supervisor frequently comes to see them in their village, at least once per month; while two low-performing CHWs said it had been over a year since they received any supervision at all. Among active supervisors, supervisors of high-performing CHWs appeared to go to greater lengths to monitor CHWs, with detailed questioning and follow-up, rather than the *pro forma* following of supervisory guidelines described by others.

The supervision papers [checklists], they don't help to find out all that you want in a CHW. I find them insufficient. If you only use [the checklists], you're not going to find out very much. (Supervisor, male, high-performing case 1)

One time, a mother brought her child, who had fever, here to the health facility, and I asked her if the CHW had given her drugs for the child. She said yes, but I knew that these weren't drugs that CHWs have… Eventually I treated the child and then I called the CHW to explain the situation. (Supervisor, male, high-performing case 3)

This anecdote from the supervisor in high-performing case 3 (the second quote, above) was also recounted by the CHW himself in a separate interview.

The supervisor advises us and encourages us. For example, a woman had bought prohibited drugs to give to her sick child… She lied to the [supervisor], saying that she bought the drugs from the CHW, and when the supervisor said he would call the CHW, she started to

tell the truth… If the [supervisor] didn't supervise us well he might have believed the woman, but the supervisor knows us well. (CHW, male, 37, high-performing case 3)

The supervisor's support in this example highlights another way in which supervisors can influence performance. Most discussions of supervision framed it as a means for verification; a process for checking that the CHW is doing their job, and doing their job correctly. But several comments by CHWs and supervisors explicitly highlighted two different goals of supervision - to encourage and motivate CHWs, and to advocate for them as legitimate health care providers. In the following quote, a high-performing CHW highlights the role his supervisor plays in increasing his legitimacy and acceptance among community members.

> The advantage of supervision is that it allows [community members] to know that we are monitored and that we don't work randomly. This gives people more confidence in us… We are truly content when the supervisor visits us in front of [the other village members]… The supervisor tells people that the CHW was chosen to represent the village, so they should go to him, except if he is not able to treat a particular illness. (CHW, male, 32, high-performing case 1)

For some supervisors, particularly those in high-performing cases, providing this support to CHWs was an integral part of their role, and involved building close, personal relationships.

> Myself, as a supervisor, when something happy or sad happens to a CHW, I want to be by their side, if only to say hello and encourage them. The CHWs and I are on good terms. (Supervisor, male, high-performing case 3)

Another difference between high- and low-performing cases was the degree to which supervisors said they could reprimand CHWs for poor performance. All the supervisors in low-performing cases said it was impossible to replace CHWs, because most CHWs were

entrenched in their positions in the community; whereas some supervisors of high-performing CHWs said that they had, or could, replace poor-performing CHWs (though even these supervisors admitted that it was difficult to do so). Although this issue concerns supervision, it also encompasses other factors, such as the status of the CHW in the community, and the community's involvement in the CHW recruitment process, which we discuss below.

They weren't rigorous in the selection [of CHWs]… Knowing that things weren't working in some villages I had to change [or replace] certain… It's not easy… you need to advocate [with the community] so that they change [the CHWs]… if the person doesn't understand, it can cause problems. (Supervisor, male, high-performing case 1)

I can't say to a CHW to stop working… We don't have the means. CHWs don't receive a salary, so you can't use that to improve their work. For example, you can say to someone who has a salary that if they don't do their job well, they will be fired. It's a way of putting pressure on them. But the CHWs don't have a salary. (Supervisor, male, low-performing case 9)

We don't have any forms which tell us what to do if a CHW doesn't do their job well. (Supervisor, male, low-performing case 8)

As a supervisor, I make sure to avoid conflict, because you can ask to change a CHW and in fact it's you that risks being changed. So I go carefully… we'll get there eventually… but for the most part my CHWs are ok. (Supervisor, male, low-performing case 6)

These last quotes suggest that the ability of supervisors to influence CHW performance could be limited by community constraints, or the lack of financial incentives. But it could be the case that other (better) supervisors in the same situation would find ways to make

things work. The true underlying factor might not concern the community, but rather the supervisor's motivation or willingness to engage with the CHW and other village members. Certainly, some supervisors in low-performing cases seemed to be less positive and enthusiastic about the work of CHWs. One supervisor said he no longer supervises CHWs because he is not paid to do so and he has no money to cover transport costs. In general, the supervisors of low-performing CHWs seemed to be less engaged and committed to the iCCM program than other supervisors. Although, as with the attitudes and motivation of CHWs, this demotivation could be a symptom, not a cause. Supervisors could be despondent *because* their CHWs are not performing well, or because of other factors.

> As a health worker, we also need motivation. The problem is that the health workers, we ourselves, are not motivated, so we can't motivate the CHWs... At our level since we don't have fuel [for transport] we can't go on supervision visits. (Supervisor, male, low-performing case 8)

*Supply chain functioning*

High- and low-performing CHWs both said they experienced drug stockouts and that these stockouts were detrimental to their ability to provide iCCM services. All CHWs, regardless of how well they scored in quantitative measures of commodity management, said they were concerned with drug stockouts, and were frustrated that their health facility did not always have the necessary drugs for them to purchase. Caregivers also mentioned stockouts as something that limits the performance and utility of CHWs.

*Interviewer :* Can you tell me what we can do to improve the care provided by CHWs ?

*CHW :* I would say drugs ; we need to stop the stockouts. This will enable us to better help

the people. (CHW, female, 50, low-performing case 9)

Regarding CHWs, one time one of my children was sick and I went to the CHW but he

didn't have any drugs, so I went to the health facility… If the CHWs could have more drugs,

we would be very happy. (Caregiver, female, low-performing case 8)

Despite these stockouts, all CHWs said that drug sales were important to them as a financial

incentive. In the Burkina Faso model of iCCM, CHWs are not paid, but they are encouraged

to sell their drugs at a price mark-up to enable them to earn some money. High- and low-

performing CHWs both said they were successfully able to earn money this way, and that it

was a small but significant motivating factor for them to continue working as a CHW.

We get a little bit of money through the sale of drugs. I can have 25 francs for each drug

sold. (CHW, male, 53, high-performing case 2)

Since I became a CHW, my financial problems have reduced. The profit I make on the sale

of drugs enables me to sort out some of my problems. So I think it's good [that I can sell

drugs for a profit]. (CHW, female, 50, low-performing case 9)

By selling drugs I can earn a bit of money to buy soap to wash my children's clothes, and

that's good. (CHW, female, 29, low-performing case 7)

*Financial/non-financial incentives*

One issue that CHWs and supervisors repeatedly stressed during interviews was the lack of

financial incentives for CHWs. Although CHWs were happy that they could sell drugs at a

mark-up, all CHWs, both high and low performers, said they should receive a regular financial payment for being a CHW. All CHWs said that providing iCCM services takes time and prevents them from effectively cultivating their fields. Many CHWs said that families would sometimes come to them for care, but without money to pay for drugs, and that in these cases they would feel obligated to give the family drugs on credit. Some CHWs expressed frustration at being promised a bicycle by their supervisor as a non-financial incentive for becoming a CHW, but never having received the bicycle.

> They need to [provide financial incentives for] the CHWs. If the CHWs are happy they will work well, but if things stay the same they are not going to work well. (CHW, female, 33, high-performing case 4)

> Promises were made but they weren't all kept. The supervisors tried to sort things out, but they haven't been able to… At the start we were promised bicycles, a salary of 5000 francs per month, and that the drug supply wouldn't stop. Regarding the bicycles, several months later we got them, but not as many as we needed. (CHW, male, 47, low-performing case 10)

Supervisors agreed that CHWs should be paid. The lack of incentives makes it difficult for supervisors to recruit good people to be CHWs, and difficult to motivate them even when they are recruited.

> In the world today you don't get anything for free. The CHWs abandon their crops and other activities to work as CHWs, but they don't get anything in return. They are not motivated and many of the CHWs have quit. (Supervisor, male, low-performing case 8)

## Community factors

We suggested in our framework that community factors, such as the participation and support of community members, could influence CHW performance. For each of our cases, we examined the relationships between CHWs and community members. All the caregivers that we spoke to said they appreciated the work of CHWs and were happy with their efforts. This was true even for low-performing CHWs.

> We really appreciate their work. There are two, a woman and a man. They're always available to us. Whatever you ask, they don't refuse… We think they work well, they're a big support for the village. They are concerned with the health of the population. Other people would prioritize their own business and problems, their own family. But with these two [CHWs], you come with your problem, they abandon what they are doing and they look after you. (Caregiver, female, low-performing case 10)

In some high-performing cases, community members were better able to articulate the role of CHWs, and provided more detail about the services they offered. This increased understanding of the CHW role could be an outcome of performance - a good CHW will take time to explain their role to community members - but it might also reflect greater attention by community members to the work of CHWs in the village, contributing to increased community support and CHW motivation. In the following quotes from high-performing case 2, the detail with which the caregiver describes the CHW role reflects the detail with which the CHW himself describes the role.

> The CHWs also sell drugs for diarrhea and fever, so we often get our drugs from the CHWs. … The CHWs are also responsible for giving polio [vaccinations] to children and screening

children for malnutrition. The CHWs are often at the health facility, helping the health workers. (Caregiver, female, high-performing case 2)

We are in charge of caring for children 2 to 59 months, applying what we learnt during different training sessions. … As a CHW I understand the five danger signs, a child refusing breastmilk, a child drinking breastmilk but vomiting each time, a child being unconscious… (CHW, male, 53, high-performing case 2)

One way community members contribute to the iCCM program is by participating in and governing the CHW recruitment process. Each CHW said they came to be a CHW because they were nominated by village leaders and elected by vote in a public meeting. For most CHWs, high and low performers, this experience of being nominated by fellow community members was a great honor. High- and low-performing CHWs both cited this sense of honor as a primary reason why they agreed to become a CHW; their nomination was such a significant sign of community respect that they couldn't refuse to take on the role.

Following recruitment, this sense of duty manifested itself differently for different CHWs. Some CHWs responded positively to their nomination, with the honor of their selection giving them strong intrinsic motivation to do well at the job. Other CHWs viewed their selection more as an obligation, even a burden - they continue to work as a CHW because they don't have any other choice. The fact that CHWs responded differently might reflect community factors (how the community organized the selection process) or individual factors (the CHW's internal values and attitudes to community service, or their current social position and the opportunity costs of taking on the role).

I told them that since I didn't choose myself, and since you believe I can do the work, I must

accept [the role of CHW], and even if I can't do it, I will do my best not to disappoint you.

So I became a CHW and with the assistance of the authorities I carry out my role fully. …

Working for this community is a pleasure. Ultimately I accepted [to be a CHW] because I am

a son of the village. I won't have shame doing this work. (CHW, male, 53, high-performing

case 2)

One final factor that was identical in high- and low-performing cases was the lack of tangible

support provided by community members to CHWs. All CHW said that, while community

members were supportive and often thanked the CHWs for their work, nothing concrete

was given to them by the community in return for their efforts. Moreover, many CHWs,

high and low performers, said that their fellow village members believed, incorrectly, that

CHWs were paid by the government. All of the caregivers that we interviewed agreed that

community members don't do anything to help the CHWs, and several caregivers admitted

that they had thought (incorrectly) that CHWs received a salary.

Truly the people don't help us at the moment… They don't do anything for us. (CHW,

male, 32, high-performing case 1)

We've never done anything to help them with their work… We haven't yet thought to do

anything for them in return for their good work for us. (Caregiver, female, high-performing case

1)

## 4.5. Discussion

This study examined the factors that affect CHW performance in two ways: (1) by analyzing the comments made by respondents themselves about CHW performance and its determinants; and (2) by comparing and contrasting the experiences of respondents in high- and low-performing cases.

### 4.5.1. Comments by respondents on CHW performance

The opinions of respondents on what makes a good CHW were similar across all cases. CHWs and caregivers said that, in order to perform well, CHWs needed to be literate, to be known and respected by other village members, to have a sense of service, and to love their community. Caregivers stressed the important of CHWs being "stable"; being people who stay in the village during the day and are available when needed. Supervisors said that increased financial incentives (from the health system or the community) would help to recruit better CHWs, further motivate CHWs, and allow CHWs to dedicate more time to iCCM. Training was mentioned by CHWs as something that improves both skills and motivation, as was supervision and the opportunities that supervision allows for report-checking and skills development. CHWs and caregivers both cited drug stockouts as a major challenge, and CHWs said that drug stockouts limit financial rewards and therefore reduce motivation.

None of these findings are unexpected, except perhaps the concern repeated by most caregivers that CHWs be "stable" (a finding that we could not find reported elsewhere). The other suggestions made by respondents have all been noted in the literature. Determinants such as the level of a CHW's education (Crispin *et al.*, 2012), the frequency and quality of supervision (Kelly *et al.*, 2001; Maji *et al.*, 2010; Javanparast *et al.*, 2011; Callaghan-Koru *et al.*, 2012), and a CHW's relationships with community members (Javanparast *et al.*, 2011) were mentioned both by our respondents and by respondents in other studies. The value of financial and non-financial incentives for CHW motivation, and the barriers arising from a lack of incentives, was reported in a recent systematic review (Glenton *et al.*, 2013). The issue of drug stockouts has also been raised before (Kalyango *et al.*, 2012; Blanas *et al.*, 2013; Glenton *et al.*, 2013). In a study from Zambia, "the non-availability of drugs was reported to frustrate both the communities and the community health workers… the community health workers lose their reputation and recognition when there are no drugs" (Stekelenburg *et al.*, 2003).

### 4.5.2.  Explaining the variability in CHW performance: comparing across cases

**(a) Factors that were *different* for high- and low-performing cases**

Between high- and low-performing cases in our study there were subtle differences in the way CHWs described their role. High-performing CHWs seemed to articulate their role, and their approach to their role, in more detail and with greater enthusiasm. High-performing CHWs appeared to have had different emotional responses at having been recruited, and different reasons for continuing to work as a CHW. Although these differences were only

slight, they support the idea that a CHW's intrinsic motivation, or attitudes, are important

for a CHW to perform well (Javanparast *et al.*, 2012; Greenspan *et al.*, 2013). Given the other

comments made by CHWs and caregivers, greater intrinsic motivation would appear to

affect a CHW's willingness to stay in the village and be available for caregivers when needed;

their drive to restock their drug kits in a timely fashion; their attention to detail in

administering the iCCM algorithm; and their conscientiousness in completing patient

registers and reports.

A more noticeable difference between high- and low-performing cases, however, was in the

attitudes and experiences of supervisors. Supervisors in high-performing cases appeared to

take a greater interest in the iCCM program, supporting CHWs more intensely and through

stronger personal relationships. Supervisors in high-performing cases were more likely to say

they could reprimand or replace CHWs who were performing poorly. CHWs from high-

performing CHWs were also more likely to say that they look to supervisors for guidance,

skills development, and report-verification; or encouragement and motivation through

personal relationships; or to increase their legitimacy in the community.

The role of supervisors in bolstering the legitimacy and morale of CHWs was a theme of a

recent systematic review of barriers to lay health worker programs (Glenton *et al.*, 2013).

Studies have shown the negative effect that poor-quality supervision can have on CHW

motivation and performance. Kok et al. write that "CHWs who perceived their supervision

as insufficient often reported to be demotivated" (Kok *et al.*, 2014). In one study from Iran

the authors concluded that, "despite formal supervisory mechanisms being in place, poor-

quality supervision was one of the barriers [to CHW performance]... supervisory teams do

not provide sufficient technical and emotional support or training... a large number of our respondents stated that supervisors mainly focus on their weaknesses rather than their strengths." (Javanparast *et al.*, 2011) The reference to "emotional support" in this quote echoes a similar sentiment among supervisors of high-performing CHWs in our study, who talked about "being by the side" of CHWs in good and bad times.

## (b) Factors that were *similar* for high- and low-performing cases

The similarities across high- and low-performing cases were also revealing. Both high- and low-performing CHWs cited challenges such as no community support, a lack of financial incentives, and occasional criticism from other village members. All CHWs said they had been recruited in the same way. Supervision content was similar for all cases, at least in terms of core activities. High- and low-performing CHWs said that the financial rewards of drug sales were important to them, but they would prefer to receive a regular stipend. Some CHWs in high- and low-performing cases said they had been promised bikes but hadn't yet received them.

The fact that these issues were similar for both high- and low-performing cases does not mean they are not important for performance. Issues such as the damaged done by unmet promises, and undelivered non-financial incentives, have been shown to be important in other studies. "By far the most frequently mentioned demotivating factor for the [CHWs] was the perception that they were given a large responsibility without receiving the support needed to help them meet expectations... Several [CHWs] described their frustration as resulting from broken "promises" and/or neglect by CCM program managers" (Callaghan-

Koru *et al.*, 2012). If these factors had been different for some CHWs - more community support, an improved drug supply, the delivery of non-financial incentives as promised - we might have seen better performance among those particular CHWs. As it is, all of the CHWs in the Burkina Faso seem to suffer the same constraints. High-performing CHWs perform well *in spite of the fact* that they don't receive regular financial incentives, they face an unreliable drug supply, and are not meaningfully supported by fellow community members.

4.5.3.   Pathways of influence: determinants, mediating factors, and performance

Our results validate many of the assumptions in our conceptual framework. But they also reveal the framework to be somewhat simplistic. The determinants of performance are more nuanced than the framework suggests. It is not the mere delivery of supervision *per se* that is important for CHW performance, but rather the quality of supervision visits, the intensity of a supervisor's efforts, and the personal relationship that supervisors build and maintain with CHWs. A CHW's personality traits are important, but this encompasses everything from a CHW's attitude to community service, to their ability to form successful relationships with diverse village members, to their conscientiousness and drive, to their cognitive understanding, memory, and implementation of the iCCM algorithm. What is important about community participation is not just the involvement of community members in CHW selection, but how community members engage CHWs, and the demands and expectations they put on CHWs at the time they are recruited.

Likewise, the pathways by which determinants affect performance are multi-faceted and interlinked. Our framework shows that determinants can affect performance through

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multiple mediating factors, and we saw this in our results; for example, supervision affects CHW's skills and also their motivation. But what our framework doesn't capture is the interplay between determinants, the two-way directionality between determinants and mediating factors, and the interconnected nature of these pathways of influence. Some factors, such as the intrinsic motivation of CHWs and supervisors, can be both determinants and outcomes of performance. Some factors can operate by influencing other factors; for example, visible supervision can affect community perceptions and participation, which in turn can affect the CHW's motivation and enabling environment. Drug stockouts can affect the ability of the CHW to treat to sick children, which can affect the ability of the CHW to receive financial rewards, which can affect motivation.

A final lesson from this study, therefore, is that the determinants of CHW performance, at least in the Burkina Faso iCCM program, are numerous and synergistic. Many factors are important for CHW performance. The interactions between CHW characteristics, health system factors, and community factors are complicated. Improving CHW performance requires a meaningful understanding of those interactions, and a willingness to explore and evaluate diverse and complementary approaches.

## 4.6. Limitations

The quantitative performance measures that we used to rank and select CHWs did not include data for the domain of Building Community Relationships.[5] Our characterization of CHWs as high and low performers might therefore have been biased towards Providing Care or Managing Commodities, rather than a CHW's performance in establishing trusting relationships with other community members. If we had included data on Building Community Relationships in our quantitative scores for performance, other CHWs may have been selected as the 5 high performers and 5 low performers, which may have revealed different or additional findings to those reported above. The implication is that while the findings from this study reflect the factors associated with a CHW's ability to provide care, manage commodities, and report on his or her work, they may not reflect the factors that enable a CHW to build trusting relationships with community members and generate demand for services. These are import aspects of CHW performance, and how to enhance these aspects should be the focus of future studies.

Although our 10 cases represented the 5 highest-performing and 5 lowest-performing CHWs in our sample, 4 of our 5 low performers were not in fact extremely poor performing. Whereas the 5 high-performing CHWs were clearly above average, 4 of the 5 low-performing CHWs had at least one domain score that was average, or even above average. This may have meant that the qualitative data for our 10 cases were more similar than they

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[5] This limitation is a feature of all three analyses in the dissertation and is discussed in more detail in Chapter 2.

could have been. A bigger pool of CHWs with matched quantitative and qualitative data may have produced more extremely high- and low-performing CHWs, which in turn might have revealed starker distinctions in cross-case comparisons, and clearer findings on the factors affecting CHW performance.

In discussions with supervisors and caregivers, we did not ask questions about specific CHWs. For this reason, when supervisors and caregivers commented on CHWs, they spoke about CHWs in general, not the specific CHW who we assessed to be high or low performing. This limited our ability to analyze the "within case" relationships between respondents that are typically associated with case-study analysis. As mentioned in our Methods section, this led to us adopting a variable-oriented approach to data analysis.

Finally, respondents may have given inaccurate or exaggerated accounts of their experiences due to social desirability bias. Although respondents did not shy from revealing or discussing negative aspects of the iCCM program, supervisors and caregivers were generally complimentary about the work of CHWs, which may not reflect reality.

## 4.7. Conclusions

Many of the factors that have been shown to influence CHW performance in other settings are also important in the Burkina Faso iCCM program. These factors have important qualitative attributes, and interact in complicated ways. CHWs with more positive attitudes, stronger intrinsic motivation, and who are more often present in the village, appear to perform better, though manipulating the selection of CHWs may be beyond the control of program implementers, given community-based CHW recruitment mechanisms. Proactive supervision from motivated supervisors has a profound, personal effect on CHW motivation and performance. From a health systems perspectives, this is an enormous opportunity to effect change, by more fully engaging and equipping supervisors to provide higher-quality support to CHWs - something for which tangible strategies could be developed. Supervisors and community leaders might also be supported to further incentivize CHWs, and to replace entrenched CHWs who are under-performing. Challenges such as drug stockouts and broken promises do not explain the current variability in CHW performance in Burkina Faso, but could be mitigated to improve the performance of all CHWs. Strategies to improve CHW performance should emphasize the *quality* of program processes, and how these processes are perceived and felt by the CHWs and caregivers for whom they are implemented.

# Chapter 5.   Conclusions

## 5.1.  Summary of findings

If CHW programs are to fulfil their potential, we need more evidence on CHW performance and its effect on program impact. This dissertation explored what is meant by CHW performance, and the role of factors such as recruitment, training, and supervision as determinants of performance. We outlined a framework for assessing CHW performance, determinants of CHW performance, and the mediating factors by which determinants operate. We used data from a study in Burkina Faso to describe the performance of CHWs in an iCCM program and the association of performance with CHW characteristics, health system factors, and community factors. Our analyses built on previous attempts in the literature to document CHW performance and explain variability in CHW performance. We extended these earlier studies by: (a) viewing CHW performance as multi-faceted, with four competency areas or "domains", (b) examining a range of potential determinants within a framework of determinants and mediating factors, and (c) using quantitative and qualitative methods.

The first paper constructed and analyzed measures and summary measures of CHW performance. Scores for tasks and performance domains varied greatly by CHW, with some CHWs performing very low, some performing very high, and many performing well at some tasks but poorly at other tasks. Certain tasks were performed poorly by most CHWs, including correct prescription of ORS and zinc for diarrhea, correct counseling for the

caregiver, and availability of drugs for diarrhea and malaria. Summary measures for overall performance showed wide variation in CHW performance across districts, with CHWs in some districts performing almost twice as well as CHWs in other districts. Although aspects of the findings were disappointing, studies of CHW performance in other iCCM programs have revealed similar weaknesses (Bagonza *et al.*, 2014). In Malawi and Ethiopia, evaluators reported comparable findings for CHWs' ability to assess, classify, and treat illnesses (Gilroy *et al.*, 2013; Miller *et al.*, 2014), and inadequate drug stock has been a common concern for many iCCM programs (Stekelenburg *et al.*, 2003; Kalyango *et al.*, 2012; Blanas *et al.*, 2013).

The second and third papers explored the role of individual, health system, and community factors in enabling or inhibiting CHW performance. In the second paper, multi-linear regression analysis showed a statistically significant association between performance and CHW characteristics such as age, literacy, and education, and between performance and health system factors such as a CHW's district and the time since a CHW's most recent supervision. The large differences in CHW performance across district, seen in the first paper, were shown to persist even when controlling for other determinants. The third paper, using qualitative methods, affirmed the importance of supervision as a determinant of CHW performance, not only for knowledge and skills development, but for motivating CHWs, and for facilitating trusting relationships between CHWs and other village members; findings that echo other research on CHW supervision (Hill *et al.*, 2014; Roberton *et al.*, 2015a). All CHWs, both high- and low-performing, struggle with health-facility drug stockouts, a lack of tangible community support, and the competing priorities of iCCM, agricultural work, and other income opportunities. While these issues don't explain variability in CHW performance, at least not in Burkina Faso, addressing these issues might improve the

performance of all CHWs in the program. Policy makers thus have various pathways by which to improve the performance of CHWs, and increase the impact of iCCM programs on population health.

## 5.2. Implications for the Burkina Faso iCCM program

The results of these papers have implications for the Burkina Faso iCCM program. The fact that CHWs are not treating illnesses correctly, or not adequately managing their drug kit, is a substantial limitation to the program. On average, CHWs have 38% of the drugs they need to treat children. When CHWs do have drugs, they are correctly treating illnesses in only 33% of cases. We did not measure CHW performance in Building Community Relationships, but we know from other sources that the number of children seen by CHWs is low: an average of 1 sick child per week, far below the expectation of 8-16 children per week given estimates of disease incidence and children per CHW in the population (ISSP and IIP-JHU, 2014; Munos *et al.*, 2015). With these facts in mind, it is difficult to imagine that the iCCM program in Burkina Faso is reaching its potential for reducing child mortality.

Indeed, the overall evaluation of the Burkina Faso "Rapid Scale-up" (RSU) program between 2010 and 2014, of which the Quality of Care and Implementation Assessment was a part, showed that the iCCM program did not have an impact (Munos *et al.*, 2015). The evaluation used a before-after longitudinal control study design, with coverage changes measured through household surveys, and mortality reductions modelled using the Lives Saved Tool (LiST). The LiST results suggested an under-five mortality reduction of 6.4% in intervention areas and 4.4% in comparison areas from 2010 to 2013. However, most of this reduction

was attributed to increased coverage of ITNs (71% of the mortality reduction in intervention areas and 63% in comparison areas), improved breastfeeding practices, and improved labor and delivery management. Changes in coverage of ORS, zinc, ACTs, and antibiotics for pneumonia were insufficient to show a meaningful impact on child mortality.

These findings presented in this dissertation confirm the fact that there are bottlenecks to the effectiveness of the iCCM program, and explain in part the findings from the overall RSU evaluation. While CHW performance is not the sole problem, and health system issues also need to be addressed (supply chain functioning, demand generation), CHW performance is a key contributor to the performance of the program as a whole. If the iCCM program is to have an impact, significant improvements are needed in the ability of CHWs to assess, classify, and treat illnesses, to manage a drug kit, and to build awareness and demand for iCCM services in the community.

The Burkina Faso MoH is aware of these problems. In meetings throughout the evaluation period, national stakeholders acknowledged the poor performance of CHWs and the lack of supports provided to them. In qualitative interviews with district health office staff (conducted separately as part of ongoing evaluation documentation), respondents also raised issues concerning CHW performance - specifically, the need to motivate CHWs better through financial payments, and the difficulty of working with CHWs who were not literate or educated.

In June 2014, the Burkina Faso MoH took a step towards addressing these issues by adopting a new policy on the "Profile of CHWs" (MoH Burkina Faso, 2014). This policy

was the culmination of several years' discussion between MoH departments, and was intended as a broad policy to cover CHWs across the country for all CHW programs, not just iCCM. The key points of the policy were around selection criteria (knowing how to read and write in French, having a certificate of primary school education, being between 20 and 50 years of age), and the introduction of regular financial payments to CHWs (20,000 francs per month, equivalent to 33 USD per month).

While the adoption of the CHW policy was a welcome step, questions were immediately raised about its implementation. At a national meeting of iCCM program stakeholders in September 2014, district health officers raised concerns around whether current CHWs who did not meet the policy's criteria should be replaced, how new CHWs should be recruited, the mechanism for making financial payments, and whether financial payments should be withheld if a CHW was not performing adequately (IIP-JHU, 2014). In the current Burkina Faso context, CHWs are difficult to recruit, and communities may not find willing candidates who meet all the selection criteria. Moreover, adopting this new policy doesn't address related gaps in health system functioning. The differences in CHW performance across districts suggests that health system factors have a large role to play. CHWs need meaningful, personal supervision, for skills development, for motivation, and to increase their legitimacy in the eyes of fellow village members. CHWs also need reliable supply chain functioning and MoH-led initiatives to generate demand for iCCM services. Thus while the new CHW policy is a positive development, further steps are needed for the iCCM program to achieve its full potential.

## 5.3. Implications for other programs

The degree to which the findings in this dissertation are relevant for iCCM programs in other settings, and for other types of CHW programs, depends on the degree to which those programs and contexts are similar or different to the program and context in Burkina Faso (Kok *et al.*, 2015). Key features of the Burkina Faso program are the fact that CHWs are volunteers, that many CHWs do not have formal schooling, that CHWs are only trained for iCCM of childhood illness and not a broader package of services, and that CHWs are responsible for restocking their drug kits by purchasing drugs with their own money. In other iCCM programs, where CHWs are all literate, or receive more substantial training, or are supported by other health system mechanisms, the performance of CHWs, and the factors that explain variability in performance, will be different. For non-iCCM programs, the domains of performance that are important for program success will also be different. With that in mind, here are five implications that might nonetheless be applicable to other programs.

*(a) High CHW performance cannot be assumed. Program implementers should measure CHW performance, as poor performance will undermine program impact.*

Current initiatives such as the "One million CHWs" campaign are advocating for a rapid expansion of CHW programs (Singh and Sachs, 2013). While such initiatives are encouraging, we need a reality check about the difficulty of establishing CHW cadres that are sufficiently high-performing to achieve impact (Kok *et al.*, 2014). As we show in our studies,

CHW performance can vary greatly, and this variability can limit the impact of CHW programs (Bagonza *et al.*, 2014; Oliphant *et al.*, 2014). Policy makers should not assume that recruiting and training CHWs will necessarily lead to improved health. An apparently functional iCCM program may be undermined by the inability of CHWs to correctly diagnose and treat children, supply chain issues, or low utilization. Thus while some studies show that CHWs can achieve impact (Baqui *et al.*, 2009; Perry *et al.*, 2014), the performance of CHWs, and the impact of CHW programs, *cannot be taken for granted.*

This in turn highlights the need for implementation research to better understand what works for CHW programs in different contexts. The fact that CHW performance can vary is not a fundamental flaw of CHW programs, but rather an implementation challenge (UNICEF, 2014). Stronger monitoring and evaluation of CHW performance will help to explain when and why CHWs perform well, and how performance can be improved and maintained (Laínez *et al.*, 2012; McGorman *et al.*, 2012). Without this learning, we will not truly understand the potential of large-scale CHW programs; and, as in Burkina Faso, programs will be implemented without realizing their true potential, leading to wasted resources and missed opportunities.

### (b) Summary measures are valuable for reporting CHW performance across locations and performance domains.

Studies of CHW quality of care are valuable and recent studies have shed great light on the potential of CHWs to deliver clinical services (Kalyango *et al.*, 2012; Gilroy *et al.*, 2013; Puett *et al.*, 2013; Miller *et al.*, 2014). To truly maximize the utility of these studies, and similar data

from routine monitoring systems, data need to be packaged and presented in ways that are useful for stakeholders at different levels of the health system (Guenther *et al.*, 2014). As shown in our studies, summary measures that are task-based, that purposefully capture multiple dimensions of performance, and are appropriately aggregated, give policy makers, program managers, and facility-based supervisors important information - at a glance - to address critical programmatic questions.

In order to develop and use summary measures, tools for collecting appropriate data are needed. The iCCM Task Force has released an indicator guide for monitoring and evaluating iCCM programs, with globally agreed indicator definitions and methodology (MCHIP, 2013b). This guide contains normative guidance on monitoring CHW programs, including 18 benchmark indicators for routine monitoring of iCCM programs, such as the "Proportion of CHWs trained in CCM who are providing CCM one year after initial training (Indicator 3.4), "Percentage of CCM sites with no expired or damaged medicine or diagnostics on the day of observation" (Indicator 4.5), and "Number of CCM conditions treated per 1,000 children under five in target areas in a given time period" (Indicator 5.1). While this indicator guide provides helpful guidance on what data should be collected to monitor iCCM, little or no guidance is given on how these indicators are to be reported. A recent review found that, while the data needed to calculate many of the iCCM Task Force indicators are already being collected through existing iCCM monitoring systems, further support is needed to assist countries in choosing indicators, revising tools and protocols, and developing data analysis strategies (Roberton *et al.*, 2015b). The summary measures used in this thesis are one example of how data on CHW performance might be aggregated for high-level policy makers, although adopting such measures would need thoughtful implementation. Health

information systems suffer when too many indicators are required to be reported upon by implementers or donors (Hotchkiss *et al.*, 2012). Routine summary measures of CHW performance would need to be built using an economical set of high-value measures, in such a way that enables efficient and integrated data collection across all of a country's CHW programs.

*(c) CHWs require diverse skills to perform well at various domains of performance. Few CHW candidates have all these skills, requiring trade-offs in selection criteria and, in turn, clear recruitment processes.*

In order to successfully carry out their role, CHWs need to perform well at multiple tasks in multiple domains of performance. ICCM programs require CHWs to provide clinical care, manage commodities, establish effective relationships with community members, be available and accessible when needed, and report on their activities. To fulfill these diverse tasks, CHWs need diverse skills. Our analyses highlighted the value of CHWs who are literate, educated, accessible to caregivers, have a strong sense of intrinsic motivation, and are able and willing to build relationships with other community members. But is it realistic to expect to recruit CHWs with all these attributes? Trade-offs in the skills and characteristics of CHWs seem inevitable, especially in programs where CHWs are not paid a regular stipend, or where managers struggle to recruit highly-educated CHWs. In programs that are structured to recruit fewer, higher-paid CHWs, managers may have greater bargaining power to recruit higher-skilled CHWs from a larger available pool of candidates. But programs that do not pay a stipend might struggle to recruit CHWs with any formal

schooling at all. In these cases, policy makers should consider the need to prioritize competencies.

If trade-offs are needed, which selection criteria should be prioritized? Is it better to favor technical criteria that can be verified (such as education, literacy, age), or qualitative attributes such as "a good disposition", "highly motivated", "stable"? And if prioritization is needed, who should make those decisions? Most programs have a policy of community recruitment, yet communities are often guided by selection criteria from policy makers. "While the selection of CHWs from local communities is common practice, participatory selection processes remain an ideal that is relatively rarely practiced, particularly in large-scale programs" (Lehmann and Sanders, 2007). Communities can default to satisfying more explicit, verifiable criteria, handed down from MoH actors, at the expense of more qualitative criteria identified and favored by village members. (This seems to have been the case in Burkina Faso, where every CHW said they were chosen because they could read and write.)

Difficulties around the recruitment and selection of CHWs are not new (Ofosu-Amaah, 1983; Gilson *et al.*, 1989). In an ideal world, policy makers and communities would know which selection criteria to prioritize, and each village would have a pool of willing candidates who meet those criteria. In lieu of this, perhaps what is needed are stronger mechanisms for communities and health system actors to review the performance of CHWs; more leverage for local leaders to incentivize and motivate CHWs; and greater flexibility and commitment to replace CHWs that are not performing sufficiently well. In Chapter 4 we saw that supervisors in Burkina Faso have varying abilities, or perceived abilities, to replace

entrenched CHWs that are under-performing. More meaningful financial or non-financial incentives might instill a greater sense of accountability among CHWs, with CHWs needing to at least actively provide iCCM to benefit. Such incentives might also give health systems and communities more bargaining power to recruit more highly-qualified CHWs with as many of the needed skills for the job as possible, and give CHWs more freedom to dedicate time to their role (Greenspan *et al.*, 2013).

*(d) The nature and quality of supervision plays a powerful role in improving the motivation and performance of CHWs.*

Previous studies have shown a link between CHW performance and supervision, and we found a similar link in our studies too (Laínez *et al.*, 2012). What appears to be most important, however, is not the mere fact of supervision, or the frequency of supervision visits, but rather the nature and quality of supervision: the content of supervision encounters; whether the supervisor visits the CHW in his or her village; the attention given by the supervisor to iCCM; and the degree to which the CHW feels supported and encouraged by the supervisor. This human aspect of supervision is receiving increasing attention, not only for CHWs but for facility-based health workers (McAuliffe *et al.*, 2013). A strategy known as "supportive supervision" emphasizes the personal relationship between supervisor and supervisee, subordinating traditional supervisory tasks such as report checking and verification, for tasks such as problem solving, ongoing training, and joint work planning (Marquez and Kean, 2002; Mogasale *et al.*, 2010). Examples of the integration of supportive supervision into CHW programs have yielded promising results (Djibuti *et al.*, 2009; Smith Paintain *et al.*, 2014; Roberton *et al.*, 2015a).

Although the need for high-quality supervision is becoming increasingly well established, gaps remain in our understanding of how to implement such supervision (Hill *et al.*, 2014; Kok *et al.*, 2014). Requiring facility-based supervisors to supervise CHWs more frequently, or more intently, is not straightforward. As supervisors in our qualitative study said, supervisors themselves have issues with resource constraints, competing priorities, and their own motivation to conduct supervision. If we want supervisors to spend more time with CHWs, we need strategies to help make that happen. This might mean protocols to reduce the time spent by supervisors on report completion, in favor of more time spent discussing problems; or more resources and incentives for supervisors to travel to villages. Given the significant positive effect that high-quality supervision can have on CHW performance, this is something worth investing in - resources to enact enhanced supervision policies now, and implementation research on "what works" to improve supervision in the future.

*(e) The way in which national policies are put into practice at district, health-facility, and village level is what truly matters.*

In Chapter 2 we saw large differences in CHW performance across districts, and in Chapter 3 these differences were shown to be independent of other factors such as the age, sex, and education of the various cohorts, and other potential confounders. Among all the determinants in our multi-linear regression model, the effect of "district" contributed most to variation in performance. This relationship makes sense. District health offices had influence over how CHWs were trained, whether new or existing CHWs were recruited for the program, how facility-based supervisors were themselves supervised, the availability of

drugs (distributed to CHWs' health facilities through a district warehouse), and the general

level of attention paid by health workers and CHWs to the iCCM program. Although the

curricula and protocols for training, supervision, and drug distribution were set at the

national level, the implementation of these protocols - the way in which CHW training and

supervision was delivered - was something that district offices were responsible for.

The idea that health programs are affected by how program policies are adopted and put

into action at lower levels of the health system is not new. Michael Lipsky coined the phrase

"street-level bureaucracy" to describe how frontline public officials at the community

interface of government institutions inadvertently affect the intent of the policies they are

asked to implement, due to the constraints and realities of their work environment (Lipsky,

2010). The actions of street-level bureaucrats "become, or add up to, agency policy, and

effectively become the public policies they carry out" (Lipsky, 2010). Kaler and Watkins

examined this phenomenon in the context of a community-based family planning program

in Kenya, showing how a national policy was reinterpreted by the CHWs responsible for its

implementation (Kaler *et al.*, 2001). To ensure programs reach their full potential, policy

makers should actively engage all stakeholders who are involved in the implementation of a

program; doing this early so that those who develop the program understand and

incorporate the perspectives of those who are responsible for its delivery.

These ideas highlight the importance of paying attention to the *implementation* of CHW

programs - making sure that well-designed policies are put into practice as conceived; that

the resources allocated to health interventions are well spent; and that CHW programs

achieve their full potential. A logical, efficacious strategy, such as iCCM, is only as good as its

realization in reality. As we advocate for the expansion of CHW programs, we should

advocate also for research to guide the implementation of those CHW programs. Without

evidence and measurement, we will not know if CHWs programs are achieving their targets,

or how to achieve them if they are not. We owe it to communities to critically evaluate

programs in this way, so that we learn for the future and make greater gains for maternal,

newborn, and child health.

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# Appendices

1. **Study tools**

2. **List of task measures with descriptions**

3. **Stata output for multi-linear regression models**

    **3.1. Primary regression models**

    **3.2. Secondary regression models, including predictor variables for which we had limited observations**

    **3.3. Scatterplot of residuals versus fitted values from the primary regression model for Overall Performance**

    **3.4. Primary regression model for Overall Performance, with robust standard errors**

    **3.5. Primary regression model for Overall Performance, with Boulsa as the base category for *district* (instead of Barsalogho)**

# Appendix 1.  Study tools

## Quantitative tools

Form 1.	Village checklist

Form 2.	CHW questionnaire

Form 3.	Observation

Form 4.	Re-examination

Form 5.	Caregiver questionnaire

Form 6.	Case scenarios

## Qualitative tools

Form 7.	CHW in-depth interview

Form 8.	Caregiver in-depth interview

Form 9.	Caregiver focus group

Form 10.	Supervisor in-depth interview

# Form 1.  Village Checklist

| 1A | ADMINISTRATION | | | |
|---|---|---|---|---|
| 1A01 | District | (1) Barsalogho<br>(2) Boulsa<br>(3) Gourcy | (4) Kaya<br>(5) Kongoussi<br>(6) Ouahigouya | (7) Seguenega<br>(8) Titao<br>(9) Yako |
| 1A02 | Village name | _____ | | |
| 1A03 | Village number | \_\_ \_\_ \_\_ | | |
| 1A04 | Name of the CHW's Health Facility | _____ | | |
| 1A05 | GPS location of village | GPS coordinates \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ | | |
| 1A06 | GPS location of CHW's Health Facility | GPS coordinates \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ | | |
| 1A07 | Observer name | _____ | | |
| 1A08 | Observer number | \_\_ \_\_ | | |
| 1A09 | Re-examiner name | _____ | | |
| 1A10 | Re-examiner number | \_\_ \_\_ | | |
| 1A11 | CHW name | _____ | | |
| 1A12 | CHW number | \_\_ \_\_ \_\_ | | |
| **Questions 1A13 to 1A16 should be asked of the Supervisor at the CHW's Health Facility** | | | | |
| 1A13 | Name of the Supervisor | | _____ | |
| 1A14 | Have you ever received training in clinical IMCI? | | (1) Yes  (2) No | |
| 1A15 | Have you ever received training in community case management? | | (1) Yes  (2) No | |
| 1A16 | Have you ever supervised (Name of CHW) in CCM? | | (1) Yes  (2) No | |
| 1A17 | Date of assessment | \_\_ \_\_ /\_\_ \_\_ /\_\_ \_\_<br>Day   Month   Year | | |
| 1A18 | Time arriving in village | \_\_ \_\_ h \_\_ \_\_ min | | |
| 1A19 | Time leaving village | \_\_ \_\_ h \_\_ \_\_ min | | |
| 1A20 | Was the assessment team able to interview the selected CHW as per the study plan (and complete Forms 2 and 6)? | (1) Yes<br>(2) Yes, partially completed<br>(3) No, could not find CHW → **END**<br>(4) No, CHW did not give consent → **END**<br>(5) No, other reason (specify) _____ → **END** | | |
| 1A21 | How many sick children 2-59 months were observed by the assessment team? | \_\_ \_\_ | | |

# Form 2.  CHW Questionnaire

| 2A | ADMINISTRATION | | | |
|---|---|---|---|---|
| 2A01 | District | (1) Barsalogho<br>(2) Boulsa<br>(3) Gourcy | (4) Kaya<br>(5) Kongoussi<br>(6) Ouahigouya | (7) Seguenega<br>(8) Titao<br>(9) Yako |
| 2A02 | Village name | _____ | | |
| 2A03 | Village number | __ __ __ | | |
| 2A04 | Interviewer name | _____ | | |
| 2A05 | Interviewer number | __ __ | | |
| 2A06 | CHW name | _____ | | |
| 2A07 | CHW number | __ __ __ | | |
| 2A08 | Date of interview | __ __ /__ __ /__ __<br>Day   Month   Year | | |
| 2A09 | Time interview begun | __ __ h __ __ min | | |
| 2A10 | Read the informed consent script to the CHW.  Does the CHW give their consent for this interview? | (1) Yes<br>(2) No → **END** | | |

| 2B | DEMOGRAPHICS | | | |
|---|---|---|---|---|
| 2B01 | How old were you at your last birthday? | Age__ __ | | |
| 2B02 | Sex? | (1) Male<br>(2) Female | | |
| 2B03 | What is your ethnicity? | (01) Mossi<br>(02) Peulh<br>(03) Gourmantché<br>(04) Nuni<br>(05) Kassena<br>(06) Bella | (07) Bissa<br>(08) Bobo<br>(09) Dioula<br>(10) Other Gourounsi<br>(11) Lobi | (12) Samo<br>(13) Sénoufo<br>(14) Touareg<br>(15) Other (specify)___ |
| 2B04 | What is your marital status? | (1) Married (traditional, religious, or civil marriage)<br>(2) Single, cohabitating<br>(3) Separated/divorced<br>(4) Widowed<br>(5) Single<br>(6) Other (specify) _____ | | |
| 2B05 | In which village do you live? | (1) This village<br>(2) Other village → **2B07** | | |

| | | |
|---|---|---|
| 2B06 | How long have you lived in this village?<br><br>***If less than 12 months, circle (1) and record the answer in months. If 12 months or more, circle (2) and record in years.*** | (1) Months __ __<br>(2) Years __ __<br>(3) My whole life |
| 2B07 | Did you ever go to school? | (1) Yes<br>(2) No → **2B10** |
| 2B08 | What is the highest level of school that you attended: Primary, Secondary 1 (first cycle), Secondary 2 (second cycle) or Tertiary? | (1) Primary<br>(2) Secondary (first cycle)<br>(3) Secondary (second cycle)<br>(4) Tertiary |
| 2B09 | What was the highest class you achieved at this level of school?<br><br>***See codes listed below.*** | Class __ |

**Codes for highest class achieved**

| LEVEL | PRIMARY | SEC 1ST CYCLE | SEC 2ND CYCLE | TERTIARY |
|---|---|---|---|---|
| CLASS | 0= LESS THAN 1 YEAR COMPLETED | | | |
| | CP=1 | 6EME=1 | 2ND=1 | 1ST YR=1 |
| | CP2=2 | 5EME=2 | 1ERE=2 | 2ND YR=2 |
| | CE1=3 | 4EME=3 | TERMINALE=3 | 3RD YR=3 |
| | CE2=4 | 3EME=4 | FPB=4 | 4TH YR=4 |
| | CM1=5 | FPP=5 | DK=8 | 5TH YR OR +=5 |
| | CM2=6 | DK=8 | | DK=8 |
| | DK=8 | | | |

| | | | |
|---|---|---|---|
| **Check 2B08.** | ***What is the highest level of school attended?***<br>***(1) Primary →2B10***<br>***(2) Secondary (first cycle) →2C***<br>***(3) Secondary (second cycle) →2C***<br>***(4) Tertiary →2C*** | | |
| 2B10 | Can you read this paragraph out loud? Please read as much as you are able to.<br><br>***Show the card with the passage*** | A. French | (1) Cannot read at all<br>(2) Can read certain words and phrases<br>(3) Can read the whole passage |
| | | B. Mooré | (1) Cannot read at all |

| | written in the appropriate language to the CHW. If the CHW cannot read the whole passage, ask the CHW to read as much as possible. | | (2) Can read certain words and phrases<br>(3) Can read the whole passage | |
|---|---|---|---|---|
| | | C. Does the CHW say that he/she can read another language? | (1) Yes<br>(2) No | |
| **2C** | **TRAINING** | | | |
| 2C01 | In what year did you first become an CHW?<br><br>*Probe if necessary:* For how many years have you been an CHW? | Year __ __ __ __ | | |
| 2C02 | Have you received training in CCM? | (1) Yes<br>(2) No → **2C11** | | |
| 2C03 | For which illnesses have you received training?<br><br>*Record all responses.* | A. Pneumonia<br>B. Diarrhea<br>C. Malaria<br>D. Other (specify) _____ | | |
| 2C04 | How many trainings in CCM have you received? | __ | | |
| 2C05 | In what year did you receive your first training in CCM? | Year __ __ __ __ | | |
| 2C06 | Who conducted the CCM training?<br><br>*Ask:* Anyone else?<br><br>*Record all responses.* | A. Supervisor<br>B. Other nurse<br>C. MCD<br>D. ECD<br>E. NGO<br>F. Other (specify) _____<br>G. Don't know | | |
| 2C07 | Did the CCM training involve any clinical practice? | (1) Yes<br>(2) No<br>(8) Don't know | | |
| 2C08 | Approximately how many people were in your CCM training cohort? | Number of people __ __ __ | | |
| 2C09 | Have you ever received refresher CCM training? (i.e. additional training since the initial training) | (1) Yes<br>(2) No → **2C12** | | |
| 2C10 | In what year did you last receive refresher CCM training? | Year __ __ __ __ | | |
| 2C11 | What (other) training have you received since becoming an CHW?<br><br>*Ask:* Anything else? | A. Nutritional rehabilitation<br>B. ITNs<br>C. Infant and young child feeding<br>D. Essential family practices | | |

| | Record all responses. | E. Antenatal care<br>F. Motherhood without risk<br>G. Family planning<br>H. HIV/AIDS<br>I. PECADO<br>J. Other (specify) _____ |
|---|---|---|
| **2D** | **CHWs IN VILLAGE** | |
| 2D01 | How many people have worked as CHWs in your village in the past **three years** (including you)? | Number __ __<br>(98) Don't know |
| 2D02 | How many people **currently** work as CHWs in your village (including you)? | Number __<br>(8) Don't know → **2D05** |
| 2D03 | How many of the CHWs currently working in your village have been trained in CCM (including you, if appropriate)? | Number __<br>(8) Don't know |
| 2D04 | How many of the CHWs currently working in your village have a drug kit (including you, if appropriate)? | Number __<br>(8) Don't know |
| 2D05 | How many people have stopped being CHWs in the past **three years**?<br><br>*The answers for 2D02 and 2D05 should add up to the answer for 2D01. If not, probe the CHW to check his or her understanding of the questions.* | Number __ **If the answer is "0"→ 2E**<br>(8) Don't know → **2E** |
| 2D06 | Do you know why one or more of these people stopped being CHWs? | (1) Yes<br>(2) No → **2E** |
| 2D07 | What are the reasons why these people stopped being CHWs?<br><br>*Ask:* Anything else?<br><br>*Record all responses.* | A. Moved to another village<br>B. Got married<br>C. Got a different job<br>D. Died<br>E. Other (specify)_____ |
| **2E** | **SUPERVISION** | |
| 2E01 | In what month and year did you last receive a CCM supervision?<br><br>*Ensure that the CHW understands that this refers to supervision visits where the supervisor talks about CCM and the management of sick children.* | Month __ __<br>(98) Don't know<br>(95) Never received a CCM supervision → **2F**<br><br>Year __ __ __ __<br>(9998) Don't know<br>(9995) Never received a CCM supervision → **2F** |

| | | |
|---|---|---|
| 2E02 | How many times in the last **three months** did you receive a CCM supervision? | __ __ |
| 2E03 | Where do your CCM supervisions usually take place?<br><br>*Ask:* Anywhere else?<br><br>*Record all responses.* | A. Village<br>B. Health Facility<br>C. CM/CMA<br>D. Other (specify)_____ |
| 2E04 | Who usually conducts your CCM supervisions?<br><br>*Ask:* Anyone else?<br><br>*Record all responses.* | A. Supervisor<br>B. Other nurse<br>C. MCD<br>D. Other (specify)_____ |
| 2E05 | What does your supervisor usually do during your CCM supervisions?<br><br>*Ask:* Anything else?<br>*Record all responses.* | A. Gives you CCM drug supplies<br>B. Instructs you on CCM issues<br>C. Observes you managing a sick child<br>D. Demonstrates how to care for a sick child<br>E. Uses a supervision checklist<br>F. Reviews your CCM patient register<br>G. Reviews clinical case scenarios with you<br>H. Provides verbal feedback<br>I. Other (specify)_____ |
| **2F** | **WORK PRACTICES** | |
| 2F01 | Which of the following health activities do you perform in the community?<br><br>***Read list to CHW and answer yes/no for each activity.*** | A. Community case management of sick children<br>B. Family planning<br>C. Antenatal care for pregnant women<br>D. Assist with birth deliveries<br>E. Growth monitoring or other nutritional activities<br>F. Assist with vaccinations or other campaigns<br>G. HIV counseling and testing<br>H. Other _____ | (1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No |
| 2F02 | What is your primary occupation? | (1) CHW<br>(2) Agricultural worker<br>(3) Teacher<br>(4) Art worker<br>(5) Other _____ | |

| | | |
|---|---|---|
| 2F03 | Approximately how many hours per week do you work as an CHW? | __ __ |
| 2F04 | Are you paid a regular salary for any work you do as an CHW?<br><br>**If yes, ask:** How much are you paid per month in total for all the work you do as an CHW (including CCM)? | (1) Yes, __ __ __ __ __ fcfa<br>(2) No |
| 2F05 | Do parents ever bring sick children to you for advice, care or drugs in your capacity as an CHW? | (1) Yes<br>(2) No → **2G**<br><br>**If an CHW answers "No" to this question, continue with this questionnaire (sections 2G, 2H and 2J) but do not administer any other forms/tools. Do not attempt to conduct observations (do not recruit any sick children).** |
| 2F06 | Approximately how many hours per week do you spend seeing sick children? | __ __ |
| 2F07 | Are you paid a regular salary for your CCM work managing sick children?<br><br>**If yes, ask:** How much are you paid per month for your CCM work? | (1) Yes, __ __ __ __ __ fcfa<br>(2) No |
| 2F08 | On average, how many sick children do you see per week? | __ __ |
| 2F09 | When do you usually see sick children?<br><br>**Ask:** Any other time?<br>**Record all responses** | A. Morning<br>B. Afternoon<br>C. Evening<br>D. During the night |
| 2F10 | Where do you usually see sick children?<br><br>**Ask:** Anywhere else?<br>**Record all responses** | A. CHW's own home<br>B. Central location in village (without structure)<br>C. Health Facility<br>D. In house-to-house visits<br>E. Other (specify)_____ |
| 2F11 | Do you find sick children in the village or do parents bring their sick children to you? | (1) I find sick children<br>(2) Parents bring their sick children to me<br>(3) Both<br>(4) Don't know |
| 2F12 | How many people (adults) in the village know that you work as an CHW | (1) Everyone<br>(2) Most people |

| | and that you provide CCM for sick children? | (3) Half the people<br>(4) Less than half<br>(5) Not many people<br>(8) Don't know |
|---|---|---|
| 2F13 | In what month and what year did you last visit a Health Facility in your role as an CHW? | Month __ __<br>(98) Don't know<br><br>Year __ __ __ __<br>(9998) Don't know |
| 2F14 | How many times in the past **three months** have you visited a Health Facility? | __ __ |
| 2F15 | What do you usually do when you visit a Health Facility?<br><br>**Record all responses.** | A. Meet with a supervisor<br>B. Assist with services at Health Facility<br>C. Pick up drugs<br>D. Other (specify)_____ |
| 2F16 | Where do you refer severely sick children?<br><br>**If a Health Facility, ask:** What is the name of the Health Facility? | (1) Health Facility (specify name)<br>_____<br>(2) District hospital<br>(3) Regional hospital<br>(4) Other (specify)_____ |
| 2F17 | How many minutes or hours does it take on average for a person to walk from the village to the nearest Health Facility?<br><br>**If less than 60 minutes, circle (1) and record in minutes.  If 60 minutes or more, circle (2) and record in hours.** | (1) __ __ minutes<br>(2) __ __ hours<br>(8) Don't know |
| 2F18 | What do you do when referring severely sick children?<br><br>**Ask:** anything else?<br>**Record all responses.** | A. Write a referral note<br>B. Help arrange transport<br>C. Provide transport<br>D. Give child first dose of treatment<br>E. Other (specify)_____ |
| 2F19 | Do caregivers usually accept referral of severely sick children? | (1) Yes<br>(2) No<br>(8) Don't know |
| 2F20 | What are the advantages of being an CHW?<br><br>**Do not read the list to the CHW. Wait for the CHW to respond and** | A. I get paid a salary<br>B. I was given a bike and/or bag<br>C. I make money by selling drugs<br>D. I can provide drugs for my family when they are sick<br>E. I am respected by my family<br>F. I am respected by the community |

| | | | |
|---|---|---|---|
| | *then ask:* Anything else? *Record all responses.* | G. People in the community know who I am<br>H. I feel that I am helping the community<br>I. Other (specify)_____<br>J. There are no advantages | |
| 2F21 | What are the disadvantages of being an CHW?<br><br>*Do not read the list to the CHW. Wait for the CHW to respond and then ask:* Anything else? *Record all responses.* | A. I have to work hard<br>B. I don't get paid any money<br>C. I don't have time to look after my family<br>D. I don't have time to do other things<br>E. When a child comes I have to interrupt my routine to help them<br>F. People say bad things about me<br>G. Other (specify)_____<br>H. There are no disadvantages | |
| 2F22 | Have you received a bicycle in return for doing CCM?<br><br>*Ensure that the CHW understands that you are asking about bicycles received for participation in the CCM/PMNCH program.* | (1) Yes<br>(2) No, but I have received a bicycle for another program<br>(3) No, I have not received any bicycle in the last four years | |

| 2G | DRUGS AND EQUIPMENT | | |
|---|---|---|---|
| 2G01 | Which of the following equipment do you have at the moment?<br><br>*Only list the equipment you can see with your own eyes.* | A. Functional watch or timing device<br>B. Source of clean water<br>C. Supplies to mix ORS (cup and spoon)<br>D. MUAC tape<br>E. Referral forms<br>F. Register of sick children<br>G. Box or bag for drug kit<br>H. Working bicycle<br>I. Other (specify)_____ | (1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No |
| 2G02 | Do you have a drug kit? | (1) Yes<br>(2) No → **2G15** | |
| 2G03 | Which of the following UNEXPIRED drugs do you have at the moment?<br><br>*Only list the UNEXPIRED drugs you can see with your own eyes.* | A. Cotrimoxazole<br>B. ORS<br>C. Zinc<br>D. ACT (infant)<br>E. ACT (child)<br>F. Paracetamol<br>G. Other<br>_____<br>H. Other<br>_____ | (1) Yes, quantity (no. of tablets)_____<br>(2) No<br>(1) Yes, quantity (no. of sachets)_____   (2) No<br>(1) Yes, quantity (no. of courses)_____   (2) No<br>(1) Yes, quantity (no. of courses)_____   (2) No<br>(1) Yes, quantity (no. of tablets)_____<br>(2) No<br>(1) Yes, quantity (no. of |

| | | | |
|---|---|---|---|
| | | J. Other _____ | courses)_____ (1) Yes, quantity (no. of courses)_____ |
| | | K. Other_____ _ | (1) Yes, quantity (no. of courses)_____ (1) Yes, quantity (no. of courses)_____ (1) Yes, quantity (no. of courses)_____ (1) Yes, quantity (no. of courses)_____ |
| 2G04 | Which of the following EXPIRED drugs do you have at the moment? **Only list the EXPIRED drugs you can see with your own eyes.** | A. Cotrimoxazole B. ORS C. Zinc D. ACT (infant) E. ACT (child) F. Paracetamol G. Other _____ H. Other _____ J. Other _____ K. Other_____ _ | (1) Yes, quantity (no. of tablets)_____ (2) No (1) Yes, quantity (no. of sachets)_____ (2) No (1) Yes, quantity (no. of tablets)_____ (2) No (1) Yes, quantity (no. of courses)_____ (2) No (1) Yes, quantity (no. of courses)_____ (2) No (1) Yes, quantity (no. of tablets)_____ (2) No (1) Yes, quantity (no. of courses)_____ (1) Yes, quantity (no. of courses)_____ (1) Yes, quantity (no. of courses)_____ (1) Yes, quantity (no. of courses)_____ |

*Check 2G03.* **Does the CHW have a stock-out of UNEXPIRED drugs for any of the listed drugs?**

        *(1) Yes → 2G05*
        *(2) No → 2G06*

| | | |
|---|---|---|
| 2G05 | **For each stock-out of UNEXPIRED drugs, ask:** Why do you not have any UNEXPIRED (name of drug)? **Record all responses.** | A. I didn't realize drugs were expired B. I have (expired) drugs so it's not a stock-out and I don't need to get more C. I haven't tried to get or buy any more drugs yet D. I tried to get drugs from the Health Facility but the Health Facility did not have any E. I don't have enough money to buy any more drugs at the moment F. Other (specify) _____ |
| 2G06 | Where do you keep these drugs? | (1) I leave the drugs at home in an unlocked container (bag or box) |

| | | | |
|---|---|---|---|
| | | (2) I leave the drugs at home in a locked container (bag or box) <br> (3) I carry the drugs with me at all times <br> (4) Other (specify) | |
| 2G07 | Have you experienced a stock-out in the last **three months** of any of the following drugs? <br><br> ***Make sure the CHW understands that you are talking about a stockout of UNEXPIRED drugs.*** <br><br> ***If yes, ask:*** How many weeks did the stock-out last? | A. Cotrimoxazole <br> B. ORS <br> C. Zinc <br> D. ACT (infant) <br> E. ACT (child) <br> F. Paracetamol | (1) Yes, duration (wks)_____ (2) No (3) Never rcvd <br> (1) Yes, duration (wks)_____ (2) No (3) Never rcvd <br> (1) Yes, duration (wks)_____ (2) No (3) Never rcvd <br> (1) Yes, duration (wks)_____ (2) No (3) Never rcvd <br> (1) Yes, duration (wks)_____ (2) No (3) Never rcvd <br> (1) Yes, duration (wks)_____ (2) No (3) Never rcvd |
| 2G08 | What do you usually do when you run out of drugs? <br><br> ***Ask:*** Anything else? <br> ***Record all responses.*** | A. I wait until someone from the Health Facility brings me more <br> B. I ask someone from the Health Facility to bring me more <br> C. I wait until my supervision <br> D. I buy them myself from the Health Facility <br> E. I get them myself for free from the Health Facility <br> F. I buy them myself from another source <br> G. Other (specify)_____ | |
| 2G09 | How many days or weeks has it been since the last time you got or bought more drugs? <br><br> ***If less than 7 days, circle (1) and record in days. If 7 days or more, circle (2) and record in weeks.*** | (1) __ days <br> (2) __ __ weeks <br> (8) Don't know | |
| 2G10 | How much does it cost for you as an CHW to BUY each of the following drugs? <br><br> ***Make sure the CHW understands that you are asking for the price per course/sachet/tablet,*** | A. Cotrimoxazole <br> B. ORS <br> C. Zinc <br> D. ACT (infant) <br> E. ACT (child) <br> F. Paracetamol | Price per tablet (fcfa) __ __ __ __ __ <br> Price per sachet (fcfa) __ __ __ __ __ <br> Price per tablet (fcfa) __ __ __ __ __ <br> Price per course (fcfa) __ __ __ __ __ <br> Price per course (fcfa) __ __ __ __ __ |

| | | | Price per tablet (fcfa) __ __ __ __ __ |
|---|---|---|---|
| | *as noted at right.* *If the CHW gets a drug for free, write '00000'. If there is no fixed price, record '99995'. If the CHW does not know, record '99998'* | | |
| 2G11 | How much do you usually SELL each of the following drugs for? *Make sure the CHW understands that you are asking for the price per course/sachet/tablet, as noted at right.* *If the CHW gives a drug for free, write '00000'. If there is no fixed price, record '99995'.* | A. Cotrimoxazole B. ORS C. Zinc D. ACT (infant) E. ACT (child) F. Paracetamol | Price per tablet (fcfa) __ __ __ __ __ Price per sachet (fcfa) __ __ __ __ __ Price per tablet (fcfa) __ __ __ __ __ Price per course (fcfa) __ __ __ __ __ Price per course (fcfa) __ __ __ __ __ Price per tablet (fcfa) __ __ __ __ __ |
| 2G12 | Approximately how many courses of each drug have you sold in the past **one month**? | A. Cotrimoxazole (<12 months) B. Cotrimoxazole (12 months +) C. ORS (1 sachet) D. Zinc (<6 months) E. Zinc (6 months +) F. ACT (infant) G. ACT (child) H. Paracetamol (1 tablet) | Courses __ __ Courses __ __ Sachets __ __ Courses __ __ Courses __ _ Courses __ __ Courses __ __ Tablets __ ___ |
| 2G13 | Do people ever come to you to get drugs without bringing a sick child? | (1) Yes (2) No ➔ **2G15** | |
| 2G14 | Do you ever sell or give drugs to people without seeing a sick child? | (1) Yes (2) No | |
| 2G15 | Where do people in this village get drugs for their children when their children are sick? *Do not read the list to the CHW. Wait for the CHW to respond and then ask:* Anywhere else? | A. From me (the CHW) B. Other CHW C. Health Facility or other health facility D. Local shop in this village E. Local shop in another village F. Private drug seller G. Market | |

| | Record all responses. | H. Other (specify)_____ |
|---|---|---|

| 2H | **REGISTER OF SICK CHILDREN** | |
|---|---|---|
| 2H01 | Do you keep a register of sick children that you have seen? | (1) Yes<br>(2) No → **2J** |
| 2H02 | How many of the children that you see do you record in the register? | (1) All<br>(2) Most<br>(3) Few<br>(4) None |

*The remaining questions should be answered by working with the CHW to abstract data from the CHW's patient register.*

| 2H03 | What information does the CHW usually record for children listed in the register? | A. Date of consultation<br>B. Name of child<br>C. Name of mother<br>D. Location of mother's household<br>E. Age of Child<br>F. Sex of child<br>G. Signs and symptoms<br>H. Classification<br>I. Breath count per minute (for ARI)<br>J. Drug prescribed<br>K. Drug dosage<br>L. Cost / amount paid for drugs<br>M. Referral<br>N. Other _____<br>O. Other _____<br>P. Other _____<br>Q. Other _____ | (1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never<br>(1) Always  (2) Sometimes  (3) Never |
|---|---|---|---|
| 2H04 | How many **total patients (all ages)** | __ __ __ | |

| | are listed in the register for the past three months? | |
|---|---|---|
| 2H05 | How many **newborns (0 to 2 months)** are listed in the register for the past three months? | __ __ __ |
| 2H06 | How many **children (2 to 59 months)** are listed in the register for the past three months? | __ __ __ |
| 2H07 | How many **children (2 to 59 months)** are listed in the register in the past three months as having the following classifications? | A. Pneumonia __ __ __<br>B. Diarrhea __ __ __<br>C. Malaria __ __ __ |
| 2H08 | How many children (2 to 59 months) are listed in the register in the past three months as having been given the following treatments? | A. Cotrimoxazole __ __ __<br>B. ORS __ __ __<br>C. Zinc __ __ __<br>D. ACT __ __ __<br>E. Paracetamol __ __ __ |
| 2H09 | How many children (2 to 59 months) are listed in the register in the past three months as having been referred to the Health Facility? | __ __ __ |
| **2J** | **SOCIO-ECONOMIC STATUS** | |
| 2J01 | Does your household have any of these items?<br><br>***Read list to CHW and answer yes/no for each item.*** | A. Radio<br>B. Television<br>C. Mobile<br>D. Table and chairs<br>E. Mattress<br>F. Gas/electric stove/hotplate<br>G. Improved cookstove<br>H. Fan | (1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No |
| 2J02 | Main material of the floor? | Natural floor<br>  (1) Earth/sand<br>  (2) Dung<br>Rudimentary floor<br>  (3) Wood planks<br>Finished floor<br>  (4) Ceramic tiles<br>  (5) Cement<br>(6) Other (specify) _____ | |
| 2J03 | Main material of the roof? | Natural roofing<br>  (1) No roof<br>  (2) Thatch/palm leaf<br>  (3) Mud/earth<br>Rudimentary roofing<br>  (4) Wood planks<br>Finished roofing | |

| | | |
|---|---|---|
| | | (5) Metal<br>(6) Cement<br>(7) Other (specify) _____ |
| 2J04 | Main material of the walls? | Natural walls<br>   (1) No walls<br>   (2) Cane/palm/trunks<br>   (3) Banco/earth/mud/sand<br>Rudimentary walls<br>   (4) Mud with straw (uncovered)<br>Finished walls<br>   (5) Banco/mud with straw covered with<br>      cement<br>   (6) Cement<br>   (7) Bricks<br>(8) Other (specify) _____ |

| 2J05 | Does any member of your household own any of these items?<br><br>***Read list to CHW and answer yes/no for each item.*** | A. Watch | (1) Yes  (2) No |
|---|---|---|---|
| | | B. Bicycle | (1) Yes  (2) No |
| | | C. Motorcycle/scooter | (1) Yes  (2) No |
| | | D. Cart | (1) Yes  (2) No |
| | | E. Plow | (1) Yes  (2) No |
| | | F. Donkey/mule | (1) Yes  (2) No |
| | | G. Cow | (1) Yes  (2) No |
| | | H. Sheep/goats | (1) Yes  (2) No |
| | | J. Poultry | (1) Yes  (2) No |

| | | |
|---|---|---|
| 2J06 | What kind of toilet facility do members of your household usually use? | (1) Flush/pour flush<br>(2) Pit latrine with slab<br>(3) Pit latrine without slab / open pit<br>(4) No facilities or bush or field → **END**<br>(5) Other (*specify*) _____ |
| 2J07 | Do you share this toilet facility with other households? | (1) Yes<br>(2) No |

# Form 3.  Observation

| 3A | ADMINISTRATION | | | |
|---|---|---|---|---|
| 3A01 | District | (1) Barsalogho | (4) Kaya | (7) Seguenega |
| | | (2) Boulsa | (5) Kongoussi | (8) Titao |
| | | (3) Gourcy | (6) Ouahigouya | (9) Yako |
| 3A02 | Village name | _____ | | |
| 3A03 | Village number | __ __ __ | | |
| 3A04 | Observer name | _____ | | |
| 3A05 | Observer number | __ __ | | |
| 3A06 | CHW name | _____ | | |
| 3A07 | CHW number | __ __ __ | | |
| 3A08 | Age of the caregiver in years *Record in completed years.* | __ __ | | |
| 3A10 | Age of child? *If less than 24 months, circle (1) and record age in months. If 24 months or more, circle (2) and record in completed years. If the caregiver gives the age as "1 year" or "2 years", probe to determine the age of the child in months. If the caregiver has a vaccination book for the child, you may use it to determine the child's age.* | (1) __ __ Months (2) __ __ Years | | |
| | Check 3A08, 3A09 and 3A10.   Is the caregiver aged at least 15 years? **(1) Yes** **(2) No → END** **Is the child aged 2 months to 4 years?** **(1) Yes** **(2) No → END** | | | |
| 3A11 | Does the caregiver give his or her consent for this observation? | (1) Yes (2) No → **END** | | |
| 3A12 | How did this child come to be seen by the CHW? | (1) Child was brought to CHW by caregiver (spontaneous) (2) Child was found as a result of door-to-door searching (recruited) | | |
| 3A13 | Date of observation | __ __ /__ __ /__ __ Day   Month   Year | | |
| 3A14 | Time observation began | __ __ h __ __ min | | |
| 3A15 | Caregiver name | _____ | | |
| 3A16 | Child name | _____ | | |

| 3A17 | Child number | __ __ |
|---|---|---|
| 3A18 | Sex of child? | (1) Male<br>(2) Female |
| **3B** | **ASSESSMENT** | |
| 3B01 | What reasons are given by the caregiver for the consultation?<br>***Record all reasons given by the caregiver.*** | A. Fast/difficult breathing<br>B. Cough<br>C. Diarrhea<br>D. Fever<br>E. Convulsions<br>F. Difficulty drinking or feeding<br>G. Vomiting<br>H. Other (specify) _____ |

*For the following questions "Available" means the information was already available. Either the caregiver spontaneously offers the information, or the caregiver already gave the information in response to a previous question, or the patient very obviously has the sign (e.g., convulsions, vomiting, etc.). "NA" means not applicable and should be circled ONLY if the CHW ended the observation and referred the child after observing a danger sign.*

| 3B02 | Danger signs | A. Does the CHW ask if the child is able to drink or breastfeed? | (1) Yes  (2) No  (3) Available (4) NA |
|---|---|---|---|
| | | B. Does the CHW **check** if the child is able to drink or breastfeed (*by offering water or breastmilk*)? | (1) Yes  (2) No  (3) Available (4) NA |
| | | C. Does the CHW ask if the child is vomiting everything? | (1) Yes  (2) No  (3) Available (4) NA |
| | | D. Does the CHW ask whether the child has convulsions? | (1) Yes  (2) No  (3) Available (4) NA |
| | | E. Does the CHW check for lethargy or unconsciousness (try to wake up the child)? | (1) Yes  (2) No  (3) Available (4) NA |
| | | F. Are any danger signs present (according to the CHW)? | (1) Yes<br>(2) No → **3B03** |
| | | G. Does the CHW immediately refer the child to the Health Facility or another health facility? | (1) Yes (2) No |

*If the CHW believes the child has a danger sign the observation must now be stopped, the re-examiner must confirm that the child has a danger sign, and if confirmed, the child must be immediately referred to the Health Facility. One of the data collectors must accompany the child and caregiver to the Health Facility.*

| 3B03 | Cough or difficult | A. Does the CHW ask if the child has cough or difficult breathing? | (1) Yes<br>(2) No → **3B04** |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | breathing | | (3) Available |
| | | B. Does the child have cough or difficult breathing? | (1) Yes<br>(2) No → **3B04** |
| | | C. Does the CHW ask how long the child has had cough or difficult breathing? | (1) Yes  (2) No  (3) Available |
| | | D. Does the CHW count breaths in 1 minute? | (1) Yes, number of breaths___<br>(2) No |
| | | E. Does the CHW look for chest indrawing? | (1) Yes  (2) No  (3) Available |
| 3B04 | Diarrhea | A. Does the CHW ask if the child has diarrhea (loose stools)? | (1) Yes<br>(2) No → **3B05**<br>(3) Available |
| | | B. Does the child have diarrhea? | (1) Yes<br>(2) No → **3B05** |
| | | C. Does the CHW ask how long the child has had diarrhea? | (1) Yes  (2) No  (3) Available |
| | | D. Does the CHW ask if there is blood in the stool? | (1) Yes  (2) No  (3) Available |
| | | E. Does the CHW check if the child is restless or irritable? | (1) Yes  (2) No  (3) Available |
| | | F. Does the CHW offer the child fluid? | (1) Yes  (2) No  (3) Available |
| | | G. Does the CHW pinch the skin of the abdomen? | (1) Yes  (2) No |
| | | H. Does the CHW check or ask the caregiver if the child's eyes are sunken? | (1) Yes  (2) No  (3) Available |
| 3B05 | Fever | A. Does the CHW ask or feel for fever (reported or now)? | (1) Yes<br>(2) No → **3B06**<br>(3) Available |
| | | B. Does the child have fever or history of fever (last 48 hours)? | (1) Yes<br>(2) No → **3B06** |
| | | C. Does the CHW ask how long the child has had fever? | (1) Yes  (2) No  (3) Available |
| | | D. Does the CHW ask if the fever has been present every day? | (1) Yes  (2) No  (3) Available |
| 3B06 | Malnutrition | A. Does the CHW press on both feet to look for swelling? | (1) Yes  (2) No |
| | | B. Does the CHW look for visible severe wasting? | (1) Yes  (2) No  (3) Available |

| | | C. Does the CHW measure the child's MUAC? | (1) Yes<br>(2) No → **3B07**<br>(3) Child <6 months →**3B07** |
|---|---|---|---|
| | | D. What is the child's MUAC measurement? | (1) <11 cm<br>(2) 11-<12.5 cm<br>(3) ≥12.5 cm |
| 3B07 | What other questions does the CHW ask? | (1) Yes, list all other questions<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>(2) No other questions | |
| 3B08 | What other actions does the CHW perform? | (1) Yes, list all other actions<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>(2) No other actions | |
| **3C** | **CLASSIFICATION** | | |
| *Ask the CHW what the child's classifications are. Ask "Any other classification?" until the CHW has stated all classifications. Do not ask for each specific classification.* | | | |
| 3C01 | Does the CHW give one or more classifications for the child? | (1) Yes<br>(2) No → **3D** | |
| 3C02 | Danger signs | A. One or more general danger signs (unable to drink or breastfeed, vomits everything, convulsions, lethargic/unconscious) | (1) Yes → *If the CHW classifies the child as having a danger sign the observation must be stopped, the re-examiner must confirm that the child has a danger sign, and if confirmed, the child must be immediately referred to the Health Facility. One of the data collectors must accompany the child and caregiver to the Health Facility.*<br><br>(2) No |
| 3C03 | Cough or difficult | A. Severe pneumonia/very severe disease | (1) Yes  (2) No |

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| | breathing | B. Pneumonia | (1) Yes  (2) No |
|---|---|---|---|
| | | C. No pneumonia: cough or cold | (1) Yes  (2) No |
| 3C04 | Diarrhea | A. Diarrhea, dehydration | (1) Yes  (2) No |
| | | B. Diarrhea, no dehydration | (1) Yes  (2) No |
| | | C. Persistent diarrhea | (1) Yes  (2) No |
| | | D. Dysentery | (1) Yes  (2) No |
| 3C05 | Fever | A. Very severe febrile disease | (1) Yes  (2) No |
| | | B. Fever / uncomplicated malaria | (1) Yes  (2) No |
| 3C06 | Malnutrition | A. Severe acute malnutrition | (1) Yes  (2) No |
| | | B. Moderate acute malnutrition | (1) Yes  (2) No |
| 3C07 | Does the CHW give any other classification? | (1) Yes, list all other classifications<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>(2) No other classifications | |

| **3D** | **TREATMENT** | | |
|---|---|---|---|
| *Record the treatment and instructions given by the CHW.* | | | |
| 3D01 | Does the CHW administer or prescribe any treatment? | (1) Yes<br>(2) No → **3E** | |
| 3D02 | Cotrimoxazole | A. Does the CHW give the caregiver cotrimoxazole? | (1) Yes<br>(2) No → **3D03** |
| | | B. How many cotrimoxazole tablets does the CHW give the caregiver? | Number of tablets \_\_ \_\_ |
| | | C. How many cotrimoxazole tablets should be given per dose? (as recommended by the CHW to the caregiver) | Tablets per dose \_\_ . \_\_<br>(9) Not specified |
| | | D. How many times should cotrimoxazole be given per day? (as recommended by the CHW to the caregiver) | Number \_\_<br>(9) Not specified |
| | | E. For how many days should cotrimoxazole be taken? (as recommended by the CHW to the caregiver) | Number\_\_ \_\_<br>(99) Not specified |

| | | F. Does the CHW ask the caregiver to repeat back the treatment instructions for cotrimoxazole? | (1) Yes<br>(2) No |
|---|---|---|---|
| 3D03 | ORS | A. Does the CHW give the caregiver ORS? | (1) Yes<br>(2) No → **3D04** |
| | | B. How many sachets of ORS does the CHW give the caregiver? | Number __ __<br>(9) Not specified |
| | | C. Does the CHW demonstrate how to prepare and administer ORS? | (1) Yes → **3D03E**<br>(2) No |
| | | D. Does the CHW tell the caregiver how to prepare and administer ORS? | (1) Yes<br>(2) No → **3D03F** |
| | | E. Does the CHW ask the caregiver to repeat back how to prepare and administer ORS? | (1) Yes<br>(2) No |
| | | F. Does the CHW give or ask the caregiver to give the first dose of ORS before leaving? | (1) Yes<br>(2) No |
| | | G. Does the CHW prescribe ORT with home fluids? | (1) Yes<br>(2) No → **3D04** |
| | | H. Which home fluids does the CHW advise for ORT? | (1) Clean water<br>(2) Sugar water<br>(3) Sugar-salt solution<br>(4) Other (specify) _____ |
| 3D04 | Zinc | A. Does the CHW give the caregiver zinc? | (1) Yes<br>(2) No → **3D05** |
| | | B. How many zinc tablets does the CHW give the caregiver? | Number of tablets __ __ |
| | | C. How many zinc tablets should be given per dose? (as recommended by the CHW to the caregiver) | Number __ . __<br>(9) Not specified |
| | | D. How many times should zinc be given per day? (as recommended by the CHW to the caregiver) | Number __<br>(9) Not specified |
| | | E. For how many days should zinc be taken? (as recommended by the CHW to the caregiver) | Number __ __<br>(99) Not specified |
| | | F. Does the CHW ask the caregiver to repeat back the treatment instructions zinc? | (1) Yes<br>(2) No |
| 3D05 | ACT | A. Does the CHW give the caregiver | (1) Yes |

| | | a course of ACT? | (2) No → **3D06** |
|---|---|---|---|
| | | B. How many ACT tablets does the CHW give the caregiver? | Number of tablets __ __ |
| | | C. How many ACT tablets should be given per dose? (as recommended by the CHW to the caregiver) | Number __ . __ <br> (9) Not specified |
| | | D. How many times should ACT be given per day? (as recommended by the CHW to the caregiver) | Number __ <br> (9) Not specified |
| | | E. For how many days should ACT be taken? (as recommended by the CHW to the caregiver) | Number __ __ <br> (99) Not specified |
| | | F. Does the CHW ask the caregiver to repeat back the treatment instructions for ACT? | (1) Yes <br> (2) No |
| 3D06 | Paracetamol | A. Does the CHW give the caregiver paracetamol? | (1) Yes <br> (2) No → **3D07** |
| | | B. How many paracetamol tablets does the CHW give the caregiver? | Number of tablets __ __ |
| | | C. How many paracetamol tablets should be given per dose? (as recommended by the CHW to the caregiver) | Number __ . __ <br> (9) Not specified |
| | | D. How many times should paracetamol be given per day? (as recommended by the CHW to the caregiver) | Number __ <br> (9) Not specified |
| | | E. For how many days should paracetamol be taken? (as recommended by the CHW to the caregiver) | Number __ __ <br> (95) Until the fever breaks <br> (99) Not specified |
| | | F. Does the CHW ask the caregiver to repeat back the treatment instructions for paracetamol? | (1) Yes <br> (2) No |
| 3D07 | Does the CHW give or prescribe other treatments? <br><br> ***Record all other treatments*** | (1) Yes, specify <br> _____ <br> _____ <br> _____ <br> _____ <br> _____ <br> _____ | |

| | | _____ _____ (2) No |
|---|---|---|
| **3E** | **REFERRAL** | |
| 3E01 | Does the CHW refer the child to the Health Facility or another health facility? | (1) Yes<br>(2) No → **3F** |
| 3E02 | What was the reason for referral? | (1) Severe illness / danger signs<br>(2) Other _____ |
| 3E03 | Does the CHW explain the need for referral to the caregiver? | (1) Yes  (2) No |
| 3E04 | Does the CHW write a referral note? | (1) Yes  (2) No |
| 3E05 | Does the CHW give a pre-printed referral form? | (1) Yes  (2) No |
| 3E06 | Does the CHW arrange transportation? | (1) Yes  (2) No |
| **3F** | **ADVISING ON HOME CARE** | |
| 3F01 | Does the CHW advise on home care? | (1) Yes<br>(2) No → **END** |
| 3F02 | Does the CHW advise to go to the Health Facility or return to the CHW if the child cannot drink or breastfeed? | (1) Yes  (2) No |
| 3F03 | Does the CHW advise to go to the Health Facility or return to the CHW if the child becomes sicker? | (1) Yes  (2) No |
| 3F04 | Does the CHW advise caregiver to increase fluids? | (1) Yes  (2) No |
| 3F05 | Does the CHW advise caregiver to continue feeding? | (1) Yes  (2) No |
| 3F06 | Does the CHW advise to continue breastfeeding and/or breastfeed more frequently? | (1) Yes  (2) No |
| 3F07 | Does the CHW advise on when to return to the CHW for follow-up? | (1) Yes  (2) No |

# Form 4.  Re-examination

| 4A | ADMINISTRATION | | |
|---|---|---|---|
| 4A01 | District | (1) Barsalogho<br>(2) Boulsa<br>(3) Gourcy | (4) Kaya<br>(5) Kongoussi<br>(6) Ouahigouya | (7) Seguenega<br>(8) Titao<br>(9) Yako |
| 4A02 | Village name | _____ | | |
| 4A03 | Village number | __ __ __ | | |
| 4A04 | Re-examiner name | _____ | | |
| 4A05 | Re-examiner number | __ __ | | |
| 4A06 | CHW name | _____ | | |
| 4A07 | CHW number | __ __ __ | | |
| 4A08 | Date of re-examination | __ __ /__ __ /__ __<br>Day   Month   Year | | |
| 4A09 | Time re-examination began | __ __ h __ __ min | | |
| 4A10 | Caregiver name | _____ | | |
| 4A11 | Child name | _____ | | |
| 4A12 | Child number<br><br>***CHECK THAT THIS NUMBER IS THE SAME AS IN FORM 3 (OBSERVATION).*** | __ __ | | |
| 4B | ASSESSMENT | | |
| 4B01 | What reasons are given by the caregiver for the consultation?<br>***Record all reasons given by the caregiver.*** | A. Fast/difficult breathing<br>B. Cough<br>C. Diarrhea<br>D. Fever<br>E. Convulsions<br>F. Difficulty drinking or feeding<br>G. Vomiting | | |

| | | H. Other (specify) _____ | |
|---|---|---|---|
| 4B02 | Danger signs | A. Is the child **unable** to drink or breastfeed? | (1) Yes  (2) No |
| | | B. Does the child vomit everything? | (1) Yes  (2) No |
| | | C. Has the child had convulsions? | (1) Yes  (2) No |
| | | D. Is the child lethargic or unconscious? | (1) Yes  (2) No |

*If the child has one or more danger signs the re-examiner must stop the re-examination and the child should be immediately referred to the Health Facility. One of the data collectors should accompany the child and caregiver to the Health Facility.*

| | | | |
|---|---|---|---|
| 4B03 | Cough or difficult breathing | A. Does the child have cough or difficult breathing? | (1) Yes (2) No ➔ **4B04** |
| | | B. How long has the child had cough or difficult breathing? | Number of days__ __ |
| | | C. How many breaths does the child have in 1 minute? | Breaths per minute __ __ |
| | | D. Does the child have chest indrawing? | (1) Yes  (2) No |
| | | E. Does the child have stridor? | (1) Yes  (2) No |
| 4B04 | Diarrhea | A. Does the child have diarrhea? | (1) Yes (2) No ➔ **4B05** |
| | | B. How long has the child had diarrhea? | Number of days __ __ |
| | | C. Is there blood in the stool? | (1) Yes  (2) No |
| | | D. Is the child restless or irritable? | (1) Yes  (2) No |
| | | E. Does the child have sunken eyes? | (1) Yes  (2) No |
| | | F. Is the child **not** able to drink or drinking poorly? | (1) Yes  (2) No |
| | | G. Is the child drinking eagerly, thirsty? *(Offer the child water to drink)* | (1) Yes  (2) No |
| | | H. Does the abdomen skin pinch go back slowly (less than 2 seconds)? | (1) Yes  (2) No |
| | | I. Does the abdomen skin pinch go back very slowly (longer than 2 seconds)? | (1) Yes  (2) No |
| 4B05 | Fever | A. Does the child have fever or history of fever (last 48 hrs)? | (1) Yes (2) No ➔ **4B06** |
| | | B. How long has the child had fever? | Number of days__ __ |
| | | C. Was the fever present every day? | (1) Yes  (2) No |

| | | D. Does the child have a stiff neck? | (1) Yes  (2) No |
|---|---|---|---|
| | | E. If child is **less than 1 year**, does the child have bulged fontanel? | (1) Yes  (2) No  (9) NA |
| 4B06 | Measles | A. Does the child have signs of measles or a history of measles in the last 3 months? (generalized rash with cough OR runny nose OR red eyes) | (1) Yes  (2) No →**4B07** |
| | | B. Does the child have mouth ulcers? | (1) Yes  (2) No |
| | | C. Does the child have pus draining from the eye? | (1) Yes  (2) No |
| | | D. Does the child have clouding of the cornea? | (1) Yes  (2) No |
| 4B07 | Malnutrition | A. Does child have pitting edema of **both** feet? | (1) Yes  (2) No |
| | | B. If **younger than 6 months**, does child have visible severe wasting? | (1) Yes  (2) No  (9) NA |
| | | C. If **6 months or older**, what is the child's MUAC measurement? | (1) <11 cm<br>(2) 11-<12.5 cm<br>(3) ≥12.5 cm<br>(9) NA |
| | | D. If **6 months or older** AND MUAC < 11 cm OR bilateral edema, did the child pass an appetite test? | (1) Yes  (2) No  (9) NA |
| | | E. If **6 months or older**, does the child have any complicating condition? (pneumonia, watery diarrhea, dysentery, fever/low temperature) | (1) Yes  (2) No  (9) NA |
| 4B08 | Anemia | A. Does the child have moderate palmar pallor? | (1) Yes  (2) No |
| | | B. Does the child have severe palmar pallor? | (1) Yes  (2) No |
| **4C** | **CLASSIFICATION** | | |
| 4C01 | Danger signs | A. One or more general danger signs (unable to drink or breastfeed, vomits everything, convulsions, lethargic/unconscious) | (1) Yes → *If the child has one or more danger signs the re-examiner must stop the re-examination and the child should be immediately referred to the Health Facility. One of the data collectors should accompany the child and caregiver to the Health Facility.*<br><br>(2) No |

| 4C02 | Cough or difficult breathing | A. Severe pneumonia/very severe disease | (1) Yes  (2) No |
| --- | --- | --- | --- |
| | | B. Pneumonia | (1) Yes  (2) No |
| | | C. No pneumonia: cough or cold | (1) Yes  (2) No |
| 4C03 | Diarrhea | A. Diarrhea, dehydration | (1) Yes  (2) No |
| | | B. Diarrhea, no dehydration | (1) Yes  (2) No |
| | | C. Persistent diarrhea | (1) Yes  (2) No |
| | | D. Dysentery | (1) Yes  (2) No |
| 4C04 | Fever | A. Very severe febrile disease | (1) Yes  (2) No |
| | | B. Fever, possible malaria | (1) Yes  (2) No |
| 4C05 | Malnutrition | A. Severe complicated acute malnutrition | (1) Yes  (2) No |
| | | B. Severe uncomplicated acute malnutrition | (1) Yes  (2) No |
| | | C. Moderate acute malnutrition | (1) Yes  (2) No |
| 4C06 | Measles | A. Complicated measles | (1) Yes  (2) No |
| | | B. Uncomplicated measles | (1) Yes  (2) No |
| 4C07 | Anemia | A. Severe anemia | (1) Yes  (2) No |
| | | B. Moderate anemia | (1) Yes  (2) No |

| 4C06 | Are any other classifications appropriate for this child? | (1) Yes, list all classifications<br>_____<br>_____<br>_____<br>_____<br>(2) No |
| --- | --- | --- |

| **4D** | **VERIFICATION** |
| --- | --- |

*Following the re-examination the re-examiner should check the CHW's treatment and ensure that the correct treatment is given to the child and the correct counseling is given to the caregiver. Once the child and caregiver have left, the re-examiner should provide feedback to the CHW on any incorrect classification, treatment or referral decisions.*

| 4D01 | Did the re-examiner check the CHW's classification and treatment and ensure that the correct treatment is given to the child and the correct counseling is given to the caregiver? | (1) Yes  (2) No |
| --- | --- | --- |

# Form 5.  Caregiver Questionnaire

| 5A | ADMINISTRATION |  |  |  |
|---|---|---|---|---|
| REMINDER: This interview should be held out of sight and ear-shot from the CHW, to the extent possible. | | | | |
| 5A01 | District | (1) Barsalogho<br>(2) Boulsa<br>(3) Gourcy | (4) Kaya<br>(5) Kongoussi<br>(6) Ouahigouya | (7) Seguenega<br>(8) Titao<br>(9) Yako |
| 5A02 | Village name | _____ | | |
| 5A03 | Village number | __ __ __ | | |
| 5A04 | Interviewer name | _____ | | |
| 5A05 | Interviewer number | __ __ | | |
| 5A06 | CHW name | _____ | | |
| 5A07 | CHW number | __ __ __ | | |
| 5A08 | Date of interview | __ __ /__ __ /__ __<br>Day  Month  Year | | |
| 5A09 | Time interview began | __ __ h __ __ min | | |
| 5A10 | Caregiver name | _____ | | |
| 5A11 | Child name | _____ | | |
| 5A12 | Child number<br><br>**CHECK THAT THIS NUMBER IS THE SAME AS IN FORM 3 (OBSERVATION).** | __ __ | | |
| 5B | DEMOGRAPHICS | | | |
| 5B01 | Relationship to child? | (01) Mother<br>(02) Step-Mother<br>(03) Father<br>(04) Brother | | |

| | | (05) Sister<br>(06) Grandmother<br>(07) Grandfather<br>(08) Aunt<br>(09) Uncle<br>(10) Cousin<br>(11) Neighbor<br>(12) Other (specify) _____ |
|---|---|---|
| 5B02 | Are you the child's primary caregiver? | (1) Yes<br>(2) No |
| 5B03 | How old were you at your last birthday? | Age __ __ |
| 5B04 | Sex? | (1) Male<br>(2) Female |
| 5B05 | Ethnicity? | (01) Mossi (07) Bissa (12) Samo<br>(02) Peulh (08) Bobo (13) Sénoufo<br>(03) Gourmantché (09) Dioula (14) Touareg<br>(04) Nuni (10) Other (15) Other<br>(05) Kassena Gourounsi (specify)<br>(06) Bella (11) Lobi _____ |
| 5B06 | What is your marital status? | (1) Married (traditional, religious, or civil marriage)<br>(2) Single, cohabitating<br>(3) Separated/divorced<br>(4) Widowed<br>(5) Single<br>(6) Other _____ |
| 5B07 | Did you ever go to school? | (1) Yes<br>(2) No →**5B10** |
| 5B08 | What is the highest level of school that you attended: Primary, Secondary 1 (first cycle), Secondary 2 (second cycle) or Tertiary? | (1) Primary<br>(2) Secondary (first cycle)<br>(3) Secondary (second cycle)<br>(4) Tertiary |
| 5B09 | What was the highest class you achieved at this level of school?<br><br>*See codes listed below.* | Class __ |

**Codes for highest class achieved**

| LEVEL | PRIMARY | SEC 1ST CYCLE | SEC 2ND CYCLE | SUPERIEUR | |
|---|---|---|---|---|---|
| CLASS | 0= LESS THAN 1 YEAR COMPLETED | | | | |
| | CP=1 | 6EME=1 | 2ND=1 | 1ST YR=1 | |
| | CP2=2 | 5EME=2 | 1ERE=2 | 2ND YR=2 | |
| | CE1=3 | 4EME=3 | TERMINALE=3 | 3RD YR=3 | |
| | CE2=4 | 3EME=4 | FPB=4 | 4TH YR=4 | |
| | CM1=5 | FPP=5 | NSP=8 | 5TH YR OR +=5 | |
| | CM2=6 | DK=8 | | DK=8 | |
| | DK=8 | | | | |

| 5C | SATISFACTION AND CARE-SEEKING |
|---|---|

| 5C01 | Were you satisfied with the services the child received today from this CHW?<br><br>**If "no", ask:** Why were you not satisfied? | (1) Yes<br>(2) No, (reason) _____ |
|---|---|---|
| 5C02 | The next time the child is sick, will you see the CHW?<br><br>**If "no", ask:** Why won't you see the CHW? | (1) Yes<br>(2) No, (reason) _____<br>(3) Don't know |
| 5C03 | When did the child get sick?<br><br>**If 'Today', ask:** How many hours ago did he/she get sick?<br><br>**If less than 1 hour, record '00'. If 'Today', circle (1) and record in completed hours. If more than 1 day,, circle (3) and record the response in completed days.** | (1) Today, hours ago __ __<br>(2) Yesterday<br>(3) Days ago __ __ |
| | *Check: How did this child come to be seen by the CHW?*<br>*(1) Child was brought to CHW by caregiver (spontaneous) → 5C04*<br>*(2) Child was found as a result of door-to-door searching (recruited) → 5C05* | |
| 5C04 | When did you start to look for the CHW?<br><br>**If 'Today', ask:** How many hours ago did you start to look for the CHW? | (1) Today, hours ago__ __<br>(2) Yesterday<br>(3) Days ago__ __ |

| | *If less than 1 hour, record '00'. If 'Today', circle (1) and record in completed hours. If more than 1 day, circle (3) and record the response in completed days.* | |
|---|---|---|
| 5C05 | Was advice or care or a treatment sought from anyone else for the child (other than the CHW)?<br><br>*If "no", be sure that the caregiver did not seek help from anyone else. Prompt by asking about family members, friends, other people in the community.* | (1) Yes<br>(2) No ➔ **5C09**<br>(8) Don't know ➔**5C09** |
| 5C06 | Who did you seek care from **first**? | (01) Family member<br>(02) Friend<br>(03) Traditional healer<br>(04) TBA<br>(05) Drug vendor<br>(06) Health Facility<br>(07) Pharmacy<br>(08) Don't know ➔**5C09**<br>(09) Local shop<br>(10) Other (specify) _____ |
| 5C07 | Who did you seek care from **next**? | (01) Family member<br>(02) Friend<br>(03) Traditional healer<br>(04) TBA<br>(05) Drug vendor<br>(06) Health Facility<br>(07) Pharmacy<br>(08) NA (Didn't seek care from anyone else) ➔**5C09**<br>(09) Local shop<br>(10) Other (specify) _____ |
| 5C08 | Who did you seek care from **next**? | (01) Family member<br>(02) Friend<br>(03) Traditional healer<br>(04) TBA<br>(05) Drug vendor<br>(06) Health Facility<br>(07) Pharmacy<br>(08) NA (Didn't seek care from anyone else)<br>(09) Local shop<br>(10) Other (specify) _____ |
| 5C09 | Before the consultation with the CHW, did the child receive any treatment for this | (1) Yes<br>(2) No ➔ **5D** |

| | illness? | | |
|---|---|---|---|
| 5C10 | What type of treatment did the child receive before the consultation with the CHW?<br><br>***Check all that apply.*** | | (1) Traditional medicine<br>(2) Home remedy (including infusions)<br>(3) Tablet<br>(4) Syrup<br>(5) Injection<br>(6) Other (specify)_____ |
| **5D** | **MEDICATIONS PRESCRIBED AND UNDERSTANDING** | | |
| 5D01 | FIRST medicine | A. Did the CHW give you any medicines for your child today? | (1) Yes<br>(2) No → **5D08**<br>(3) Referred → **5D08** |
| | | B. What was the FIRST medicine given to you by the CHW? | (1) Cotrimoxazole<br>(2) ORS<br>(3) Zinc<br>(4) ACT<br>(5) Paracetamol<br>(6) Other (specify) _____<br>(8) Don't know |
| | | C. How much will you give the child each time? | (1) __ . __ tablets<br>(2) __ sachets |
| | | D. How many times will you give it to the child each day? | Times per day __ __<br>(98) Don't know |
| | | E. For how many days will you give the medicine to the child? | Number of days __ __<br>(95) Until the fever breaks<br>(96) Until the symptoms are gone<br>(98) Don't know |
| 5D02 | SECOND medicine | A. Did the CHW give you a SECOND medicine for the child today? | (1) Yes<br>(2) No → **5D05** |
| | | B. What was this medicine? | (1) Cotrimoxazole<br>(2) ORS<br>(3) Zinc<br>(4) ACT<br>(5) Paracetamol<br>(6) Other (specify) _____<br>(8) Don't know |
| | | C. How much will you give the child each time? | (1) __ . __ tablets<br>(2) __ sachets |
| | | D. How many times will you give it to the child each day? | Times per day __ __<br>(98) Don't know |
| | | E. For how many days will you | Number of days __ __ |

| | | give the medicine to the child? | (95) Until the fever breaks<br>(96) Until the symptoms are gone<br>(98) Don't know |
|---|---|---|---|
| 5D03 | THIRD medicine | A. Did the CHW give you a THIRD medicine for the child today? | (1) Yes<br>(2) No → **5D05** |
| | | B. What was this medicine? | (1) Cotrimoxazole<br>(2) ORS<br>(3) Zinc<br>(4) ACT<br>(5) Paracetamol<br>(6) Other (specify)_____<br>(8) Don't know |
| | | C. How much will you give the child each time? | (1) __ . __ tablets<br>(2) __ sachets |
| | | D. How many times will you give it to the child each day? | Times per day __ __<br>(98) Don't know |
| | | E. For how many days will you give the medicine to the child? | Number of days __ __<br>(95) Until the fever breaks<br>(96) Until the symptoms are gone<br>(98) Don't know |
| 5D04 | FOURTH medicine | A. Did the CHW give you a FOURTH medicine for the child today? | (1) Yes<br>(2) No → **5D05** |
| | | B. What was this medicine? | (1) Cotrimoxazole<br>(2) ORS<br>(3) Zinc<br>(4) ACT<br>(5) Paracetamol<br>(6) Other _____<br>(8) Don't know |
| | | C. How much will you give the child each time? | (1) __ . __ tablets<br>(2) __ sachets |
| | | D. How many times will you give it to the child each day? | Times per day __ __<br>(98) Don't know |
| | | E. For how many days will you give the medicine to the child? | Number of days __ __<br>(95) Until the fever breaks<br>(96) Until the symptoms are gone<br>(98) Don't know |
| 5D05 | *Check 5D01B - 5D04B.  Was ORS given?* | | (1) Yes →5D06<br>(2) No →5D08 |
| 5D0 | Did the CHW demonstrate how to mix the | | (1) Yes |

| | | |
|---|---|---|
| 6 | ORS solution? | (2) No<br>(8) Don't know |
| 5D07 | How much water will you mix with one ORS packet?<br><br>***If a non-numerical answer is given, probe for a numerical answer. If the answer is given in terms of a standard size plastic bottle (0.5 L or 1.5 L), record the corresponding number of liters.*** | __ . __ __ liters<br>(998) Don't know |
| 5D08 | Did the CHW tell you to take the child to the Health Facility or another health facility? | (1) Yes<br>(2) No → **5D10**<br>(8) Don't know |
| 5D09 | Will you take the child to the Health Facility or another health facility?<br><br>***If "no", ask:*** Why will you not take the child to the Health Facility? | (1) Yes<br>(2) No, (reason) _____<br>(8) Don't know |
| 5D10 | What form of transport do you usually take to get to the Health Facility? | (1) On foot<br>(2) Bicycle<br>(3) Moto<br>(4) Taxi<br>(5) Other (specify)_____ |
| 5D11 | Using this form of transport, how long does it usually take you to get to the Health Facility?<br><br>***Probe for a numerical response. If less than 1 hour, circle (1) and record in minutes. If 1 hour or more, circle (2) and record in hours.*** | (1) ___ ___ minutes<br>(2) ___ ___ hours |
| 5D12 | How much money does the trip to the Health Facility usually cost you?<br><br>***If it costs nothing, record '00000'*** | (1) Yes, amount __ __ __ __ __ fcfa<br>(99998) NSP |
| **5E** | **SOCIO-ECONOMIC STATUS** | |
| 5E01 | Does your household have any of these items?<br><br>***Read the list and answer yes/no for each item.*** | A. Radio<br>B. Television<br>C. Mobile<br>D. Table and chairs<br>E. Mattress<br>F. Gas/electric stove/hotplate<br>G. Improved cookstove<br>H. Fan | (1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No |

| | | |
|---|---|---|
| 5E02 | What is the main material of the floor of your principal dwelling? | Natural floor<br>  (1) Earth/sand<br>  (2) Dung<br>Rudimentary floor<br>  (3) Wood planks<br>Finished floor<br>  (4) Ceramic tiles<br>  (5) Cement<br>(6) Other (specify) _____ |
| 5E03 | What is the main material of the roof of your principal dwelling? | Natural roofing<br>  (1) No roof<br>  (2) Thatch/palm leaf<br>  (3) Mud/earth<br>Rudimentary roofing<br>  (4) Wood planks<br>Finished roofing<br>  (5) Metal<br>  (6) Cement<br>(7) Other (specify) _____ |
| 5E04 | What is the main material of the walls of your principal dwelling? | Natural walls<br>  (1) No walls<br>  (2) Cane/palm/trunks<br>  (3) Banco/earth/mud/sand<br>Rudimentary walls<br>  (4) Mud with straw (uncovered)<br>Finished walls<br>  (5) Banco/mud with straw covered with cement<br>  (6) Cement<br>  (7) Bricks<br>(8) Other (specify) _____ |

| | | | |
|---|---|---|---|
| 5E05 | Does any member of your household own any of these items?<br><br>**_Read the list and answer yes/no for each item._** | A. Watch<br>B. Bicycle<br>C. Motorcycle/scooter<br>D. Cart<br>E. Plow<br>F. Donkey/mule<br>G. Cow<br>H. Sheep/goats<br>J. Poultry | (1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No<br>(1) Yes  (2) No |

| | | |
|---|---|---|
| 5E06 | What kind of toilet facility do members of your household usually use? | (1) Flush/pour flush<br>(2) Pit latrine with slab<br>(3) Pit latrine without slab / open pit<br>(4) No facilities or bush or field → **END**<br>(5) Other (_specify_) _____ _____ |
| 5E07 | Do you share this toilet facility with other households? | (1) Yes<br>(2) No |

# Form 6.  Case Scenarios

| 6A | ADMINISTRATION | |
|----|----------------|---|
| 6A01 | District | (1) Barsalogho (4) Kaya (7) Seguenega<br>(2) Boulsa (5) Kongoussi (8) Titao<br>(3) Gourcy (6) Ouahigouya (9) Yako |
| 6A02 | Village name | _____ |
| 6A03 | Village number | __ __ __ |
| 6A04 | Interviewer name | _____ |
| 6A05 | Interviewer number | __ __ |
| 6A06 | CHW name | _____ |
| 6A07 | CHW number | __ __ __ |
| 6A08 | Date of case scenarios interview? | __ __ / __ __ / __ __<br>Day   Month   Year |
| 6A09 | Time case scenarios began | __ __ h __ __ min |
| 6B | SCENARIOS | |

*Tell the CHW:* Now I will read you some case scenarios to know your usual practice in specific situations. After I read each scenario, I will ask you to tell me what actions you would take to examine treat the child. You can refer to any manuals or other materials you may have. These scenarios will not be used to judge your practice and the information collected will not be communicated to your supervisor, Health Facility, or district, regional, or central level MOH authorities.

You should assume that you have the authority to decide whether or not to refer a child to the Health Facility, that all the drugs and materials you need are available in your drug box, and that there is a referral facility 20 minutes away.

Before we begin, do you have any concerns?

*Address any CHW concerns <u>before</u> beginning the first case scenario.*

| | | |
|---|---|---|
| ***Read Scenario 1 to the CHW:*** | | |

SCENARIO 1. A mother brings her 6 month old baby daughter to you. She says the girl is having diarrhea.

***Next, ask the CHW:*** Please describe what questions you would ask the mother in order to classify the child. If you would like to hear the case scenario again, I will repeat it any time you like.

| 6B01 | Which of the following questions does the CHW ask in response to SCENARIO 1?<br><br>***Do not read the answer choices to the CHW. When the CHW explains what questions he/she will ask, circle the appropriate answer choices listed. When the CHW is finished, ask*** "Anything else?"<br><br>***Continue asking until the CHW has no further questions for the case.*** | A. Is she able to eat and drink?<br>B. Is she vomiting everything?<br>C. Has she had any convulsions recently?<br>D. For how many days has she had diarrhea?<br>E. Is there any blood in the stool?<br>F. Has she had a fever in the past 2 days?<br>G. Does she have a cough or difficulty breathing?<br>H. Does she have any other problems?<br>J. Other (specify)_____ |
|---|---|---|

***Next, ask the CHW:*** Please explain how you would examine this child, including any actions you would take in order to determine how to classify and treat the child. Assume that you have all needed materials. If you would like to hear the case scenario again, I will repeat it any time you like.

| 6B02 | Which of the following actions does the CHW propose in response to SCENARIO 1?<br><br>***Do not read the answer choices to the CHW. When the CHW explains what actions he/she will take to examine the child, circle the appropriate answer choices listed. When the CHW is finished, ask:*** "Anything else?"<br><br>***Continue asking until the CHW has no further actions for the case.*** | A. Observe whether the child is lethargic or unconscious<br>B. Try to wake the child up, if she is not awake<br>C. Offer the child something to drink<br>D. Observe whether the child is having convulsions<br>E. Count the number of breaths in one minute<br>F. Check for chest indrawing<br>G. Pinch the skin of the abdomen to check for dehydration<br>H. Check if the child's eyes are sunken<br>J. Observe whether the child is agitated or irritable<br>K. Check whether the child has a fever<br>L. Check the child's MUAC measurement<br>M. Look for visible severe wasting<br>N. Press on both feet to check for bilateral edema |
|---|---|---|

| | | |
|---|---|---|
| **Read Scenario 2 to the CHW:** | | |
| SCENARIO 2. A mother brings her 18 month old son to you. She says he has been coughing. | | |
| **Next, ask the CHW:** Please describe what questions you would ask the mother in order to classify the child. If you would like to hear the case scenario again, I will repeat it any time you like. | | |

| 6B03 | Which of the following questions does the CHW ask in response to SCENARIO 2? **Do not read the answer choices to the CHW. When the CHW explains what questions he/she will ask, circle the appropriate answer choices listed. When the CHW is finished, ask** "Anything else?" **Continue asking until the CHW has no further questions for the case.** | A. Is he able to eat and drink? <br> B. Is he vomiting everything? <br> C. Has he had any convulsions recently? <br> D. For how many days has he been coughing? <br> E. Does he have diarrhea? <br> F. Is there blood in the stool? <br> G. Has he had a fever in the past 2 days? <br> H. Does he have any other problems? <br> J. Other (specify)_____ |
|---|---|---|

**Next, ask the CHW:** Please explain how you would examine this child, including any actions you would take in order to determine how to classify and treat the child. Assume that you have all needed materials. If you would like to hear the case scenario again, I will repeat it any time you like.

| 6B04 | Which of the following actions does the CHW propose in response to SCENARIO 2? **Do not read the answer choices to the CHW. When the CHW explains what actions he/she will take to examine the child, circle the appropriate answer choices listed. When the CHW is finished, ask:** "Anything else?" **Continue asking until the CHW has no further actions for the case.** | A. Observe whether the child is lethargic or unconscious <br> B. Try to wake the child up, if she is not awake <br> C. Offer the child something to drink <br> D. Observe whether the child is having convulsions <br> E. Count the number of breaths in one minute <br> F. Check for chest indrawing <br> G. Pinch the skin of the abdomen to check for dehydration <br> H. Check if the child's eyes are sunken <br> J. Observe whether the child is agitated or irritable <br> K. Check whether the child has a fever <br> L. Check the child's MUAC measurement <br> M. Look for visible severe wasting <br> N. Press on both feet to check for bilateral edema |
|---|---|---|

*Read Scenario 3 to the CHW:*

SCENARIO 3.  A two-year-old little girl is taken to the CHW. She has a lot of diarrhea, has been eating poorly, and is vomiting. When asked, the mother states she has had diarrhea for ten days. There is no blood in the stool. She also began vomiting Yesterday and has not eaten anything since. The CHW examines the child and finds the little girl to be very weak, but still alert. The CHW helps the mother to feed her child some porridge at the clinic, and the girl vomits everything. The CHW tries to give her ORS but she refuses to take it. No other problems are found.

*Next, ask the CHW:* Please explain how you would manage this child, including any actions you would take or drugs you would provide to give this child the most appropriate treatment.  Assume that you have all needed drugs and that the nearest referral facility is 20 minutes away.  If you would like to hear the case scenario again, I will repeat it any time you like.

| 6B05 | Which of the following actions does the CHW propose in response to SCENARIO 3? *Do not read the answer choices to the CHW. When the CHW explains how he/she will manage the child, circle the appropriate answer choices listed. When the CHW is finished, ask:* "Anything else?" *Continue asking until the CHW has no further management for the case.* | A. Give three sachets of ORS<br>B. Give the child ORS<br>C. Help caregiver to give the child ORS<br>D. Give zinc for 10 days<br>E. Give an ACT for 3 days<br>F. Give first dose of ACT<br>G. Advise caregiver on use of ITN<br>H. Give Cotrimoxazole for 8 days<br>J. Give first dose of Cotrimoxazole<br>K. Give paracetamol tablets<br>L. Give the first dose of paracetamol<br>M. Refer to health facility<br>N. Write a referral note<br>O. Give a pre-printed referral form<br>P. Arrange transportation to health facility<br>Q. Advise to give fluids and continue feeding<br>R. Advise to keep child warm if not hot with fever<br>S.  Advise to wrap the child in a wet cloth if hot with fever<br>T. Advise caregiver on when to return to CHW or to a health facility<br>U. Follow up child at home |
|------|------|------|

*Read Scenario 4 to the CHW:*

SCENARIO 4.  A 15-month-old girl is taken to the CHW because she is coughing. The CHW inquires to the mother for how long she has been coughing and learns that the girl has had a cough for about 10 days. The mother does not believe there has been fever, vomiting or diarrhea. The CHW examines the child and finds that she is breathing about 55 times per minute. There is no chest indrawing.

*Next, ask the CHW:* Please explain how you would manage this child, including any actions you would take or drugs you would provide to give this child the most appropriate treatment.  Assume

that you have all needed drugs and that the nearest referral facility is 20 minutes away.  If you would like to hear the case scenario again, I will repeat it any time you like.

| 6B06 | Which of the following actions does the CHW propose in response to SCENARIO 4?<br><br>***Do not read the answer choices to the CHW. When the CHW explains how he/she will manage the child, circle the appropriate answer choices listed. When the CHW is finished, ask:*** "Anything else?"<br><br>***Continue asking until the CHW has no further management for the case.*** | A. Give three sachets of ORS<br>B. Give the child ORS<br>C. Help caregiver to give the child ORS<br>D. Give zinc for 10 days<br>E. Give an ACT for 3 days<br>F. Give first dose of ACT<br>G. Advise caregiver on use of ITN<br>H. Give Cotrimoxazole for 8 days<br>J. Give first dose of Cotrimoxazole<br>K. Give paracetamol tablets<br>L. Give the first dose of paracetamol<br>M. Refer to health facility<br>N. Write a referral note<br>O. Give a pre-printed referral form<br>P. Arrange transportation to health facility<br>Q. Advise to give fluids and continue feeding<br>R. Advise to keep child warm if not hot with fever<br>S.  Advise to wrap the child in a wet cloth if hot with fever<br>T. Advise caregiver on when to return to CHW or to a health facility<br>U. Follow up child at home |

***Read Scenario 5 to the CHW:***

SCENARIO 5.  An 11-month-old boy is brought to the home of an CHW for fever and cough. When asked, the mother says he is breastfeeding normally although he is not eating solid foods. The cough began about 3 days ago. The fever has been low grade for just over one week. The CHW looks at the boy from head to toe, feels that he is warm.  The CHW counts 56 breaths per minute.  There are no other problems.

***Next, ask the CHW:*** Please explain how you would manage this child, including any actions you would take or drugs you would provide to give this child the most appropriate treatment.  Assume that you have all needed drugs and that the nearest referral facility is 20 minutes away.  If you would like to hear the case scenario again, I will repeat it any time you like.

| 6B07 | Which of the following actions does the CHW propose in response to SCENARIO 5?<br><br>***Do not read the answer choices to the CHW. When the CHW explains how he/she will manage the child, circle the appropriate answer choices listed. When the CHW is finished, ask:*** "Anything else?"<br><br>***Continue asking until the CHW has no further management for the case.*** | A. Give three sachets of ORS<br>B. Give the child ORS<br>C. Help caregiver to give the child ORS<br>D. Give zinc for 10 days<br>E. Give an ACT for 3 days<br>F. Give first dose of ACT<br>G. Advise caregiver on use of ITN<br>H. Give Cotrimoxazole for 8 days<br>J. Give first dose of Cotrimoxazole<br>K. Give paracetamol tablets<br>L. Give the first dose of paracetamol<br>M. Refer to health facility<br>N. Write a referral note<br>O. Give a pre-printed referral form<br>P. Arrange transportation to health facility<br>Q. Advise to give fluids and continue feeding<br>R. Advise to keep child warm if not hot with fever<br>S.  Advise to wrap the child in a wet cloth if hot with fever<br>T. Advise caregiver on when to return to CHW or to a health facility<br>U. Follow up child at home |

***Read Scenario 6 to the CHW:***

SCENARIO 6.  A mother brings her nine-month-old little boy to the CHW to have him checked out. He has been acting very fussy for the past few days. She has felt that he has had a fever for about 3 or 4 days. The CHW looks at the boy and finds that he is crying a lot and he is difficult to examine. The boy calms down after breastfeeding and the CHW finds he is very warm to the touch. There are no other problems.

***Next, ask the CHW:*** Please explain how you would manage this child, including any actions you would take or drugs you would provide to give this child the most appropriate treatment.  Assume that you have all needed drugs and that the nearest referral facility is 20 minutes away.  If you would like to hear the case scenario again, I will repeat it any time you like.

| 6B08 | Which of the following actions does the CHW propose in response to SCENARIO 6?<br><br>***Do not read the answer choices to the CHW. When the CHW explains how he/she will manage the child, circle the appropriate answer choices listed. When the CHW is finished,*** | A. Give three sachets of ORS<br>B. Give the child ORS<br>C. Help caregiver to give the child ORS<br>D. Give zinc for 10 days<br>E. Give an ACT for 3 days<br>F. Give first dose of ACT<br>G. Advise caregiver on use of ITN<br>H. Give Cotrimoxazole for 8 days<br>J. Give first dose of Cotrimoxazole<br>K. Give paracetamol tablets<br>L. Give the first dose of paracetamol<br>M. Refer to health facility<br>N. Write a referral note |

| | | |
|---|---|---|
| | *ask:* "Anything else?"<br><br>*Continue asking until the CHW has no further management for the case.* | O. Give a pre-printed referral form<br>P. Arrange transportation to health facility<br>Q. Advise to give fluids and continue feeding<br>R. Advise to keep child warm if not hot with fever<br>S.  Advise to wrap the child in a wet cloth if hot with fever<br>T. Advise caregiver on when to return to CHW or to a health facility<br>U. Follow up child at home |

**Read Scenario 7 to the CHW:**

SCENARIO 7.  A three-month-old baby boy is brought to the CHW because he is difficult to wake up. He has had fever for the past 2 days. Yesterday his mother noted that his arms and legs stiffened and shuddered for 2 or 3 minutes at a time. Since then he has been breastfeeding poorly. There are no other problems. The CHW looks at the child and his eyes are closed and he is lying quietly in his mother's arms. The CHW tries to wake the child by moving his arms and clapping in front of him but the boy's eyes remain closed.

*Next, ask the CHW:* Please explain how you would manage this child, including any actions you would take or drugs you would provide to give this child the most appropriate treatment.  Assume that you have all needed drugs and that the nearest referral facility is 20 minutes away.  If you would like to hear the case scenario again, I will repeat it any time you like.

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|---|---|---|
| 6B09 | Which of the following actions does the CHW propose in response to SCENARIO 7?<br><br>*Do not read the answer choices to the CHW. When the CHW explains how he/she will manage the child, circle the appropriate answer choices listed. When the CHW is finished, ask:* "Anything else?"<br><br>*Continue asking until the CHW has no further management for the case.* | A. Give three sachets of ORS<br>B. Give the child ORS<br>C. Help caregiver to give the child ORS<br>D. Give zinc for 10 days<br>E. Give an ACT for 3 days<br>F. Give first dose of ACT<br>G. Advise caregiver on use of ITN<br>H. Give Cotrimoxazole for 8 days<br>J. Give first dose of Cotrimoxazole<br>K. Give paracetamol tablets<br>L. Give the first dose of paracetamol<br>M. Refer to health facility<br>N. Write a referral note<br>O. Give a pre-printed referral form<br>P. Arrange transportation to health facility<br>Q. Advise to give fluids and continue feeding<br>R. Advise to keep child warm if not hot with fever<br>S.  Advise to wrap the child in a wet cloth if hot with fever<br>T. Advise caregiver on when to return to CHW or to a health facility<br>U. Follow up child at home |

## Form 7.  CHW In-Depth Interview

| 7A | Role and recruitment |
|----|----------------------|
| 7A01 | Tell me about your life as an CHW. <br><br> *Possible probes: Imagine that I don't know anything about your work as an CHW: tell me what your role involves. Tell me all the things you do. Which parts of your role are most important? Which parts take the most time? Which parts are the most difficult?* |
| 7A02 | How much time do you spend working as an CHW? <br><br> *Do you have other jobs?* |
| 7A03 | Tell me how you became an CHW. <br><br> *How were you selected? Whose decision was it? Why did you agree to become an CHW? What were you told when you first became an CHW?* |
| 7A04 | How have things changed since you first started as an CHW? |
| **7B** | **Training** |
| 7B01 | What training have you received as an CHW? <br><br> **Ensure that the CHW understands that you are asking about all training related to being an CHW.** |
| 7B02 | What training have you received in CCM? <br><br> **Ensure that the CHW understands that you are asking about training related to CCM.** <br><br> *Tell me about the CCM training. Who conducted the training? Where was it held? What activities did it involve? How useful was the training? What are the main things you learned?* |
| **7C** | **Relationship with community** |
| 7C01 | How well do people in the village understand your role as an CHW? <br><br> *How many people know who the CHWs are? How many people know what you do? How do you describe your role as an CHW to the people in your village?* |
| 7C02 | How do parents find you when their children are sick? |

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|---|---|
| | *When and where do you usually see sick children? Is it your job to find sick children or do people come to you?* |
| 7C03 | Which people come to you for help?<br><br>*What ages of people? What type of help are these people looking for? Why do some people come to you and not others?* |
| 7C04 | What do people think of the CHWs?<br><br>*Do people trust the CHWs? How many people in the village go to the CHWs when their children are sick?* |
| 7C05 | How do you coordinate your work with the other CHW in the village?<br><br>*How often do you communicate with each other? Do you do different things or the same things? Is there a difference between the CHWs who are men and the CHWs who are women?* |
| **7D** | **Drugs** |
| 7D01 | Tell me about your drug kit. |
| 7D02 | When do you sell drugs to people?<br><br>*Do you ever sell drugs to a parent without seeing her/his child? Do people ever ask you for drugs that are not appropriate for a child's symptoms (for example, antibiotics when the child does not have a respiratory infection)? Do you sell drugs for sick adults or only for sick children?*<br><br>*What happens when someone can't afford drugs? How often does this happen?* |
| 7D03 | What happens when you run out of drugs?<br><br>*How do you get more drugs? How easy or difficult is it to get more drugs? What happens when your drugs expire? Do you ever sell expired drugs? Do people still come to you when you don't have drugs? If so, what do you do when they come to you?* |
| 7D04 | Where else do people get drugs (other than from CHWs)?<br><br>*In the village? Outside the village?* |
| 7D05 | Which drugs do you sell the most? |

| | *Do people buy both ORS and zinc for diarrhea? Is it easy or difficult to remember which drugs to give people?* |
|---|---|
| **7E** | **Motivation** |
| 7E01 | Describe the impact that being an CHW has had on your life. |
| 7E02 | What are the advantages of being an CHW?<br><br>*What makes you want to keep being an CHW? What benefits or rewards do you get from being an CHW? What benefits or rewards do you get for CCM? Who provides these benefits or rewards? What about financial benefits? Can you make money from drug sales? What about non-financial benefits?* |
| 7E03 | What are the disadvantages of being an CHW?<br><br>*What makes you want to stop being an CHW?* |
| 7E04 | For how much longer will you be an CHW?<br><br>*Why would you stop being an CHW? What would happen if you stopped? Do you know of others who have stopped? Why did they stop? What happened when they stopped?* |
| 7E05 | How do the people in the village help you to be an CHW? |
| 7E06 | What would make your job easier or help you be more effective in caring for sick children? |
| **7F** | **Performance and supervision** |
| 7F01 | What skills does someone need to be a good CHW?<br><br>*What people make the best CHWs? How can you tell whether someone is a good CHW or not?* |
| 7F02 | Tell me about the supervision you receive.<br><br>*Describe a typical supervision. How often are you supervised? What happens during a supervision? How does your supervisor help you? What other contact do you have with staff at the Health Facility?* |
| 7F03 | What would happen if you didn't do your job well as an CHW?<br><br>*What would the people in the village do? What would the Supervisor do?* |

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| 7F04 | Tell me about your register of consultations.<br><br>*How is the register used? Is the register helpful for you? Is it helpful for other people? How much time does it take to fill out the register? Which consultations do you record in the register?* |

## Form 8.  Caregiver In-Depth Interview

| 8A | Care-seeking |
|----|----|
| 8A01 | Tell me about your family and children. <br><br> *How many children do you have? Who are the main people who look after your children?* |
| 8A02 | Tell me about the last time one of your children was sick. <br><br> *How did you know your child was sick? What did you do? Who decided what to do?* |
| 8A03 | Where do you go to get help when your children are sick? <br><br> ***Identify all the people and places where the caregiver goes to get help when her/his children are sick.*** <br><br> *Where else do you go? (In the village? Outside the village?)* <br><br> ***For each of the people and places that you discuss with the caregiver, ask and probe on the following questions:*** <br><br> *Tell me about this person/place. When do you take your child to this person/place? For which illnesses do you take your child to this person/place? How much does it cost to get help from this person/place? How long does it take to get help from this person/place?* |
| 8A04 | What problems do you have getting help when your children are sick? <br><br> *Problems with money? Problems with transport? Problems getting support or agreement from family members?* |
| **8B** | **Drugs** |
| 8B01 | Tell me about the last time you got drugs. <br><br> *Where did you get them? What were they for? How much did you pay? Did you trust the person who gave you the drugs? Did you ask them for health advice or ask for the drugs directly? Did the drugs work? Did you use all the drugs or did you save some for another time?* |
| 8B02 | Where else can you get drugs for your children when they are sick? <br><br> *In the village? Outside the village?* |

| | |
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| 8B03 | What problems do you have getting drugs? |
| 8B04 | Tell me about the cost of drugs. |
| | *Which drugs are cheap and which drugs are expensive? Have you ever been unable to buy the drugs that your children needed?* |
| **8C** | **CHWs** |
| 8C01 | Tell me about the CHWs in your village. |
| | ***If the caregiver does not understand the term CHW or an equivalent term, say the names of the CHWs and confirm whether the caregiver knows who the CHWs are. Reiterate to the caregiver that her/his comments will remain confidential and anonymous, and the information provided will not be shared with the CHW, the CHW's supervisor, or anyone else in the village.*** |
| | *Who are the CHWs? What are all the things the CHWs do? What are the most important things the CHWs do?* |
| 8C02 | Have you ever taken a sick child to an CHW? |
| | ***If the caregiver has taken a child to an CHW, ask and probe on the following questions:*** |
| | *Describe the experiences you have had of taking your child to an CHW. What made you take your child to the CHW? How did you decide which CHW to go to? When and where did you meet the CHW? What did the CHW do? Did you get any drugs from the CHW? Were you satisfied with the care the CHW gave your child?* |
| | ***If the caregiver has never taken a child to an CHW, ask the following questions:*** |
| | *What do you think of the care that CHWs provide? What are the reasons why you have never taken a child to an CHW?* |
| 8C03 | How easy or difficult is it to get help from an CHW? |
| | *What makes it easy or difficult to find an CHW? What makes it easy or difficult to talk to an CHW? What makes it easy or difficult to get drugs from an CHW?* |
| 8C04 | What do people generally think about the CHWs? |
| | *How well-known are the CHWs in the village? Do CHWs play a valuable role in the village?* |
| 8C05 | What other things could the CHWs do to improve the health of the village? |

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| 8C06 | What benefits or rewards do the CHWs receive for being CHWs?<br><br>*How do the people in the village support the CHWs? How does the government support the CHWs? Do the CHWs get paid? Do you think it is easy or difficult to be an CHW?* |
| 8C07 | Who makes sure the CHWs are doing the things they are supposed to be doing?<br><br>*What would happen if the CHWs stopped working?* |

# Form 9.  Caregiver Focus Group

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|---|---|
| **9A** | **Terminology and perception of childhood illnesses** |
| 9A01 | Tell me about the health problems that children experience in this village.<br><br>*What are all the illnesses or types of sickness that you have experienced with your children?*<br><br>***Identify all the "types of sickness" that participants have experienced with their children (as described and articulated by the participants themselves – do not use medical descriptions unless people use those descriptions themselves).***<br><br>***Spend time clarifying the terminology used to describe these sicknesses. For each sickness, ask and probe on the following questions:***<br><br>*How do you know when a child has this sickness? How is this sickness different from other sicknesses? How serious is it when a child has this sickness? What do people do to help children who have this sickness?* |
| **9B** | **Terminology of health care providers and care-seeking preferences** |
| 9B01 | Where do people in the village go to get help when their children are sick?<br><br>***With the participants, identify all the people and places that caregivers go to get help when their children are sick.***<br><br>*Where else do people go? In the village? Outside the village?*<br><br>***Spend time clarifying the terminology used to describe these people and places. For each person/place, ask and probe on the following questions:***<br><br>*Tell me about this person/place. When do people take their child to this person/place? For which illnesses do people take their child to this person/place? How much does it cost to get help from this person/place? How long does it take to get help from this person/place?* |
| 9B02 | What problems do people in this village have getting help when their children are sick?<br><br>*Problems with money? Problems with transport? Problems getting support or agreement from family members?* |
| **9C** | **Drugs** |
| 9C01 | Where do people in this village get drugs for their children when their children are sick?<br><br>*Where else do people get drugs? In the village? Outside the village? Do people ask for* |

| | |
|---|---|
| | *health advice when they get these drugs or do they ask for the drugs directly?* |
| 9C02 | What problems do people have getting drugs? |
| **9D** | **CHWs** |
| 9D01 | Tell me about the CHWs in your village.<br><br>***If the participants do not understand the term CHW or an equivalent term, describe the role of the CHWs and confirm whether the participants know who the CHWs are. Reiterate to the participants that all of their comments will remain confidential and anonymous, and the information provided will not be shared with the CHW, the CHW's supervisor, or anyone else in the village.***<br><br>*Who are the CHWs? What are all the things the CHWs do? What are the most important things the CHWs do?* |
| 9D02 | What do people generally think about the CHWs?<br><br>*Do CHWs play a valuable role? How well-known are the CHWs in the village? Do people trust the CHWs? How comfortable are people bringing their children to the CHWs for care?* |
| 9D03 | What other things could the CHWs do to improve the health of the village? |
| 9D04 | What benefits or rewards do the CHWs receive for being CHWs?<br><br>*How do the people in the village support the CHWs? How does the government support the CHWs? Do the CHWs get paid? Do you think it is easy or difficult to be an CHW?* |
| 9D05 | Who makes sure the CHWs are doing the things they are supposed to be doing?<br><br>*What would happen if the CHWs stopped working?* |

## Form 10.  Supervisor In-Depth Interview

| 10A | Role and recruitment |
|---|---|
| 10A01 | Tell me about the CHWs in your *aire de santé*.<br><br>*How many CHWs are there? How many men and how many women? Imagine that I don't know anything about the CHWs: tell me what their role involves. What are all the things the CHWs do? What are the most important things the CHWs do?* |
| 10A02 | How are CHWs recruited?<br><br>*How are people selected to be CHWs? What is your role in the selection of CHWs? When was the last time an CHW was recruited in this aire de santé?* |

| 10B | Training |
|---|---|
| 10B01 | What training have you received in CCM?<br><br>*Tell me about the CCM training. What did you think of the training? Who conducted it? Where was it held? What activities did it involve? How useful was it?* |
| 10B02 | What training have the CHWs in your *aire de santé* received in CCM?<br><br>**Ensure that the Supervisor understands that you are asking about CCM and not other types of training.** |

| 10C | Relationship with community |
|---|---|
| 10C01 | Tell me about the relationship between CHWs and the people in their villages.<br><br>*How many people know who the CHWs are? What do people think of the CHWs? Do people trust the CHWs? How comfortable are people bringing their children to the CHWs for care?* |

| 10D | Performance |
|---|---|
| 10D01 | What skills does someone need to be a good CHW?<br><br>*Is there a difference between CHWs who are women and CHWs who are men? Is there a difference between younger CHWs and older CHWs?* |
| 10D02 | What do CHWs find easy and difficult about CCM?<br><br>*Which aspects of CCM are most difficult? How easy or difficult is it for CHWs to communicate with caregivers?* |

| | |
|---|---|
| 10D03 | What would make it easier for CHWs to deliver CCM in their villages? |
| **10E** | **Supervision** |
| 10E01 | How often do you communicate with the CHWs in your *aire de santé*?<br><br>*How often do you meet in person?* |
| 10E02 | Tell me about the supervision you provide to CHWs.<br><br>*Describe a typical supervision. Where do you meet the CHW? What are your goals when you conduct a supervision? What makes supervising CHWs difficult? Are you able to conduct supervision visits as often as you would like? What would make it easier for you to supervise CHWs effectively?* |
| 10E03 | How do you know whether an CHW is doing their job well or not?<br><br>*Do the people in the village know whether an CHW is doing their job well or not? What would happen if an CHW wasn't doing their job well? What would you do? What would the community do? What would happen if an CHW stopped working completely?* |
| 10E04 | Tell me about the registers that the CHWs keep.<br><br>*How useful are the registers for the CHWs? How useful are the registers for you as the supervisor?* |
| 10E05 | Tell me about the paperwork that is involved with supervising the CHWs.<br><br>*How often do you compile reports for the district on CHWs? How much time does it take? How are your reports used? What are the advantages and disadvantages of these reports?* |

# Appendix 2. List of task measures with descriptions

| PROVIDING CARE | | |
|---|---|---|
| *Assessment* | | |
| a1 | CHW checks danger signs: able to drink | Does the CHW ask if the child is able to drink or breastfeed or does the CHW check if the child is able to drink or breastfeed (by offering water or breastmilk)? |
| a2 | CHW checks danger signs: vomits everything | Does the CHW ask if the child is vomiting everything? |
| a3 | CHW checks danger signs: convulsions | Does the CHW ask whether the child has convulsions? |
| a4 | CHW checks danger signs: lethargy/unconscious | Does the CHW check for lethargy or unconsciousness (try to wake up the child)? |
| a5 | CHW asks about cough | Does the CHW ask if the child has cough or difficult breathing? |
| a6 | CHW asks about diarrhea | Does the CHW ask if the child has diarrhea (loose stools)? |
| a7 | CHW asks about fever | Does the CHW ask or feel for fever (reported or now)? |
| a8 | CHW correctly measures MUAC | If the child is 6+ months old, does the CHW measure the child's MUAC and does the CHW's measurement match that of the clinicion re-examiner? |
| a9 | CHW checks odema | If the child is 6+ months old, does the CHW press on both feet to look for swelling? |
| a10 | CHW correctly counts breaths | Does the CHW count breaths in 1 minute and does the CHW's measurement match that of the clinicion re-examiner? (Only applicable to CHWs in the pneumonia study arm.) |
| *Classification* | | |
| b1 | CHW correctly classifies danger signs | If the clinician re-examiner classifies the child as having danger signs, does the CHW also classify the child as having danger signs? |

| b2 | CHW correctly classifies diarrhea | If the clinician re-examiner classifies the child as having any form of diarrhea, does the CHW also classify the child as having any form of diarrhea? |
|---|---|---|
| b3 | CHW correctly classifies fever | If the clinician re-examiner classifies the child as having fever, does the CHW also classify the child as having fever? |
| b4 | CHW correctly classifies pneumonia | If the clinician re-examiner classifies the child as having cough or difficult breathing, does the CHW also classify the child as having cough or difficult breathing? (Only applicable to CHWs in the pneumonia study arm.) |
| b5 | CHW correctly classifies malnutrition | If the clinician re-examiner classifies the child as havingany form of malnutrition, does the CHW also classify the child as having any form of malnutrition? |
| *Treatment* | | |
| c1 | CHW correctly prescribes ORS | If the clinician re-examiner classifies the child as having diarrhea without dehydration (i.e. not diarrhea with dehydration, persistent diarrhea, or dysentary), does the CHW prescribe ORS with correct dosage and duration? |
| c2 | CHW correctly prescribes zinc | If the clinician re-examiner classifies the child as having diarrhea without dehydration (i.e. not diarrhea with dehydration, persistent diarrhea, or dysentary), does the CHW prescribe zinc with correct dosage and duration? |
| c3 | CHW correctly prescribes ACT | If the clinician re-examiner classifies the child as having non-severe fever (i.e. not severe fever), does the CHW prescribe ACTs with correct dosage and duration? |
| c4 | CHW correctly prescribes paracetamol | If the clinician re-examiner classifies the child as having non-severe fever (i.e. not severe fever), does the CHW prescribe paracetamol with correct dosage and duration? |

| c5 | CHW correctly prescribes cotrimoxizole | If the clinician re-examiner classifies the child as having non-severe pneumonia (i.e. not severe pneumonia), does the CHW prescribe antibiotics (cotrimoxizole) with correct dosage and duration? (Only applicable to CHWs in the pneumonia study arm.) |
|---|---|---|
| c6 | CHW correctly refers child to health facility | If the clinician re-examiner classifies the child as needing to be referred to a health facility for severe illness, does the CHW also refer the child? |
| *Counselling* | | |
| d1 | CHW asks caregiver to repeat | If the CHW prescribed a treatment for the child, does the CHW ask the caregiver to repeat the prescription dosage and duration so as to verify the caregiver's understanding? |
| d2 | CHW tells to drink more | If the clinician re-examiner classified the child as having diarrhea without dehydration, does the CHW advise caregiver to increase fluids? |
| d3 | CHW tells to cold wrap | If the clinician re-examiner classified the child as having fever (moderate or severe fever), does the CHW tell the caregiver to wrap the child in a cold wrap? |
| d4 | CHW tells to go to health facility if still sick | Does the CHW advise to go to the Health Facility or return to the CHW if the child becomes sicker? |
| d5 | CHW explains when to return | Does the CHW advise on when to return to the CHW for follow-up? |
| **MANAGING COMMODITIES** | | |
| *Drug Stock* | | |
| e1 | CHW has unexpired cotrimoxizole | Does the CHW have at least one tablet of unexpired cotrimoxazole? |
| e2 | CHW has unexpired ORS | Does the CHW have at least one sachet of unexpired ORS |
| e3 | CHW has unexpired zinc | Does the CHW have at least one tablet of unexpired zinc? |
| e4 | CHW has unexpired ACT for infants | Does the CHW have at least one course of unexpired ACT for infants? |

| e5 | CHW has unexpired ACT for children | Does the CHW have at least one course of unexpired ACT for children? |
|----|-----------------------------------|----------------------------------------------------------------------|
| e6 | CHW has unexpired paracetamol | Does the CHW have at least one tablet of unexpired paracetamol? |

| **Equipment** | | |
|----|----|----|
| f1 | CHW has working timer | Does the CHW have a functional watch or timing device? |
| f2 | CHW has source clean water | Does the CHW have a source of clean water available? |
| f3 | CHW has ORS kit | Does the CHW have an ORS kit (plastic measuring cup)? |
| f4 | CHW has MUAC tape | Does the CHW have a MUAC tape? |
| f5 | CHW has consultation register | Does the CHW have a register of consultations? |
| f6 | CHW has bag or box for drug kit | Does the CHW have a bag or box for his or her drug kit? |
| f7 | CHW has working bike | Does the CHW have a working bicycle? |

| **Drug Practices** | | |
|----|----|----|
| g1 | CHW keeps drugs stored appropriately | Does the CHW say that he/she keeps drugs in alocked box or bag, or in a dedicated health post/facility? |
| g2 | CHW maintains a drug register | Does the CHW have a register for noting drug sales and purchases? |
| g3 | CHW does not give drugs without seeing child | Does that CHW say that he/she never gives drug to a caregiver without first examining the sick child? |

| **REPORTING** | | |
|----|----|----|

| **Register Use** | | |
|----|----|----|
| h1 | CHW has register (and register available) | Do you keep a register of sick children that you have seen? |
| h2 | CHW records all consultations in register | Does the CHW say that they record all of the children that they see in the register? |
| h3 | CHW records consultations himself/herself | Does the CHW record consultation entries himself/herself (as opposed to asking another person to record entries on his/her behalf)? |

| Register Quality | | |
|---|---|---|
| i1 | CHW always records date | Do entries in the CHW's patient register always include a date? |
| i2 | CHW always records child's name | Do entries in the CHW's patient register always include the child's name? |
| i3 | CHW always records child's age | Do entries in the CHW's patient register always include the child's age? |
| i4 | CHW always records child's sex | Do entries in the CHW's patient register always include the child's sex? |
| i5 | CHW always records mom's name | Do entries in the CHW's patient register always include the child's mom's name? |
| i6 | CHW always records symptoms | Do entries in the CHW's patient register always include symptoms? |
| i7 | CHW always records breaths per minute | Do entries in the CHW's patient register for suspected pneumonia always include a record of breaths per minute? |
| i8 | CHW always records treatment | Do entries in the CHW's patient register always include treatment details? |
| i9 | CHW always records nutritional status | Do entries in the CHW's patient register always include nutritional status? |
| i10 | CHW always records vitamin A status | Do entries in the CHW's patient register always include vitamin A status? |
| i11 | CHW always records immunization status | Do entries in the CHW's patient register always include immunization status? |
| i12 | CHW always records price of drugs | Do entries in the CHW's patient register always include the price at which drugs were sold? |
| i13 | CHW always records observations | Do entries in the CHW's patient register always include any other observations? |

# Appendix 3.  Stata output for multi-linear regression models

<u>Appendix 3.1. Primary regression models</u>

## *Primary model for Overall Performance*

```
. regress per age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings
```

| Source   | SS         | df  | MS         |
|----------|-----------|-----|-----------|
| Model    | 181.640973 | 30  | 6.05469909 |
| Residual | 160.863354 | 344 | .467626029 |
| Total    | 342.504327 | 374 | .91578697  |

Number of obs =     375
F( 30,   344) =   12.95
Prob > F      =  0.0000
R-squared     =  0.5303
Adj R-squared =  0.4894
Root MSE      =  .68383

| per | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | -.205702 | .1028242 | -2.00 | 0.046 | -.4079453 | -.0034587 |
| sex | -.2287798 | .0967736 | -2.36 | 0.019 | -.4191221 | -.0384374 |
| **edulevel** | | | | | | |
| 1 | .3391127 | .1129376 | 3.00 | 0.003 | .1169776 | .5612478 |
| 2 | .1944216 | .1494137 | 1.30 | 0.194 | -.0994579 | .4883011 |
| **littype** | | | | | | |
| 1 | .5498605 | .1861504 | 2.95 | 0.003 | .1837243 | .9159967 |
| 2 | .5027042 | .1347692 | 3.73 | 0.000 | .2376289 | .7677796 |
| 3 | .5520554 | .1402095 | 3.94 | 0.000 | .2762795 | .8278313 |
| **district** | | | | | | |
| 2 | -1.303176 | .1990692 | -6.55 | 0.000 | -1.694722 | -.9116295 |
| 3 | -.4293424 | .1221053 | -3.52 | 0.000 | -.6695093 | -.1891755 |
| 4 | -1.49994 | .191776 | -7.82 | 0.000 | -1.877141 | -1.122739 |
| 5 | -1.11218 | .1865812 | -5.96 | 0.000 | -1.479163 | -.745196 |
| 6 | -.5130352 | .1627608 | -3.15 | 0.002 | -.8331668 | -.1929035 |
| 7 | -.7333933 | .1570778 | -4.67 | 0.000 | -1.042347 | -.4244395 |
| 8 | -.6657395 | .1955098 | -3.41 | 0.001 | -1.050285 | -.2811944 |
| 9 | -.2376833 | .1697878 | -1.40 | 0.162 | -.5716361 | .0962696 |
| distance | -.0040152 | .0058782 | -0.68 | 0.495 | -.0155769 | .0075465 |
| **supcat** | | | | | | |
| 2 | -.0393305 | .0944458 | -0.42 | 0.677 | -.2250944 | .1464335 |
| 3 | -.3129935 | .1031437 | -3.03 | 0.003 | -.5158652 | -.1101219 |
| timechw | .002124 | .005935 | 0.36 | 0.721 | -.0095495 | .0137975 |
| ccm2years | .5544751 | .125857 | 4.41 | 0.000 | .3069291 | .8020212 |
| refnumber | .0170844 | .0244916 | 0.70 | 0.486 | -.0310878 | .0652566 |
| timelasttraining | -.0463385 | .0537097 | -0.86 | 0.389 | -.1519792 | .0593022 |
| clinical | .0058253 | .0994196 | 0.06 | 0.953 | -.1897216 | .2013721 |
| pecadotraining | .191016 | .0930405 | 2.05 | 0.041 | .0080161 | .3740158 |
| pecadoparticipation | -.0475679 | .103641 | -0.46 | 0.647 | -.2514177 | .156282 |
| hfmonths | -.0421676 | .0165555 | -2.55 | 0.011 | -.0747304 | -.0096048 |
| timevillage | -.0020979 | .0030628 | -0.68 | 0.494 | -.0081221 | .0039264 |
| bike | -.0553567 | .0819253 | -0.68 | 0.500 | -.2164942 | .1057809 |
| respect | .0129301 | .0973789 | 0.13 | 0.894 | -.1786029 | .2044631 |
| blessings | .0927661 | .0851902 | 1.09 | 0.277 | -.0747931 | .2603253 |
| _cons | -.0696003 | .3455438 | -0.20 | 0.840 | -.7492448 | .6100443 |

## *Primary model for Providing Care*

```
. regress pro age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings
```

| Source   | SS         | df  | MS         |
|----------|------------|-----|------------|
| Model    | 125.941856 | 30  | 4.19806188 |
| Residual | 336.120833 | 344 | .977095444 |
| Total    | 462.062689 | 374 | 1.23546173 |

```
Number of obs =     375
F( 30,  344) =    4.30
Prob > F      = 0.0000
R-squared     = 0.2726
Adj R-squared = 0.2091
Root MSE      = .98848
```

| pro | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | -.6059813 | .1486327 | -4.08 | 0.000 | -.8983247 | -.3136379 |
| sex | -.2188692 | .1398865 | -1.56 | 0.119 | -.4940098 | .0562713 |
| **edulevel** | | | | | | |
| 1 | .2879667 | .1632517 | 1.76 | 0.079 | -.0331304 | .6090638 |
| 2 | .0713928 | .2159781 | 0.33 | 0.741 | -.353411 | .4961967 |
| **littype** | | | | | | |
| 1 | .239278 | .269081 | 0.89 | 0.374 | -.2899732 | .7685291 |
| 2 | .4029105 | .1948093 | 2.07 | 0.039 | .0197431 | .7860779 |
| 3 | .4657567 | .2026734 | 2.30 | 0.022 | .0671216 | .8643917 |
| **district** | | | | | | |
| 2 | -.8736825 | .2877552 | -3.04 | 0.003 | -1.439664 | -.3077014 |
| 3 | -.2632491 | .1765036 | -1.49 | 0.137 | -.6104112 | .083913 |
| 4 | -.729062 | .2772129 | -2.63 | 0.009 | -1.274308 | -.1838163 |
| 5 | -.0159971 | .2697037 | -0.06 | 0.953 | -.546473 | .5144789 |
| 6 | -.3598375 | .2352713 | -1.53 | 0.127 | -.8225889 | .1029139 |
| 7 | -.6912982 | .2270565 | -3.04 | 0.003 | -1.137892 | -.2447043 |
| 8 | -.2503008 | .2826101 | -0.89 | 0.376 | -.8061621 | .3055606 |
| 9 | -.0538655 | .2454288 | -0.22 | 0.826 | -.5365955 | .4288645 |
| distance | -.0048656 | .0084969 | -0.57 | 0.567 | -.0215781 | .0118468 |
| **supcat** | | | | | | |
| 2 | -.1111142 | .1365218 | -0.81 | 0.416 | -.3796367 | .1574082 |
| 3 | -.4574337 | .1490946 | -3.07 | 0.002 | -.7506854 | -.164182 |
| timechw | .0097285 | .0085791 | 1.13 | 0.258 | -.0071456 | .0266026 |
| ccm2years | .4763018 | .1819267 | 2.62 | 0.009 | .1184731 | .8341305 |
| refnumber | -.0076248 | .0354027 | -0.22 | 0.830 | -.0772579 | .0620083 |
| timelasttraining | -.0476174 | .0776375 | -0.61 | 0.540 | -.2003214 | .1050866 |
| clinical | -.0989261 | .1437114 | -0.69 | 0.492 | -.3815898 | .1837376 |
| pecadotraining | .2252193 | .1344903 | 1.67 | 0.095 | -.0393076 | .4897462 |
| pecadoparticipation | .0509501 | .1498135 | 0.34 | 0.734 | -.2437156 | .3456158 |
| hfmonths | .0258048 | .023931 | 1.08 | 0.282 | -.0212648 | .0728744 |
| timevillage | .0006264 | .0044273 | 0.14 | 0.888 | -.0080816 | .0093345 |
| bike | .0082329 | .1184233 | 0.07 | 0.945 | -.224692 | .2411578 |
| respect | .007495 | .1407615 | 0.05 | 0.958 | -.2693667 | .2843566 |
| blessings | .2178989 | .1231427 | 1.77 | 0.078 | -.0243085 | .4601064 |
| _cons | .0776512 | .4994848 | 0.16 | 0.877 | -.9047774 | 1.06008 |

## Primary model for Managing Commodities

```
. regress man age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings
```

| Source | SS | df | MS |
|--------|-----|-----|-----|
| Model | 155.122746 | 30 | 5.17075819 |
| Residual | 209.945265 | 344 | .610306002 |
| Total | 365.068011 | 374 | .976117675 |

| | |
|---|---|
| Number of obs = | 375 |
| F( 30, 344) = | 8.47 |
| Prob > F = | 0.0000 |
| R-squared = | 0.4249 |
| Adj R-squared = | 0.3748 |
| Root MSE = | .78122 |

| man | Coef. | Std. Err. | t | P>|t| | [95% Conf. Interval] | |
|-----|-------|-----------|---|-------|-----|-----|
| age50 | .0515184 | .1174681 | 0.44 | 0.661 | -.1795276 | .2825645 |
| sex | -.2152947 | .1105557 | -1.95 | 0.052 | -.432745 | .0021555 |
| edulevel | | | | | | |
| 1 | .3108944 | .1290217 | 2.41 | 0.016 | .0571236 | .5646652 |
| 2 | .334057 | .1706927 | 1.96 | 0.051 | -.0016758 | .6697898 |
| littype | | | | | | |
| 1 | .0402246 | .2126612 | 0.19 | 0.850 | -.3780554 | .4585046 |
| 2 | .3599316 | .1539626 | 2.34 | 0.020 | .0571051 | .6627581 |
| 3 | .2031089 | .1601777 | 1.27 | 0.206 | -.1119421 | .5181598 |
| district | | | | | | |
| 2 | -1.018904 | .2274199 | -4.48 | 0.000 | -1.466213 | -.5715953 |
| 3 | -.5415306 | .1394951 | -3.88 | 0.000 | -.8159012 | -.2671599 |
| 4 | -1.34071 | .2190881 | -6.12 | 0.000 | -1.771631 | -.9097893 |
| 5 | -1.337978 | .2131534 | -6.28 | 0.000 | -1.757226 | -.91873 |
| 6 | -.805363 | .1859406 | -4.33 | 0.000 | -1.171087 | -.4396393 |
| 7 | -.7386254 | .1794483 | -4.12 | 0.000 | -1.091579 | -.3856714 |
| 8 | -.8617912 | .2233537 | -3.86 | 0.000 | -1.301102 | -.4224805 |
| 9 | -.0786657 | .1939684 | -0.41 | 0.685 | -.460179 | .3028475 |
| distance | -.0015588 | .0067153 | -0.23 | 0.817 | -.0147671 | .0116494 |
| supcat | | | | | | |
| 2 | -.1503219 | .1078965 | -1.39 | 0.164 | -.3625418 | .0618979 |
| 3 | -.3481395 | .117833 | -2.95 | 0.003 | -.5799034 | -.1163755 |
| timechw | .0068773 | .0067803 | 1.01 | 0.311 | -.0064586 | .0202133 |
| ccm2years | .4177351 | .1437811 | 2.91 | 0.004 | .1349344 | .7005359 |
| refnumber | .0403472 | .0279796 | 1.44 | 0.150 | -.0146855 | .09538 |
| timelasttraining | -.0384912 | .0613588 | -0.63 | 0.531 | -.1591769 | .0821944 |
| clinical | .0347605 | .1135786 | 0.31 | 0.760 | -.1886355 | .2581564 |
| pecadotraining | .1454234 | .106291 | 1.37 | 0.172 | -.0636386 | .3544855 |
| pecadoparticipation | -.0626512 | .1184012 | -0.53 | 0.597 | -.2955327 | .1702303 |
| hfmonths | -.0913936 | .0189133 | -4.83 | 0.000 | -.1285939 | -.0541934 |
| timevillage | -.0035919 | .003499 | -1.03 | 0.305 | -.0104741 | .0032903 |
| bike | -.0403706 | .0935928 | -0.43 | 0.666 | -.2244568 | .1437156 |
| respect | .0337224 | .1112473 | 0.30 | 0.762 | -.1850881 | .2525329 |
| blessings | -.0749766 | .0973227 | -0.77 | 0.442 | -.266399 | .1164458 |
| _cons | .1439003 | .3947549 | 0.36 | 0.716 | -.6325368 | .9203375 |

## Primary model for Reporting

```
. regress rep age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings
```

| Source   | SS         | df  | MS         |
|----------|-----------|-----|------------|
| Model    | 136.868429 | 30  | 4.56228096 |
| Residual | 175.159109 | 344 | .509183456 |
| Total    | 312.027538 | 374 | .834298229 |

```
Number of obs =     375
F( 30,   344) =    8.96
Prob > F      =  0.0000
R-squared     =  0.4386
Adj R-squared =  0.3897
Root MSE      =  .71357
```

| rep | Coef. | Std. Err. | t | P>|t| | [95% Conf. Interval] | |
|-----|-------|-----------|---|-------|---------------------|---|
| age50 | -.0997373 | .1072959 | -0.93 | 0.353 | -.3107759 | .1113013 |
| sex | -.1570517 | .1009821 | -1.56 | 0.121 | -.3556718 | .0415684 |
| **edulevel** | | | | | | |
| 1 | .251439 | .1178491 | 2.13 | 0.034 | .0196435 | .4832345 |
| 2 | .1040806 | .1559116 | 0.67 | 0.505 | -.2025794 | .4107406 |
| **littype** | | | | | | |
| 1 | .7292646 | .1942458 | 3.75 | 0.000 | .3472056 | 1.111324 |
| 2 | .4325037 | .1406301 | 3.08 | 0.002 | .1559005 | .7091069 |
| 3 | .5612224 | .1463071 | 3.84 | 0.000 | .2734533 | .8489915 |
| **district** | | | | | | |
| 2 | -1.146688 | .2077265 | -5.52 | 0.000 | -1.555262 | -.7381144 |
| 3 | -.2852407 | .1274155 | -2.24 | 0.026 | -.5358522 | -.0346292 |
| 4 | -1.346697 | .2001162 | -6.73 | 0.000 | -1.740302 | -.9530916 |
| 5 | -1.036977 | .1946954 | -5.33 | 0.000 | -1.41992 | -.6540339 |
| 6 | -.2440637 | .1698391 | -1.44 | 0.152 | -.5781175 | .0899901 |
| 7 | -.4834796 | .1639089 | -2.95 | 0.003 | -.8058695 | -.1610898 |
| 8 | -.4943425 | .2040123 | -2.42 | 0.016 | -.895611 | -.0930739 |
| 9 | -.3045469 | .1771716 | -1.72 | 0.087 | -.653023 | .0439292 |
| distance | -.0034512 | .0061338 | -0.56 | 0.574 | -.0155157 | .0086132 |
| **supcat** | | | | | | |
| 2 | .0586855 | .0985531 | 0.60 | 0.552 | -.1351571 | .2525282 |
| 3 | -.1251347 | .1076293 | -1.16 | 0.246 | -.336829 | .0865596 |
| timechw | -.0040405 | .0061931 | -0.65 | 0.515 | -.0162217 | .0081406 |
| ccm2years | .4539992 | .1313303 | 3.46 | 0.001 | .1956877 | .7123108 |
| refnumber | .0092278 | .0255567 | 0.36 | 0.718 | -.0410393 | .059495 |
| timelasttraining | -.0330424 | .0560454 | -0.59 | 0.556 | -.1432773 | .0771925 |
| clinical | .0311567 | .1037433 | 0.30 | 0.764 | -.1728943 | .2352077 |
| pecadotraining | .1312435 | .0970867 | 1.35 | 0.177 | -.0597148 | .3222018 |
| pecadoparticipation | -.0622664 | .1081483 | -0.58 | 0.565 | -.2749815 | .1504486 |
| hfmonths | -.0296379 | .0172755 | -1.72 | 0.087 | -.0636168 | .004341 |
| timevillage | -.001687 | .003196 | -0.53 | 0.598 | -.0079732 | .0045992 |
| bike | -.0682594 | .0854881 | -0.80 | 0.425 | -.2364047 | .0998858 |
| respect | .0001036 | .1016138 | 0.00 | 0.999 | -.199759 | .1999661 |
| blessings | .0928196 | .088895 | 1.04 | 0.297 | -.0820266 | .2676658 |
| _cons | -.2094913 | .3605711 | -0.58 | 0.562 | -.9186928 | .4997102 |

## Appendix 3.2. Secondary regression models, including predictor variables for which we had limited observations

### *Secondary model for Overall Performance*

```
. regress per age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings supage supsex timeicpmonths supimci supccm numsupcat
```

| Source | SS | df | MS |   | Number of obs = | 293 |
|---|---|---|---|---|---|---|
|   |   |   |   |   | F( 36, 256) = | 7.94 |
| Model | 141.728749 | 36 | 3.9369097 |   | Prob > F = | 0.0000 |
| Residual | 126.953587 | 256 | .495912451 |   | R-squared = | 0.5275 |
|   |   |   |   |   | Adj R-squared = | 0.4610 |
| Total | 268.682337 | 292 | .920144988 |   | Root MSE = | .70421 |

| per | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | -.2344914 | .12038 | -1.95 | 0.053 | -.4715525 | .0025697 |
| sex | -.1967162 | .1176393 | -1.67 | 0.096 | -.4283801 | .0349478 |
| **edulevel** |   |   |   |   |   |   |
| 1 | .2388256 | .1341047 | 1.78 | 0.076 | -.0252632 | .5029144 |
| 2 | .1129737 | .1767282 | 0.64 | 0.523 | -.2350525 | .4609998 |
| **littype** |   |   |   |   |   |   |
| 1 | .5269571 | .2157213 | 2.44 | 0.015 | .1021429 | .9517714 |
| 2 | .4589671 | .1554039 | 2.95 | 0.003 | .1529343 | .7649998 |
| 3 | .5752758 | .167421 | 3.44 | 0.001 | .2455779 | .9049737 |
| **district** |   |   |   |   |   |   |
| 2 | -1.279444 | .2260871 | -5.66 | 0.000 | -1.724671 | -.8342168 |
| 3 | -.2308773 | .1657947 | -1.39 | 0.165 | -.5573724 | .0956178 |
| 4 | -1.495716 | .2508221 | -5.96 | 0.000 | -1.989654 | -1.001779 |
| 5 | -.9354384 | .2302859 | -4.06 | 0.000 | -1.388934 | -.4819425 |
| 6 | -.5881679 | .2038182 | -2.89 | 0.004 | -.9895419 | -.186794 |
| 7 | -.5690108 | .1893898 | -3.00 | 0.003 | -.9419712 | -.1960504 |
| 8 | -.6685788 | .2355687 | -2.84 | 0.005 | -1.132478 | -.2046795 |
| 9 | -.1649299 | .2158342 | -0.76 | 0.445 | -.5899666 | .2601068 |
| distance | -.002185 | .0068384 | -0.32 | 0.750 | -.0156516 | .0112817 |
| **supcat** |   |   |   |   |   |   |
| 2 | .0705836 | .1166137 | 0.61 | 0.546 | -.1590608 | .300228 |
| 3 | -.1379732 | .1235099 | -1.12 | 0.265 | -.381198 | .1052516 |
| timechw | .0039525 | .0073108 | 0.54 | 0.589 | -.0104444 | .0183495 |
| ccm2years | .5918409 | .1437458 | 4.12 | 0.000 | .3087662 | .8749157 |
| refnumber | .0122473 | .028877 | 0.42 | 0.672 | -.0446194 | .0691139 |
| timelasttraining | -.0627282 | .0626139 | -1.00 | 0.317 | -.1860322 | .0605758 |
| clinical | .0635533 | .1230933 | 0.52 | 0.606 | -.1788512 | .3059577 |
| pecadotraining | .2061614 | .1103317 | 1.87 | 0.063 | -.011112 | .4234348 |
| pecadoparticipation | -.0318122 | .1221773 | -0.26 | 0.795 | -.2724128 | .2087884 |
| hfmonths | -.0566115 | .0208709 | -2.71 | 0.007 | -.0977121 | -.015511 |
| timevillage | -.0018056 | .0038133 | -0.47 | 0.636 | -.009315 | .0057038 |
| bike | .0314157 | .0976409 | 0.32 | 0.748 | -.1608659 | .2236972 |
| respect | .0125613 | .1171633 | 0.11 | 0.915 | -.2181652 | .2432879 |
| blessings | .0657438 | .1012368 | 0.65 | 0.517 | -.1336193 | .2651068 |
| supage | .0383718 | .011882 | 3.23 | 0.001 | .0149729 | .0617708 |
| supsex | -.0133613 | .1399538 | -0.10 | 0.924 | -.2889687 | .2622461 |
| timeicpmonths | .0010596 | .0023013 | 0.46 | 0.646 | -.0034722 | .0055915 |
| supimci | -.1131283 | .1297017 | -0.87 | 0.384 | -.3685465 | .14229 |
| supccm | -.0557691 | .1177473 | -0.47 | 0.636 | -.2876459 | .1761076 |
| numsupcat | -.0200474 | .0712729 | -0.28 | 0.779 | -.1604033 | .1203084 |
| _cons | -1.46326 | .5451469 | -2.68 | 0.008 | -2.536803 | -.389716 |

## Secondary model for Providing Care

```
. regress pro age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings supage supsex timeicpmonths supimci supccm numsupcat
```

| Source | SS | df | MS |
|---|---|---|---|
| Model | 105.032686 | 36 | 2.91757462 |
| Residual | 250.09884 | 256 | .976948594 |
| Total | 355.131526 | 292 | 1.21620386 |

Number of obs = 293
F( 36, 256) = 2.99
Prob > F = 0.0000
R-squared = 0.2958
Adj R-squared = 0.1967
Root MSE = .98841

| pro | Coef. | Std. Err. | t | P>|t| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | -.5884103 | .1689614 | -3.48 | 0.001 | -.9211416 | -.255679 |
| sex | -.1807659 | .1651147 | -1.09 | 0.275 | -.5059219 | .1443901 |
| **edulevel** | | | | | | |
| 1 | .217442 | .188225 | 1.16 | 0.249 | -.1532245 | .5881085 |
| 2 | -.0134336 | .2480499 | -0.05 | 0.957 | -.5019118 | .4750447 |
| **littype** | | | | | | |
| 1 | .2068332 | .3027794 | 0.68 | 0.495 | -.3894223 | .8030888 |
| 2 | .3438014 | .2181198 | 1.58 | 0.116 | -.0857363 | .773339 |
| 3 | .4182431 | .2349868 | 1.78 | 0.076 | -.0445102 | .8809964 |
| **district** | | | | | | |
| 2 | -.8245179 | .3173285 | -2.60 | 0.010 | -1.449425 | -.1996112 |
| 3 | -.3162088 | .232704 | -1.36 | 0.175 | -.7744668 | .1420491 |
| 4 | -.8124408 | .3520457 | -2.31 | 0.022 | -1.505715 | -.1191664 |
| 5 | .1265852 | .3232218 | 0.39 | 0.696 | -.509927 | .7630974 |
| 6 | -.5140871 | .2860727 | -1.80 | 0.074 | -1.077442 | .0492684 |
| 7 | -.6535837 | .2658214 | -2.46 | 0.015 | -1.177059 | -.1301085 |
| 8 | -.3574187 | .3306366 | -1.08 | 0.281 | -1.008533 | .2936954 |
| 9 | .0036267 | .302938 | 0.01 | 0.990 | -.5929411 | .6001945 |
| distance | -.0020794 | .0095981 | -0.22 | 0.829 | -.0209807 | .0168219 |
| **supcat** | | | | | | |
| 2 | -.0422879 | .1636753 | -0.26 | 0.796 | -.3646093 | .2800335 |
| 3 | -.382719 | .1733545 | -2.21 | 0.028 | -.7241014 | -.0413365 |
| timechw | .0089225 | .0102612 | 0.87 | 0.385 | -.0112846 | .0291296 |
| ccm2years | .346054 | .2017569 | 1.72 | 0.088 | -.0512606 | .7433685 |
| refnumber | .0029097 | .0405308 | 0.07 | 0.943 | -.0769065 | .0827259 |
| timelasttraining | -.0774653 | .0878829 | -0.88 | 0.379 | -.2505308 | .0956002 |
| clinical | -.0222826 | .1727698 | -0.13 | 0.897 | -.3625136 | .3179485 |
| pecadotraining | .2224693 | .1548581 | 1.44 | 0.152 | -.0824887 | .5274272 |
| pecadoparticipation | -.0033653 | .1714841 | -0.02 | 0.984 | -.3410645 | .3343339 |
| hfmonths | .0263838 | .0292937 | 0.90 | 0.369 | -.0313036 | .0840712 |
| timevillage | -.0002709 | .0053522 | -0.05 | 0.960 | -.0108109 | .0102691 |
| bike | .0800466 | .1370455 | 0.58 | 0.560 | -.1898336 | .3499268 |
| respect | .0209452 | .1644466 | 0.13 | 0.899 | -.3028952 | .3447855 |
| blessings | .2804501 | .1420927 | 1.97 | 0.049 | .0006306 | .5602696 |
| supage | .0274027 | .0166772 | 1.64 | 0.102 | -.0054393 | .0602447 |
| supsex | .0056763 | .1964346 | 0.03 | 0.977 | -.3811573 | .3925099 |
| timeicpmonths | -.0045793 | .00323 | -1.42 | 0.157 | -.01094 | .0017815 |
| supimci | .2461924 | .1820452 | 1.35 | 0.177 | -.1123044 | .6046891 |
| supccm | -.0444591 | .1652664 | -0.27 | 0.788 | -.3699138 | .2809956 |
| numsupcat | -.0456668 | .1000363 | -0.46 | 0.648 | -.2426657 | .1513321 |
| _cons | -.6913056 | .7651505 | -0.90 | 0.367 | -2.198097 | .8154854 |

## Secondary model for Managing Commodities

```
. regress man age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings supage supsex timeicpmonths supimci supccm numsupcat
```

| Source | SS | df | MS | | Number of obs = | 293 |
|---|---|---|---|---|---|---|
| | | | | | F( 36, 256) = | 5.34 |
| Model | 122.397817 | 36 | 3.39993937 | | Prob > F = | 0.0000 |
| Residual | 163.111824 | 256 | .637155563 | | R-squared = | 0.4287 |
| | | | | | Adj R-squared = | 0.3484 |
| Total | 285.509641 | 292 | .977772744 | | Root MSE = | .79822 |

| man | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | .023914 | .1364503 | 0.18 | 0.861 | -.244794 | .292622 |
| sex | -.207581 | .1333437 | -1.56 | 0.121 | -.4701713 | .0550093 |
| edulevel | | | | | | |
| 1 | .1991214 | .1520072 | 1.31 | 0.191 | -.1002224 | .4984652 |
| 2 | .310473 | .2003208 | 1.55 | 0.122 | -.0840135 | .7049595 |
| littype | | | | | | |
| 1 | -.0203986 | .2445193 | -0.08 | 0.934 | -.5019242 | .461127 |
| 2 | .2278398 | .1761497 | 1.29 | 0.197 | -.1190473 | .5747269 |
| 3 | .1680591 | .1897712 | 0.89 | 0.377 | -.2056524 | .5417705 |
| district | | | | | | |
| 2 | -1.029644 | .2562689 | -4.02 | 0.000 | -1.534308 | -.5249805 |
| 3 | -.3009183 | .1879277 | -1.60 | 0.111 | -.6709993 | .0691628 |
| 4 | -1.436887 | .284306 | -5.05 | 0.000 | -1.996764 | -.877011 |
| 5 | -1.216507 | .2610282 | -4.66 | 0.000 | -1.730543 | -.7024713 |
| 6 | -.7599417 | .2310273 | -3.29 | 0.001 | -1.214898 | -.3049858 |
| 7 | -.5191648 | .2146727 | -2.42 | 0.016 | -.9419142 | -.0964155 |
| 8 | -.758682 | .2670164 | -2.84 | 0.005 | -1.28451 | -.2328537 |
| 9 | -.1386527 | .2446474 | -0.57 | 0.571 | -.6204304 | .3431251 |
| distance | -.0017762 | .0077513 | -0.23 | 0.819 | -.0170406 | .0134882 |
| supcat | | | | | | |
| 2 | -.0614058 | .1321813 | -0.46 | 0.643 | -.3217069 | .1988953 |
| 3 | -.2368548 | .139998 | -1.69 | 0.092 | -.5125492 | .0388397 |
| timechw | .007923 | .0082868 | 0.96 | 0.340 | -.0083959 | .0242419 |
| ccm2years | .4603805 | .1629353 | 2.83 | 0.005 | .1395162 | .7812448 |
| refnumber | .0392922 | .0327319 | 1.20 | 0.231 | -.025166 | .1037504 |
| timelasttraining | -.0425258 | .0709727 | -0.60 | 0.550 | -.1822904 | .0972388 |
| clinical | .0232961 | .1395259 | 0.17 | 0.868 | -.2514685 | .2980608 |
| pecadotraining | .1561019 | .1250607 | 1.25 | 0.213 | -.0901768 | .4023806 |
| pecadoparticipation | -.0201511 | .1384876 | -0.15 | 0.884 | -.2928711 | .2525688 |
| hfmonths | -.1198439 | .0236571 | -5.07 | 0.000 | -.1664312 | -.0732565 |
| timevillage | -.0025428 | .0043224 | -0.59 | 0.557 | -.0110548 | .0059691 |
| bike | .0884245 | .1106756 | 0.80 | 0.425 | -.129526 | .306375 |
| respect | -.0716645 | .1328042 | -0.54 | 0.590 | -.3331923 | .1898633 |
| blessings | -.1055808 | .1147516 | -0.92 | 0.358 | -.3315581 | .1203966 |
| supage | .043434 | .0134682 | 3.22 | 0.001 | .0169114 | .0699567 |
| supsex | -.2071193 | .1586372 | -1.31 | 0.193 | -.5195194 | .1052807 |
| timeicpmonths | -.0007058 | .0026085 | -0.27 | 0.787 | -.0058426 | .0044311 |
| supimci | -.171539 | .1470165 | -1.17 | 0.244 | -.4610547 | .1179767 |
| supccm | -.0757117 | .1334662 | -0.57 | 0.571 | -.3385433 | .1871198 |
| numsupcat | .0098753 | .0807876 | 0.12 | 0.903 | -.1492176 | .1689682 |
| _cons | -1.032637 | .6179222 | -1.67 | 0.096 | -2.249495 | .1842205 |

## Secondary model for Reporting

```
. regress rep age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings supage supsex timeicpmonths supimci supccm numsupcat
```

| Source   | SS         | df  | MS         |
|----------|------------|-----|------------|
| Model    | 112.232252 | 36  | 3.11756256 |
| Residual | 134.627164 | 256 | .525887361 |
| Total    | 246.859417 | 292 | .845408961 |

Number of obs = 293
F( 36, 256) = 5.93
Prob > F = 0.0000
R-squared = 0.4546
Adj R-squared = 0.3779
Root MSE = .72518

| rep | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | -.1372559 | .1239647 | -1.11 | 0.269 | -.3813763 | .1068646 |
| sex | -.1268374 | .1211424 | -1.05 | 0.296 | -.3654 | .1117251 |
| **edulevel** | | | | | | |
| 1 | .1810985 | .1380981 | 1.31 | 0.191 | -.0908545 | .4530515 |
| 2 | .0245383 | .1819909 | 0.13 | 0.893 | -.3338516 | .3829281 |
| **littype** | | | | | | |
| 1 | .737176 | .2221452 | 3.32 | 0.001 | .2997114 | 1.174641 |
| 2 | .454592 | .1600316 | 2.84 | 0.005 | .1394461 | .769738 |
| 3 | .6332957 | .1724066 | 3.67 | 0.000 | .2937799 | .9728115 |
| **district** | | | | | | |
| 2 | -1.124514 | .2328196 | -4.83 | 0.000 | -1.583 | -.6660287 |
| 3 | -.0788353 | .1707318 | -0.46 | 0.645 | -.4150529 | .2573824 |
| 4 | -1.259094 | .2582912 | -4.87 | 0.000 | -1.76774 | -.7504476 |
| 5 | -.8827637 | .2371434 | -3.72 | 0.000 | -1.349764 | -.4157633 |
| 6 | -.3205043 | .2098876 | -1.53 | 0.128 | -.7338305 | .092822 |
| 7 | -.355118 | .1950296 | -1.82 | 0.070 | -.7391846 | .0289487 |
| 8 | -.5072164 | .2425836 | -2.09 | 0.038 | -.98493 | -.0295028 |
| 9 | -.1858916 | .2222615 | -0.84 | 0.404 | -.6235854 | .2518021 |
| distance | -.0016435 | .007042 | -0.23 | 0.816 | -.0155112 | .0122241 |
| **supcat** | | | | | | |
| 2 | .1558612 | .1200863 | 1.30 | 0.195 | -.0806217 | .392344 |
| 3 | .0585941 | .1271878 | 0.46 | 0.645 | -.1918736 | .3090618 |
| timechw | -.0014295 | .0075285 | -0.19 | 0.850 | -.0162552 | .0133962 |
| ccm2years | .5421971 | .1480263 | 3.66 | 0.000 | .2506927 | .8337014 |
| refnumber | -.0018847 | .0297369 | -0.06 | 0.950 | -.0604448 | .0566753 |
| timelasttraining | -.044301 | .0644785 | -0.69 | 0.493 | -.1712768 | .0826748 |
| clinical | .0949523 | .1267589 | 0.75 | 0.454 | -.1546707 | .3445752 |
| pecadotraining | .1503001 | .1136173 | 1.32 | 0.187 | -.0734434 | .3740436 |
| pecadoparticipation | -.037511 | .1258156 | -0.30 | 0.766 | -.2852764 | .2102543 |
| hfmonths | -.0379124 | .0214924 | -1.76 | 0.079 | -.0802369 | .0044121 |
| timevillage | -.0014014 | .0039269 | -0.36 | 0.721 | -.0091345 | .0063316 |
| bike | -.0276621 | .1005485 | -0.28 | 0.783 | -.2256696 | .1703453 |
| respect | .0465751 | .1206522 | 0.39 | 0.700 | -.1910221 | .2841724 |
| blessings | .0415509 | .1042515 | 0.40 | 0.691 | -.1637489 | .2468507 |
| supage | .0264146 | .0122358 | 2.16 | 0.032 | .0023189 | .0505104 |
| supsex | .0802039 | .1441214 | 0.56 | 0.578 | -.2036107 | .3640185 |
| timeicpmonths | .0038071 | .0023698 | 1.61 | 0.109 | -.0008597 | .0084739 |
| supimci | -.186787 | .1335641 | -1.40 | 0.163 | -.4498112 | .0762372 |
| supccm | -.0302829 | .1212537 | -0.25 | 0.803 | -.2690647 | .2084988 |
| numsupcat | -.0174803 | .0733953 | -0.24 | 0.812 | -.1620157 | .1270552 |
| _cons | -1.458615 | .5613806 | -2.60 | 0.010 | -2.564127 | -.353103 |

Appendix 3.3. Scatterplot of residuals versus fitted values from the primary regression model for Overall Performance
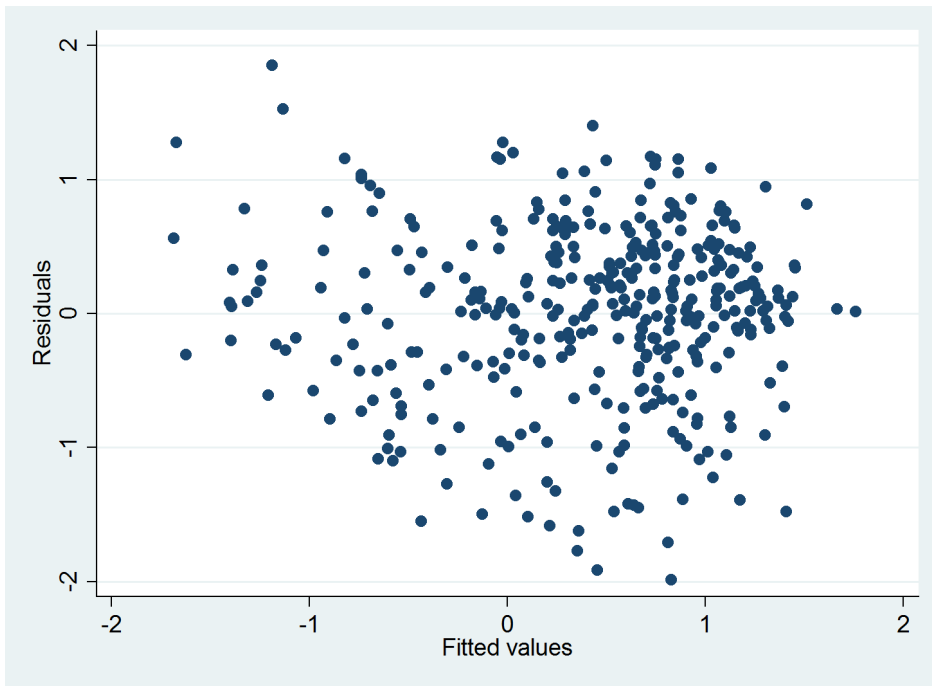
## Appendix 3.4. Primary regression model for Overall Performance, with robust standard errors

```
. regress per age50 sex i.edulevel i.littype i.district distance i.supcat timechw ccm2yea
> rs refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths time
> village bike respect blessings, vce(robust)

Linear regression                                   Number of obs =      375
                                                    F( 30,   344) =    14.90
                                                    Prob > F       =   0.0000
                                                    R-squared      =   0.5303
                                                    Root MSE       =  .68383
```

| per | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | -.205702 | .1000047 | -2.06 | 0.040 | -.4023997 | -.0090043 |
| sex | -.2287798 | .0977022 | -2.34 | 0.020 | -.4209487 | -.0366108 |
| | | | | | | |
| edulevel | | | | | | |
| 1 | .3391127 | .1144751 | 2.96 | 0.003 | .1139535 | .5642719 |
| 2 | .1944216 | .161867 | 1.20 | 0.231 | -.1239521 | .5127953 |
| | | | | | | |
| littype | | | | | | |
| 1 | .5498605 | .1847984 | 2.98 | 0.003 | .1863836 | .9133374 |
| 2 | .5027042 | .1490751 | 3.37 | 0.001 | .2094909 | .7959176 |
| 3 | .5520554 | .153487 | 3.60 | 0.000 | .2501642 | .8539465 |
| | | | | | | |
| district | | | | | | |
| 2 | -1.303176 | .2290996 | -5.69 | 0.000 | -1.753788 | -.8525632 |
| 3 | -.4293424 | .1209843 | -3.55 | 0.000 | -.6673046 | -.1913803 |
| 4 | -1.49994 | .1986151 | -7.55 | 0.000 | -1.890593 | -1.109287 |
| 5 | -1.11218 | .186808 | -5.95 | 0.000 | -1.479609 | -.7447499 |
| 6 | -.5130352 | .1771686 | -2.90 | 0.004 | -.8615052 | -.1645651 |
| 7 | -.7333933 | .1521374 | -4.82 | 0.000 | -1.03263 | -.4341567 |
| 8 | -.6657395 | .2064055 | -3.23 | 0.001 | -1.071715 | -.2597639 |
| 9 | -.2376833 | .1870337 | -1.27 | 0.205 | -.6055568 | .1301902 |
| | | | | | | |
| distance | -.0040152 | .0052079 | -0.77 | 0.441 | -.0142585 | .006228 |
| | | | | | | |
| supcat | | | | | | |
| 2 | -.0393305 | .0915713 | -0.43 | 0.668 | -.2194406 | .1407796 |
| 3 | -.3129935 | .1028647 | -3.04 | 0.003 | -.5153164 | -.1106706 |
| | | | | | | |
| timechw | .002124 | .0058152 | 0.37 | 0.715 | -.0093138 | .0135618 |
| ccm2years | .5544751 | .1438225 | 3.86 | 0.000 | .2715929 | .8373573 |
| refnumber | .0170844 | .0197266 | 0.87 | 0.387 | -.0217156 | .0558845 |
| timelasttraining | -.0463385 | .0524079 | -0.88 | 0.377 | -.1494187 | .0567417 |
| clinical | .0058253 | .1066994 | 0.05 | 0.956 | -.20404 | .2156905 |
| pecadotraining | .191016 | .090045 | 2.12 | 0.035 | .0139079 | .368124 |
| pecadoparticipation | -.0475679 | .0949892 | -0.50 | 0.617 | -.2344005 | .1392648 |
| hfmonths | -.0421676 | .0175333 | -2.41 | 0.017 | -.0766535 | -.0076817 |
| timevillage | -.0020979 | .0031529 | -0.67 | 0.506 | -.0082993 | .0041036 |
| bike | -.0553567 | .0861642 | -0.64 | 0.521 | -.2248318 | .1141184 |
| respect | .0129301 | .1045773 | 0.12 | 0.902 | -.1927614 | .2186216 |
| blessings | .0927661 | .0818791 | 1.13 | 0.258 | -.0682805 | .2538127 |
| _cons | -.0696003 | .3906741 | -0.18 | 0.859 | -.838011 | .6988105 |

## Appendix 3.5. Primary regression model for Overall Performance, with Boulsa as the base category for *district* (instead of Barsalogho)

```
. regress per age50 sex i.edulevel i.littype ib2.district distance i.supcat timechw ccm2y
> ears refnumber timelasttraining clinical pecadotraining pecadoparticipation hfmonths ti
> mevillage bike respect blessings
```

| Source | SS | df | MS | | Number of obs = | 375 |
|---|---|---|---|---|---|---|
| | | | | | F( 30, 344) = | 12.95 |
| Model | 181.640973 | 30 | 6.05469909 | | Prob > F = | 0.0000 |
| Residual | 160.863354 | 344 | .467626029 | | R-squared = | 0.5303 |
| | | | | | Adj R-squared = | 0.4894 |
| Total | 342.504327 | 374 | .91578697 | | Root MSE = | .68383 |

| per | Coef. | Std. Err. | t | P>|t| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| age50 | -.205702 | .1028242 | -2.00 | 0.046 | -.4079453 | -.0034587 |
| sex | -.2287798 | .0967736 | -2.36 | 0.019 | -.4191221 | -.0384374 |
| | | | | | | |
| edulevel | | | | | | |
| 1 | .3391127 | .1129376 | 3.00 | 0.003 | .1169776 | .5612478 |
| 2 | .1944216 | .1494137 | 1.30 | 0.194 | -.0994579 | .4883011 |
| | | | | | | |
| littype | | | | | | |
| 1 | .5498605 | .1861504 | 2.95 | 0.003 | .1837243 | .9159967 |
| 2 | .5027042 | .1347692 | 3.73 | 0.000 | .2376289 | .7677796 |
| 3 | .5520554 | .1402095 | 3.94 | 0.000 | .2762795 | .8278313 |
| | | | | | | |
| district | | | | | | |
| 1 | 1.303176 | .1990692 | 6.55 | 0.000 | .9116295 | 1.694722 |
| 3 | .8738331 | .2159992 | 4.05 | 0.000 | .4489877 | 1.298678 |
| 4 | -.1967647 | .2216666 | -0.89 | 0.375 | -.6327573 | .2392278 |
| 5 | .190996 | .2295785 | 0.83 | 0.406 | -.2605583 | .6425503 |
| 6 | .7901404 | .2286267 | 3.46 | 0.001 | .3404581 | 1.239823 |
| 7 | .5697822 | .2242927 | 2.54 | 0.012 | .1286246 | 1.01094 |
| 8 | .637436 | .2263827 | 2.82 | 0.005 | .1921674 | 1.082705 |
| 9 | 1.065492 | .2340721 | 4.55 | 0.000 | .6050996 | 1.525885 |
| | | | | | | |
| distance | -.0040152 | .0058782 | -0.68 | 0.495 | -.0155769 | .0075465 |
| | | | | | | |
| supcat | | | | | | |
| 2 | -.0393305 | .0944458 | -0.42 | 0.677 | -.2250944 | .1464335 |
| 3 | -.3129935 | .1031437 | -3.03 | 0.003 | -.5158652 | -.1101219 |
| | | | | | | |
| timechw | .002124 | .005935 | 0.36 | 0.721 | -.0095495 | .0137975 |
| ccm2years | .5544751 | .125857 | 4.41 | 0.000 | .3069291 | .8020212 |
| refnumber | .0170844 | .0244916 | 0.70 | 0.486 | -.0310878 | .0652566 |
| timelasttraining | -.0463385 | .0537097 | -0.86 | 0.389 | -.1519792 | .0593022 |
| clinical | .0058253 | .0994196 | 0.06 | 0.953 | -.1897216 | .2013721 |
| pecadotraining | .191016 | .0930405 | 2.05 | 0.041 | .0080161 | .3740158 |
| pecadoparticipation | -.0475679 | .103641 | -0.46 | 0.647 | -.2514177 | .156282 |
| hfmonths | -.0421676 | .0165555 | -2.55 | 0.011 | -.0747304 | -.0096048 |
| timevillage | -.0020979 | .0030628 | -0.68 | 0.494 | -.0081221 | .0039264 |
| bike | -.0553567 | .0819253 | -0.68 | 0.500 | -.2164942 | .1057809 |
| respect | .0129301 | .0973789 | 0.13 | 0.894 | -.1786029 | .2044631 |
| blessings | .0927661 | .0851902 | 1.09 | 0.277 | -.0747931 | .2603253 |
| _cons | -1.372776 | .3522588 | -3.90 | 0.000 | -2.065628 | -.6799237 |

# Curriculum vitae

## TIMOTHY JAMES ROBERTON

**MPH, MIntS, BA Hons**

| | | | |
|---|---|---|---|
| **Nationality** | Australian | **Email** | timroberton@gmail.com |
| **DOB** | 25 December 1979 | **Post** | 1 East Chase St, Apt 812 Baltimore MD 21202 |
| **Phone** | +1-443-844-9749 | | |

## EMPLOYMENT

**Institute for International Programs: Johns Hopkins University**
Research Assistant

January 2012 – Present
Baltimore, USA

Focal Point for the National Evaluation Platform (NEP) project in Mozambique (2015-present), involving:

- development and implementation of capacity-building activities to support enhanced decision-making within the Mozambique Ministry of Health;

- oversight of a Technical Working Group, comprised of staff from multiple Mozambique government agencies, undertaking ongoing data analysis to answer health policy questions proposed by senior officials;

- management of NEP staff employed by JHSPH in Mozambique.

Technical support for the ongoing development of the Lives Saved Tool (LiST) (2014-present), involving:

- development of new mathematical methods to improve the results generated by the model, accounting for assumptions such as co-coverage of interventions, equity distributions, and correlation of risk factors;

- improvements to the LiST interface to enhance its usability by government policy-makers in low- and middle-income countries;

- design and testing of an Impact Model App as an evaluation tool to complement LiST;

- revisions to the maternal component of LiST, including modifications to cause-of-death categories, childbirth interventions, and the links between interventions and detailed causes of deaths;

- coordination of workshops to train new users and undertake group analysis of survey data

(Burkina Faso, Mali, Tanzania, Mozambique).

Technical assistance for a large-scale evaluation of the Burkina Faso Ministry of Health's community case  management (CCM) program (2012-2014), including:

- design and coordination of a qualitative study on factors affecting utilization of community health workers;

- training and supervision of interviewers and clinicians for a quality of care assessment of CCM services  (including community-based observation and re-examination of child consultations);

- data management for a large-scale survey of 18,000 households to model changes in child mortality as a result of the CCM program;

- design and programming of multi-level survey questionnaires for electronic data collection.

Other associated projects at JHSPH (2014-2015):

- Review of the iCCM Taskforce's Indicator Handbook as applied to the routine monitoring systems for CCM in DRC, Madagascar, Niger, Senegal, South Sudan, and Zambia.

- Qualitative data analysis and manuscript preparation for a study on formal health system supports for community health workers in Tanzania.

- Quantitative data analysis for a study on community-based management of acute malnutrition (CMAM).

- Coordination of a household survey in Jordan to assess health access among Syrian refugees.

- Real-time evaluation of the Red Cross response to the West African Ebola Epidemic, with fieldwork in Guinea in July-August and December 2014.

**Grassroots Strategies**
July 2008 – August 2011
Community Development Consultant
Perth, Australia

Contracted by government and non-government organizations to design, coordinate, and evaluate community development projects in Australia and abroad. Work included coordination of a two-year project to increase recreational opportunities for young adults with high support needs, development of a health education program and organizational strategic plan for a local NGO in rural Malawi, and in-country rapid assessment and project support to World Vision Georgia in the aftermath of the 2008 Russia-Georgia conflict.

**Australian Red Cross**
January 2008 – July 2008
Project Officer: International Blood Projects
Banda Aceh, Indonesia

Responsible for monitoring and evaluation of a five-year technical project in Banda Aceh, Indonesia, to  restore the local blood service following the December 2004 tsunami. Work included the revision of volunteer blood donor guidelines.

**Disability Services Commission**

Local Area Coordinator

<div align="right">December 2006 – January 2008
Perth, Australia</div>

Employed on a permanent basis by the Western Australian state government Disability Services Commission as a Local Area Coordinator in the north-east metropolitan region of Perth. Established multiple programs to increase inclusive recreational opportunities for people with a disability or mental health illness.

**World Vision: Russian Federation**

Program Officer

<div align="right">July 2005 – December 2006
North Caucasus, Russia</div>

Responsible for monitoring and evaluation of all World Vision projects throughout Russia, including oversight of an integrated health, psychosocial and child protection project involving mobile health teams, child friendly spaces and health promotion activities. Also responsible for staff training in Sphere standards and the development of a regional disaster preparedness plan.

**World Vision: West Bank/Gaza Strip**

Program Assistant

<div align="right">March 2004 – July 2005
Jerusalem</div>

Responsible for monitoring and evaluation of selected health and agriculture projects, communication with the Israeli and Palestinian defense forces, and development of a disaster preparedness plan for the Israeli disengagement from the Gaza Strip in August 2005.


## EDUCATION

**Doctor of Public Health (in progress)**

Johns Hopkins University

<div align="right">August 2011 – Present
Baltimore, USA</div>

**Master of Public Health**

University of Western Australia

<div align="right">August 2007 – July 2009
Perth, Australia</div>

**Master of International Studies**

University of Sydney

<div align="right">January 2002 – December 2002
Sydney, Australia</div>

**Bachelor of Arts**

University of Cambridge

<div align="right">September 1998 – July 2001
Cambridge, England</div>

## PUBLICATIONS IN PEER-REVIEWED JOURNALS

Roberton T, Applegate J, Lefevre AE, et al. 2015a. Initial experiences and innovations in supervising community health workers for maternal, newborn, and child health in Morogoro region, Tanzania. Human resources for health 13: 19.

Roberton T, Kasungami D, Guenther T, Hazel E. 2015b. Monitoring iCCM: a Feasibility Study of the Indicator Guide for Monitoring and Evaluating Integrated Community Case Management. *Accepted for publication in Health Policy and Planning.*

Munos M, Guiella G, Roberton T, et al. 2015. The independent evaluation of the Rapid Scale-Up program to reduce under-five mortality in Burkina Faso. *Submitted for publication.*

Doocy S, Lyles E, Roberton T, Akhu-Zaheya L, Oweis A, Burnham G. 2015. Prevalence and care seeking for chronic diseases among Syrian refugees in Jordan. *Submitted for publication.*

## CONFERENCE PRESENTATIONS

Roberton T, Fu C, Burnham G. 2014. Learning from the experiences of Red Cross volunteers in Guinea. Session on Ebola Virus Disease Epidemic, American Public Health Association (APHA) Annual Meeting and Exposition, 15-19 November 2014, New Orleans, USA.

Roberton T, Fu C, Burnham G. 2014. Real-Time Research on Ebola Communication in Guinea. Forum on Ebola Communication and Prevention, 8-9 September 2014, Dakar, Senegal.

Emary C, Aidam B, Roberton T. 2014. Online database allows for quick and easy monitoring and reporting of supplementary feeding programme performance: An analysis of World Vision CMAM programmes. IAEA International Symposium on Moderate Acute Malnutrition, 26-29 May 2014, Vienna, Austria.

## OTHER PUBLICATIONS

Roberton T. 2015. The performance of community health workers in an integrated community case management program in Burkina Faso. Dissertation for the degree of Doctor of Public Health. Johns Hopkins University.

Murray A, Majwa P, Roberton T, Burnham G. 2015. Report of the real-time evaluation of Ebola control programs in Guinea, Sierra Leone and Liberia. International Federation of Red Cross and Red Crescent Societies.

Doocy S, Lyles E, Roberton T, Weiss W, and Burnham G. 2014. Syrian Refugee Health Access Survey in Jordan. UNHCR, Johns Hopkins Bloomberg School of Public Health, Jordan University of Science and Technology, WHO.

Roberton T, Kasungami D, Guenther T, Hazel E, and Dwivedi V. 2013. Report on the Feasibility of Measuring the iCCM Task Force Indicators through Existing Monitoring Systems in DRC, Niger, Madagascar, Senegal, South Sudan and Zambia. MCHIP, USAID.

## AWARDS

- Humanitarian Assistance Award from the Center for Refugee and Disaster Response at the Johns Hopkins Bloomberg School of Public Health (2012)

- Postgraduate Student Award from the Public Health Association of Australia (2010)

- Churchill Fellowship to travel to France to study the work of *L'Association Ressource Nationale Musique et Handicap* (2010)

- University of Western Australia School of Population Health Postgraduate Student Association Prize (2009)

- University of Western Australia Konrad Jamrozik Prize (2009)

- Finalist for the WA Young Australian of the Year Award (2009)

## ADDITIONAL SKILLS & EXPERIENCE

**Languages**   Advanced spoken and written French, with DELF diplomas A1, A2, B1, and B2 from *L'Alliance Française*.

**Software**   Professional proficiency in the following software packages and languages: Stata and SPSS (quantitative data analysis); NVivo and Atlas.ti (qualitative data analysis); Pendragon and Magpi (electronic data collection); HTML, CSS, PHP, SQL, Javascript, and jQuery (website, web server, and web app programming); Adobe Illustrator, Adobe Premiere Pro, and Adobe After Effects (graphic design and video).

**Community service**   Founded Catch Music Inc, a non-profit organization that runs community music activities in Perth, Australia. Extensive volunteer experience in Australia with TEAR, the WA State Emergency Service, and Prison Fellowship.

**Music**   Professional musician with diplomas from the Australian Music Examination Board (AMusA) and the Royal College of Organists (ARCO). Previous appointments as a pianist for the Western Australia Academy of Performing Arts, the Western Australia Symphony Orchestra Chorus, and the University of Western Australia School of Music.