

**Implementation Research for Integrated Health System  
Strengthening in Ghana: Towards Tipping Point for Improved  
Health Systems Performance and Population Health**

**INAUGURALDISSERTATION**

zur

Erlangung der Würde eines Doktors der Philosophie

vorgelegt der

Philosophisch-Naturwissenschaftlichen Fakultät der

Universität Basel

von

**John Koku Awoonor-Williams**

aus Ghana

Basel, 2017

“Originaldokument gespeichert auf dem Dokumentenserver der Universität Basel edoc.unibas.ch”

Genehmigt von der Philosophisch-Naturwissenschaftlichen Fakultät

auf Antrag von

Prof. Dr. Don de Savigny und Prof. Dr. David Ross

Basel, den 22.3.2016

Prof. Dr. Jörg Schibler

Dekan der  
Philosophisch-Naturwissenschaftlichen Fakultät

Dedicated to the legacy and memory of my late brother **Prof. Kofi Awoonor**

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## Acknowledgement

I write to acknowledge those people who made this work possible and to thank God for his mercies and abundant love and kindness to me throughout this journey. This work would not have been possible without the support, guidance and tolerance of my supervisor Prof. Don de Savigny. I thank him immensely for accepting to supervise me and for guiding me throughout this work. He is such an inspiration and his expertise in health systems science and years of experience in this field and particularly working in Africa provides such a great opportunity for me to learn under his supervision. It is such a privilege and I remain extremely grateful to him.

I am equally thankful to Prof. Jürg Utzinger and Kaspar Wyss for their support and technical guidance in reviewing my prospectus. My thanks also go to Prof. Marcel Tanner for accepting me to do my PhD in Basel at the Swiss TPH. My sincere and special thanks to Christine Mensch without whom life in Basel and for that matter Swiss TPH would have been a nightmare. Special thanks to Dagmar Batra for her support and all the entire staff and faculty of Swiss TPH.

My sincere gratitude goes to Prof. James Phillips, Heilbrunn Department of Population and Family Health, Columbia University who is my mentor. His expertise in population and health system development and understanding of the systemic issues confronting health development in Africa and Asia earns him immense respect from many especially those who ever worked with him. His selfless devotion and commitment to developing human resources for health and building capacity for young African health scientists is outstanding. I remember many years ago in the early 1990's when he found me in the remote village of Nkwanta in the Volta region of Ghana while I was working as a practicing clinician. Since then, his continuous mentorship and ideas regarding public health in general and emergency public health culminated in my deep interest in the field of public health, to which he greatly contributed, leading me into the public health arena. I will continue to cherish our relationship.

Many thanks to Prof. Fred Binka, who I consider my chief mentor and who gracefully accepted to be external expert of my PhD thesis. Prof Binka in 1996 opened my eyes to the real world of field epidemiology and public health in Navrongo and as if by fate, gave me the first two motorbikes to initiate community-based health services delivery through the Community-based Health Planning and Services (CHPS) concept in the Nkwanta district of the Volta Region of Ghana. That was the seed that has grown and now bearing fruits. He inspired me in developing a passion for community public health and this grew stronger throughout my work over the years. I will remain forever grateful to him.

I am also grateful to Prof. David Ross for gladly and graciously accepting to be the co-referee of my PhD thesis. The light he and others like Prof. Binka ignited in Navrongo many years ago in health systems research is still blazing on unabated and saving many lives. His effort and that of many others including the late Dr. Sam Adjei have transformed health research in Ghana.

This work is borne out of the Ghana Essential Health Intervention Project (GEHIP) which was implemented in the Upper East Region of Ghana of which I am the Co-Principal Investigator. Several people were part of this work. I am indebted to the many people through this journey and I wish to extend my gratitude to all. Dr. Frank Nyonator, former Director Policy Planning Monitoring and Evaluation of the Ghana Health Service, who was part of the original brains behind the design and implementation of GEHIP, Dr. Elias Sory, former Director General of the Ghana Health Service who chaired the Advisory Board of GEHIP and Dr. Moses Adibo, former Director of Medical Services and Project Advisor. Their technical guidance, advisory support and collaboration have been crucial to the success of this work. Dr. Bawah Ayaga, Director of Research, GEHIP provided enormous research advisory support for this work and I am deeply grateful for his true friendship.

I am equally grateful to the staff of the Upper East Regional Health Directorate, Rofina Asuru, Robert Alirigia, Mathias Aboba, Maurice Anyawie, Joyce Ndago, Janet Tiah, Dominic Achinkok, Abdul Jaleel Mumuni, Lawrence Yelifari and many others.

Many thanks to the Municipal and District Directors of Health Services of the 13 districts of the Upper East Region who supported my work in the districts in various ways. Special thanks goes to Juliana Anam-erime Akugre, Bongo District Director of Health Services, Juliana Adiale, Builsa District Director of Health Services and Cecilia Azaabu, Garu-Tempene District Director of Health Services for their dedicated work, immense contribution in the field of health service delivery and this important work saving lives especially mothers and children. Without their commitment and support, this work would not have been successfully completed.

I was privileged to work with interns, fellows and students from the Heilbrunn Department of Population and Family Health, Columbia University whose contributions has enriched my work and contributed to health systems strengthening in the Upper East Region. My gratitude to all of them. Special thanks goes to Allison Stone, Margaret Schmidt, Sneha Patel, Mallory Sheff, Chen Wang and Tioluwa Olokunde all with whom I have published one paper or another. I also thank all the members and staff and colleagues in Swiss TPH and the EPH department and my Unit for many shared moments.

Lastly I will like to thank the Doris Duke Charitable Foundation (DDCF) who provided financial support with grants to Columbia University through the Population Health Implementation and Training Partnership (PHIT) under the African Health Initiative (AHI) to carry out my PhD work. My gratitude also goes to British Charity Comic Relief for providing additional financial support to GEHIP and the School of Public Health, University of Ghana (UGSPH). GEHIP is part of a broader project of the PHIT AHI funded by the Doris Duke Charitable Foundation that involves five African countries namely Ghana, Zambia, Mozambique, Tanzania and Rwanda.

Finally all this work would not have been possible without the inestimable support of my family. I wish to thank them for all their tolerance, support and sacrifices. Special thanks and love to my daughter Stephanie. And to my late brother Prof. Kofi Awoonor, whose encouragement to pursue a PhD was so inexcusable, but never lived to see this dream come true. It is my hope that this work will be an important contribution towards building a strong health system leading to the provision of better community health care in Ghana.

## Summary

Recent decades have witnessed the proliferation of large-scale initiatives for improving health systems. Strategies such as the Bamako Initiative, the Sector-Wide Approach, Child Survival+ and many others were instituted with compelling rationales for improving the provision of essential health services. Yet, large-scale investments in untested health system initiatives have often been associated with disappointing results, or with little formal evidence that investments in organizational strategies have actually improved health. Interestingly, no prior study has tested the proposition that the six WHO health system building block subsystems (integrated health service delivery, health workforce, information for decision making, essential drug supplies and logistics, health financing and resources allocation and leadership and governance) can be strengthened with an integrated package of systems interventions in ways that can accelerate the pace of improvements in child health and survival. If such incremental effects can be demonstrated, prospects for expanding international and national commitment to health systems strengthening will be greatly enhanced and specific lessons from implementation research and operational experience of this nature will be invaluable to health planners.

Health services delivery in Ghana is decentralized and in discharging its constitutional mandate to expand access to healthcare, the Government of Ghana has implemented policies that mandate a system of services, referral operations and supervisory roles for health care services that is provided in hospitals, sub-district health centres and community-based facilities. Health service innovations are provided at the community level through a policy known as the Community-based Health Planning and Services (CHPS) Initiative that aims to mobilize community leadership, decision-making systems and resources in poor rural areas; relocate facility-based nurses to community service points called “CHPS zones” and orient these workers to the active provision of community-based outreach and doorstep healthcare. CHPS also supports nurses with logistics and community volunteer systems to provide services according to the principles of primary healthcare including integrated management of childhood illnesses, comprehensive immunization services and basic safe motherhood care.

Despite efforts to implement this community-based health system, a number of challenges have emerged that limit access to service delivery using the six WHO health systems building block subsystems. Critically identified are the following challenges:

1. *Governance*: Leadership and governance systems are poorly understood and inadequately marshalled for health development at the local and community level.

2. *Financing:* Budgets and financial plans are largely determined by past budgets or external vertical programmes rather than resource allocation that is based on the configuration of need.
3. *Information:* Health information capability to support decentralized healthcare system has instead been a time consuming data extraction process for the health insurance and central health bureaucracy rather than a system for community-based healthcare workers that contributes to their work, decision-making, or supervisory support needs.
4. *Logistics:* Even though there is deemed to be a decentralized management of health services, there is still a centralized medical stores system, resulting in episodes of catastrophic breakdown in supply chains, with stock-outs that are exacerbated when district health service operations increase.
5. *Human resources:* Shortages in the district health management, midwifery, and nursing workforce arise, either because of their inappropriate posting location or inadequate numbers as well as poor leadership that seriously undermines efforts to strengthen the health systems.

This work reviews the Ghana Essential Health Interventions Project (GEHIP), implemented in the Upper East Region of Ghana to contribute to the health systems strengthening policy by testing the health and survival impact of strengthening the primary health care system. GEHIP tested the hypothesis that integrated system initiatives cutting across the WHO “pillars” of health system strengthening can improve system performance to the point of having an impact on population and health outcomes and ensure that essential health interventions reach under-served populations and progress towards Millennium Development Goal (MDG) 4 can be achieved. The project essentially focused on strengthening district-level capacity to plan and set priorities using locally obtained burden of disease and cost-effectiveness data in order to increase the effectiveness of Ghana’s Community-based Health Planning and Services (CHPS) programme, with the goal of accelerating the expansion of CHPS coverage and improving the quality of CHPS provided care.

A mixed methodology was used to gauge the impact of the health system functioning according to a framework of interventions spanning the six WHO health systems building block subsystems. Aggregate impact of GEHIP on child survival was tested with the Heckman “difference of differences” procedure using results from a baseline survey that was conducted in 2010 and an endline survey conducted in 2015 in four treatment and seven comparison districts. Qualitative Systems Appraisal (QSA) in the form of in-depth interviews and focus group investigations of community stakeholders, frontline workers, supervisors, and district health managers was employed to gauge reactions to the GEHIP system, clarify inputs by the

health subsystem, reactions to these inputs and recommendations for systems change. Regression methods were used to refine the Heckman procedure, adjusting for potential confounders and estimating net effects of household exposure to GEHIP improved care on the survival of children.

GEHIP is a quasi-experimental study of a project designed to accelerate the scale up of one of the most effective health development experiments ever conducted in Africa –The “Navrongo Experiment”. It supplements the provision of effective primary healthcare strategies with leadership training, field demonstration, improved budgeting and resource mobilization. By means of these interventions, GEHIP sought to enhance health equity, mitigate social and monetary health care costs, foster parental health seeking behaviour and improve maternal and child survival. Training was designed to expand access to life saving technology that reduces neonatal, infant, and childhood mortality. Additional components for improving referral, neonatal survival, and maternal health rekindled Ghana’s legacy of generating evidence-based means of achieving affordable and accessible primary health care throughout Ghana.

Findings from this work have shown that the combined effects of leadership training, catalytic investment, political engagement, and evidence-based budgeting are capable of solving CHPS start-up problem and accelerate scale up. At baseline, neonatal and maternal mortality rates were unacceptably high, but the rapid training of frontline workers proved to be inexpensive, operationally feasible, and potentially effective in reducing maternal and neonatal mortality. Moreover, an innovative pilot referral system utilizing locally appropriate tri-car ambulances has been implemented and information systems have been reformed through the adoption of a simplified register system with impressive results.

Accelerating CHPS scale-up is crucial to health development in Ghana where the expansion of CHPS has languished because district health systems strengthening requirements were unanticipated by national policies. Research results showed that the interventions had their intended impact on the pace of CHPS scale-up. This success translated into an impact on child mortality resulting in GEHIP providing a critically needed focus for national efforts to develop primary health care, and lessons for global health experts as well.

## Abbreviations

ACT	Artemisinin-based Combination Therapy
AHI	Africa Health Initiative
AIDS	Acquired immune deficiency syndrome
ANC	Antenatal Care
ARI	Acute Respiratory Infection
ASFR	Age Specific Fertility Rate
ATE	Average Treatment Effect
BCG	Bacillus Calmette–Guérin
BMC	Budget Management Centre
BoD	Burden of Disease
CHAG	Christian Health Association of Ghana
CHC	Community Health Compound
CHO	Community Health Officer
CHPS	Community-based Health Planning and Services
CHV	Community Health Volunteer
CRVS	Civil registration and vital statistics
DA	District Assembly
DCE	District Chief Executive
DD	Differences-in-Differences
DDCF	Doris Duke Charitable Foundation
DHIMS	District Health Information Management System
DHMT	District Health Management Team
DiHPART	District Health Planning and Reporting Toolkit
DPT	diphtheria, pertussis and tetanus
DSS	Demographic Surveillance System
DVLA	Driver and Vehicle Licensing Authority

EmONC	Emergency Obstetrics and Neonatal Care
FGD	Focus Group Discussion
GDHS	Ghana Demographic and Health Survey
GEHIP	Ghana Essential Health Intervention Programme
GHS	Ghana Health Service
GoG	Government of Ghana
GSS	Ghana Statistical Service
HepB	Hepatitis B
HIV	Human immunodeficiency virus
HMIS	Health Management Information System
IDI	Individual Interview
IMCI	Integrated Management of Childhood Illness
IPPD	Integrated Pay Processing Department
IPTp	Intermittent Preventive Treatment of malaria during pregnancy
ITNs	Insecticide treated nets
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MoF	Ministry of Finance
MOH	Ministry of Health
NGO	Non-Governmental Organisation
NHIS	National Health Insurance Scheme
NHRC	Navrongo Health Research Centre
ODK	Open Data Kit
PHIT	Population Health Implementation and Training Partnership
PPME	Policy Planning Monitoring and Evaluation
QSA	Qualitative Systems Appraisal
RHA	Regional Health Administration
RHS	Resilient Health System

SERC	Sustainable Emergency Referral Care
SES	Socio-economic status
SP	Sulphadoxine-Pyrimethamine
SWAp	Sector-wide Approach
TEHIP	Tanzanian Essential Health Intervention Project
TFR	Total Fertility Rate
UDS	University of Development Studies
UER	Upper East Region
UGSPH	University of Ghana School of Public Health
UHAS	University of Health and Allied Sciences
UHC	Universal Health Coverage
UN	United Nations
UNICEF	United Nations Children's Fund
WHO	World Health Organisation

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## **Part I**

### **INTRODUCTION**

# 1 Introduction

*“Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots.” Peter Senge, *The Fifth Discipline**

## 1.1 Background

Ghana has a long experience with evidence-based health systems development. During the early 1990s, debate about practical means of achieving the World Health Organization’s goal of “Health for All by the Year 2000”, led the Ministry of Health to implement an experimental maternal and child health programme in the Kassena-Nankana District of the Upper East Region (UER), Ghana’s poorest region (Ghana Statistical Service 2008a). The programme, known as the “Navrongo Experiment” was based at the Navrongo Health Research Centre (Binka et al. 1995b), which due to its past involvement in international public health research, had a Demographic Surveillance System (DSS) that regularly conducted continuous monitoring of mortality, morbidity and fertility dynamics in this largely rural Sahelian area (Ghana Vast Study Team 1993, Binka et al. 1998, 1999). By 1998, preliminary results of the Navrongo experiment had begun to demonstrate that the project would have an impact. In the initial five years, fertility declined by about a birth from a total fertility rate of 5.5 (Debuur et al. 2002; Ngom et al. 1999; Phillips et al. 2006) and the maternal mortality ratio declined by 40 per cent (Mills et al. 2008). By the end of project monitoring in 2003, childhood mortality was reduced by 68 per cent in communities where nurses were based while levels remained relatively unchanged in comparison areas (Binka et al. 2007).

The Navrongo Experiment’s success was based on at least two key features. Firstly, it offered life-saving services delivered in a convenient, low cost, and effective manner. Estimates derived during the programme suggested that if faithfully scaled up, the programme would add only \$2.92 per year per capita to the revenue budget to launch, and an additional \$1.92 per capita to current spending to sustain over time. Secondly, through community mobilization activities, especially with men, the programme built a climate of trust between community health workers and extended families. Whereas clinical workers are required to charge fees from parents at the time of care, the community-engagement system enabled community-based workers to trust clientele to eventually reimburse the system for pharmaceutical costs, even if families lacked cash at the time of care. This “trust as insurance” system prevented delay in seeking care immediately as needed, but ensured the system that extended families could be trusted to support emergency health care costs (Nyarko et al. 2002). Moreover, community engagement overcame “gate-keeping” of women’s health seeking behaviour

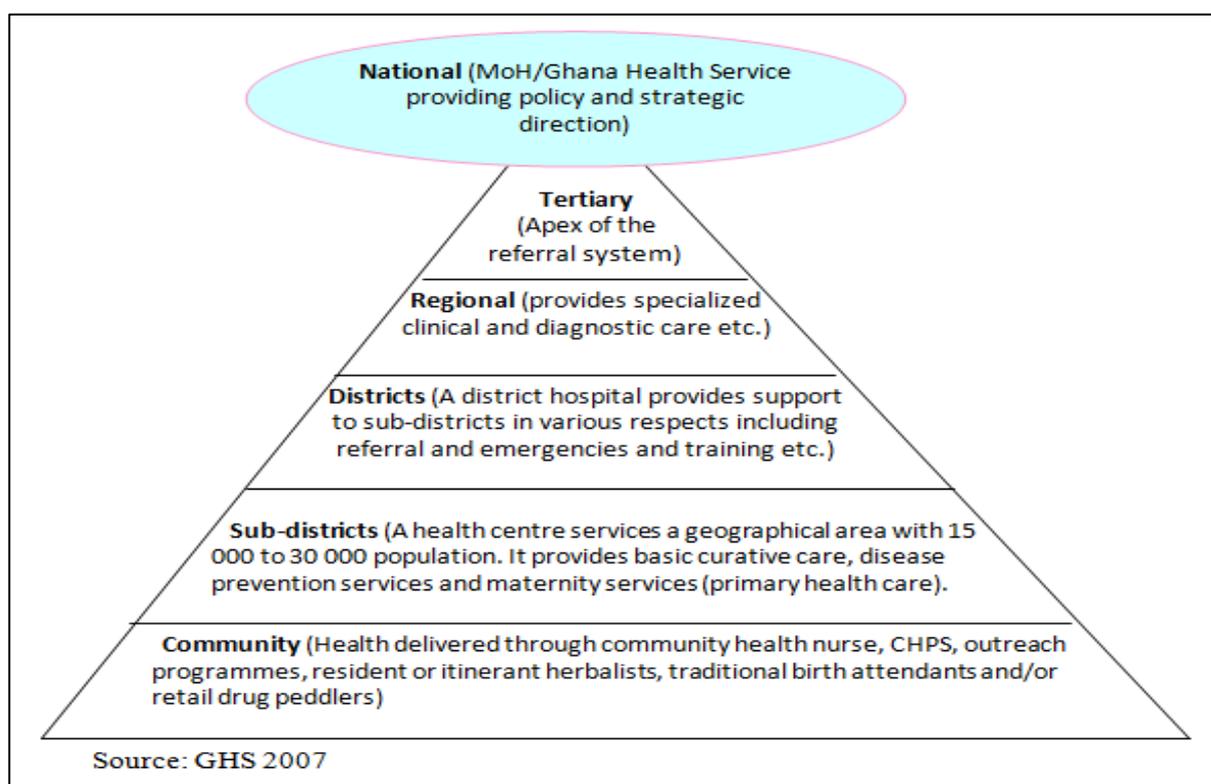
(Ngom et al. 2003). When women and children become ill in profoundly gender stratified societies like those of northern Ghana, they are often denied the timely provision of simple, lifesaving interventions because their elder women or male relatives are reluctant to allow them to seek care immediately (Moyer et al. 2013). This problem is particularly constraining for family planning services (Adongo et al. 1997). Through community meetings, peer education and other interventions, the Navrongo model helped relax these constraints on women's behaviour (Phillips et al. 2012, Adongo et al. 2014).

Despite the success of the Navrongo project, the policy relevance of results was questioned by many district, regional, and national programme managers. To address this skepticism, the District Health Management Team (DHMT) from Nkwanta District of the Volta Region launched a replication trial of the Navrongo model (Akosa et al. 2003, Nyonator et al. 2008). Implementation research showed that immunization coverage, service volume, and family planning acceptance replicated the Navrongo project (Awoonor-Williams et al. 2004). In 2000, in response to this demonstration scaling up of the Navrongo model, now called the Community-based Health Planning and Services (CHPS) Initiative was adopted as national policy (Nyonator, Awoonor-Williams, et al. 2005; Ghana Health Service 2005) .

### **1.1.1 Organizational Structure of the Ghana Health Service Delivery System**

The Ghana Health Service (GHS) is the main provider of public health care services in Ghana, though health services delivery is complimented by services provided by the Christian Health Association of Ghana (CHAG) and other private health care providers. The Ministry of Health (MoH) however is in charge of policy formulation and all institutional players within the Ghana health system are ultimately accountable to the MoH. A major objective of the MoH is to improve access and equity to essential health care and to ensure that the health sector plays an important role in the overall national Poverty Reduction Strategy by improving financial and geographic access to quality health care services, with a priority focus on the needs of vulnerable groups (Republic of Ghana Ministry of Health 2007).

**Thus, the Ghanaian health care delivery system is functionally organised into five levels; community health facilities, sub-district health centres, district hospitals, regional hospitals and at the apex, teaching hospitals**



**Figure 1.1: Organization of health services in Ghana. Adapted from Ghana Health Service (Republic of Ghana Ministry of Health 2007)**

### **1.1.2 The Community-based Health Planning and Services (CHPS) initiative**

The Community-based Health Planning and Services (CHPS) initiative is a unique component of Ghana’s health care delivery system, designed to provide cost-effective and adequate basic primary health care services to individuals and households in communities where they live. This is achieved by engaging the community in the planning and delivery of services. CHPS is a strategy for Primary Health Care that involves basing one or more trained nurses in a defined community who offer limited curative and preventive health care services. Usually, volunteer health workers are deployed in CHPS service areas, termed “zones” where nurses reside in a health post and coordinate the health promotional activities of volunteers.

The primary staff resource for CHPS are nurses, termed “Community Health Officers (CHOs), who spend 18 months in training schools and carry out an additional six month internship for developing community liaison skills. CHOs are provided with essential equipment and assigned to health posts (termed Community Health Compounds) where they live and conduct doorstep services. This involves treatment of malaria, acute respiratory infections and diarrheal diseases (termed “Integrated Management of Childhood Illness”) as well as the organization and provision of comprehensive childhood immunization, family planning care for oral, injectable, and barrier contraception. CHOs live and work in health posts built with

donated materials and the labour of community volunteers, and are provided with a motorcycle. As resources become available, the health posts are often upgraded or reconstructed as permanent structures that replace the makeshift community provided facilities. Volunteers care for diarrheal diseases, but are mainly health promoters and referral agents who balance nurse outreach to women with a focus on the information needs of men and organizational activities such as community gatherings, security arrangements for nurses, and information services for outreach clinics where immunization is provided. To support their work effectively, these volunteers are provided with a bicycle.

CHPS thus occupies the “ground-level” of the health system. Both CHOs and community volunteers provide services at the doorstep and at community health posts. As in the rest of the Ghana Health Service (GHS), trained paramedics provide care at sub-district health centres serving roughly six to ten villages or 20 to 30 thousand people, and clinicians provide surgical and other specialty care at district hospitals. Financial management and policy guidance is provided by a “District Health Management Team” (DHMT) comprising a District Director of Health Services and officers responsible for disease control, nursing, clinical operations, and nutrition. Supplemental funding for CHPS is sometimes provided by Regional Health Administration (RHA) resources, but uniform standards for such support is lacking.

### **1.1.3 The Navrongo Experiment, CHPS and Lessons Learned**

The Navrongo experiment demonstrated the limitations of basing child survival programmes on access to commodities and/or clinical care alone. In one of the cells, briefly trained, unpaid volunteers were deployed to refer cases and provide antipyretics, vitamins and other non-prescription drugs. Over the short term, child mortality actually rose in this area compared to a control area where no interventions were offered, other than those routinely offered by the GHS. Research subsequently showed that syndromic intervention by credible, but poorly trained volunteer workers delayed parental health seeking for effective curative care (Nyarko et al. 2002, Pence et al. 2007). Only when comprehensively trained and fully paid nurses were posted to these areas did child mortality begin to fall substantially (Binka et al. 2007b). This crucial lesson still has yet to be internalized by many international donors, many of whom continue to favour interventions based on the distribution of simple commodities or health promotion by untrained volunteers alone, eschewing more substantial health system interventions because they seem complicated and expensive (Bryce et al. 2008, 2010). Moreover, properly trained and equipped community health workers can have health equity effects. In the Navrongo experiment, nurse posting offset the detrimental effects of low parental educational attainment and relative household poverty on immunization, health seeking behaviour, and child survival. Volunteer services had no comparable equity effects

(Bawah et al. 2013). However, if nurse-provided community based care was combined with health promotion activities of volunteers, family planning gained credibility and fertility declined, as well as maternal and child mortality. Thus, the combined approach was adopted as the organizational model for CHPS.

Ghana had aimed to expand CHPS to all communities by 2015 with finances provided largely through government resources and yet there has not been any health sector budget provision for the cost of launching CHPS. Additional support is to be provided by NGOs, District Assemblies, and the global community. Though CHPS facility costs, equipment costs, and special start-up investments are not routinely available, flexibility for financing these costs exists in the development sector. In particular, development revenues of the World Bank, the European Union and some bilateral donors are committed to flexible revenue accounts managed by District Chief Executive and District Assembly development decision-makers. Whereas policies of the "Sector Wide Approach" once provided flexible revenue to district health managers, all fiscal flexibility is now managed by district political authorities. Taken as District Assembly Common Fund, this source of revenue provides crucial district development resources that are external to the health sector but could be used to finance the essential \$2.92 per capita in CHPS start-up costs. Since only about \$14 per capita is available for all health expenditures combined, any meaningful contribution to the \$2.92 per capita represents a major catalytic investment in CHPS expansion (Nyonator et al. 2005a). However, district officials must decide to make and sustain this investment, despite competing demands on the development budget from other sectors. Where CHPS leadership is well articulated, district political commitment has directed some of these resources to the \$2.92 per capita incremental start-up costs. Exchanges between districts have been critical to demonstrating effective means of developing this commitment.

By 2008, CHPS implementation had commenced in all of Ghana's districts, but scale-up within districts had stalled or was incomplete nearly everywhere. CHPS as it was originally envisioned was reaching only 12 per cent of Ghana's households (Nyonator et al 2011). Where Regional Health Administration support involved the financing of exchanges between districts, there was active engagement with political and development authorities. Routine discussion of CHPS at staff meetings led to a small investment in CHPS and generated pilot implementation zones within districts. These demonstration communities, in turn, were instrumental in establishing a process of CHPS implementation within a given district that was rapid and straightforward. The Nkwanta experience showed that proper introduction within a given district, with strategies for community engagement, could catalyse political and NGO investment in scale-up (Awoonor-Williams et al. 2010b). Through peer-to-peer exchanges, district leaders who had implemented CHPS successfully were able to persuade those in other

districts to do the same, but this “catalytic leadership” was hard to define programmatically, and has not been instituted on a national scale (Nyonator et al. 2005b). Donor support for some aspects of CHPS expansion has been generous but has tended to support technical assistance and workshops rather than the political mobilization that seems necessary to transfer implementation capacity from one district to another.

The fundamental problem was that CHPS was originally conceived as a community-based trial rather than a systems initiative that involved interventions for developing district and regional leadership. Its research was focused on identifying the best way of delivering services and sustaining community engagement for primary health care. However, scaling up CHPS is a district systems issue, and requires improved capabilities in regional and district management, planning, budgeting, and resource development. This, in turn, requires political mobilization beyond the community level.

In addition, fidelity to the original CHPS model developed at Navrongo has dissipated with passing time - a scaling-up phenomenon noted elsewhere (Awoonor-Williams et al 2015b; Awoonor-Williams, et al. 2013). For example, the Navrongo Experiment encouraged communities to construct health posts for CHOs from donated materials with volunteer labour. Construction of permanent facilities was meant to be a reward for this community activity. However, some district managers delayed nurse deployment until revenue became available for financing outside contractors to construct health posts. Consequently, construction has become a constraint to implementation rather than an incentive for community action. Using funds to hire outside contractors also substantially raised the potential cost of scaling up, creating a further disincentive for donors and others to support CHPS.

The package of services was also often incomplete and proven life-saving components were needlessly excluded from the regimen. For example, supervision of nurses and volunteers was inadequate in many districts and information systems were so cumbersome that they were useless to CHOs. Another problem was that district leadership often prioritized ambulatory clinical care of adults rather than building community and political engagement to encourage community-based preventive health services and early treatment of the leading causes of childhood morbidity. In addition, owing to official National Nurses and Midwifery Council objections, CHO training excluded emergency obstetric care, life-saving skills such as the management of asphyxia and haemorrhaging, and proven approaches to saving newborn lives. In CHPS zones that were as yet incomplete, IMCI services were often inaccessible because there was no CHO. Volunteers might have been able to provide some of these services but since they were often poorly trained and supervised, the GHS did not allow them to provide antibiotic therapy. Thus, despite evidence that community-based primary health

care was scalable and affordable, health conditions remained needlessly poor as a result of implementation bottlenecks.

### 1.1.4 The Ghana Essential Health Intervention Project

As a solution to the challenges of CHPS, the Ghana Essential Health Interventions Project (GEHIP) was designed as a quasi-experiment to test the proposition that a novel set of interventions could improve the impact of CHPS, accelerate its adoption by districts, and thereby improve the health and survival of children under age five. GEHIP interventions are informed by a prior initiative in Tanzania, known as the Tanzania Essential Health Interventions Project (TEHIP) which developed and tested tools for evidence-based planning, resource mobilization, and district health system leadership. GEHIP is posited on the assumption that improved planning, resource allocation, and leadership will accelerate CHPS, improve CHPS functioning, and reduce mortality as a result (Figure 1.2).

During the 1990s, TEHIP was shown to have significant effects on child health and survival in Tanzania, but its main potential for contributing to Ghana was its success in scaling up. Within a brief period, TEHIP transformed national management training, planning, and resource mobilization in all 120 districts of the country (DeSavigny et al. 2008). In the case of GEHIP, the Tanzania district systems strengthening approach is augmented with frontline worker training, emergency referral systems development, and other health systems strengthening initiatives that, when implemented together, are posited to have synergistic effects on CHPS implementation. But, mainly, GEHIP has borrowed the TEHIP focus on district planning capacity, resources and leadership development. By doing so, GEHIP aims to set the stage for Ghana to scale-up CHPS, thereby replicating the success of Navrongo in every community of the country.

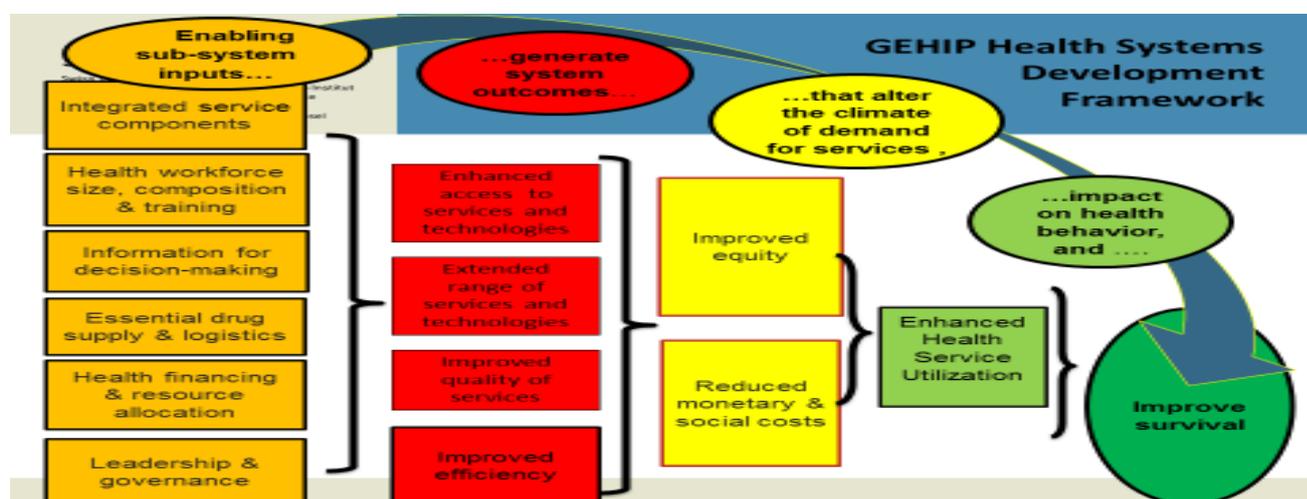


Figure 1.2: Ghana Essential Health Intervention Project Systems Development Framework

The Ghana Essential Health Intervention Project had six key areas of intervention as illustrated in Figure 1.3 below:



**Figure 1.3: GEHIP Core Elements for Health Systems Strengthening**

- Improving IMCI and related community-based services.* National survey research and review of Navrongo long term trends showed that neonatal mortality has declined more gradually than post-neonatal mortality. GEHIP has therefore introduced the Save the Children “Saving Newborn Lives” intervention package for both nurses and volunteers (Beck et al. 2004, Baqui et al. 2008). This involves instituting procedures for promoting facility-based delivery, knowing the timing of delivery and providing immediate post-delivery follow-up for neonates that are born at home, providing “kangaroo mother care” training for mothers of premature neonates, and developing an emergency referral system that prevents delay in care when emergencies arise. Because Integrated Management of Childhood Illness (IMCI) services remained inaccessible in communities where CHPS has yet to be implemented, a programme of training volunteers in antibiotic therapy and malaria treatment was introduced that involves intensive supervision, referral services, and follow-up care. These interventions, together with in-service refresher training for all frontline workers, was aimed at strengthening the community-based service system.
- The simplification of information systems.* Procedures for data collection was simplified with the elimination of gratuitous registers and forms, in conjunction with the development and testing of a new national health management information system known as the District Health Information Management System (DHIMS2). Designed to support the decentralization of the healthcare system, DHIMS2 improves the flow of information and supports the integration of health service operations. With the completion of GEHIP register simplification, DHIMS2 addresses the need of

community-based healthcare workers for simple and accessible information for supporting routine service delivery operations. Previously, cumbersome paper registers were required, along with tedious manual data aggregation procedures, requiring CHOs to spend copious amounts of time recording patient visits and registering insurance forms. Ghana’s efforts to expand access to its health insurance programme only added to the information burden. A GEHIP baseline time use study found that workers spent more time on paperwork than client care (Frimpong et al. 2011) and received no useful feedback or guidance from these efforts. GEHIP introduced a “Simplified Register” to condense the volume of registers from 27 to five. Taken as a set of interventions, these GEHIP activities was aimed to improve the quality, intensity, and access of primary health care.

**Table 1.1: GEHIP Core Elements for Health System Strengthening**

Type of Health System Component	Health System Challenge	GEHIP Strategy/Intervention to Address
Improved community-based services	Frontline workers often lack essential skills for saving newborn lives.	GEHIP developed a community-engaged emergency referral system as well as improved emergency management capacity
Clinical capacity development	Lack of training and essential skills for frontline workers	GEHIP launched health and mortality audit procedure for all frontline workers, which results highlighted areas necessitating clinical care improvements including essential newborn care and expanding the range of volunteer skills
Information for decision-making	Lack of effective health care delivery requires essential information for decision-making.	GEHIP worked at two levels namely information tools for frontline workers and knowledge management for decision-makers
Essential equipment and supplies	Frontline workers are often confronted with challenging community level responsibilities without the provision of enabling equipment and supplies.	GEHIP developed health information tools that monitor access to essential equipment for primary health care and ensure essential logistics needs
Building district capacity for budgeting and planning	Health system strengthening (HSS) is often hampered by the lack of capacity to plan healthcare services and allocate resources according to actual need.	GEHIP piloted a tool known as the District Health Implementation and Reporting Toolkit for basing budgeting on the burden of disease implications of alternative strategies for health care spending.
Leadership for expanding community services:	Strong leadership is essential to HSS. Yet leadership training typically focuses on district managers alone.	GEHIP uses an HSS approach that combines political, traditional and health system leadership through observation, participation, and peer learning for building HSS with grassroots political, financial, and social backing.

*iii) Improving district leadership, management, planning, and political engagement.*

Scaling-up community health services requires attention to more than the roles and functions of frontline workers. District Health Management Teams require strengthened capabilities to make community-based care happen. Management

functions that foster community liaison and social mobilization, grassroots political engagement, volunteerism, gender-based communication and male outreach constitute a package of capabilities that the GEHIP initiative aims to develop, test, and disseminate. Leaders of district health systems are trained in public health science and clinical care, but typically lack experience with leadership and political mobilization. In response, GEHIP sought to help district managers understand the community-engaged approach through leadership training emphasising the value of peer exchanges, field demonstration, and political partnership for health systems development. Budgeting and resource mobilization has also been missing in the CHPS implementation experience. Indeed, when managers are interviewed about the reasons for the failure of CHPS to scale up, the most widely cited problem concerns resource constraints and lack of feasible strategies for solving the resource mobilization challenge. While budget lines exist for activities that frontline workers can implement, the cost of launching CHPS services, particularly developing practical means for DHMT to raise support for the construction of health posts where workers can live and work, as indicated earlier, has no GHS budget line. This has been a key focus of the GEHIP project.

In order to help managers address the budgeting problem, the GEHIP team entered into a partnership with counterparts in Tanzania who had developed a project that combined a budgeting tool and an additional dollar per capita per year for five years. District managers were then able to use the tool to estimate the burden of disease implications of investing that dollar in different programmes. Research showed that this strategy enhanced the effective allocation of resources. With technical support from the Tanzanian team, their “PlanRep Toolkit” was reengineered for trial by GEHIP as the District Health Planning and Reporting Toolkit (DiHPART). The implementation of DiHPART was therefore designed to address the absence of a budget line for CHPS, and the rational spending of health resources by districts. Whereas budgets in the past were based on previous budgets rather than actual need, DiHPART enabled district managers to allocate budget priorities according to their relative impact on the burden of disease. GEHIP also added \$0.85 per capita to district budgets per project year for DiHPART-guided programming. DiHPART introduction involved training district managers to implement budgeting procedures that prepare “before charts” showing the burden of disease implications of the budget plan. Bar diagrams illustrate the pattern of risk apportioned according to the addressable burden of disease (BoD) associated with categories of interventions. The DiHPART resource allocation model is used to apportion each investment according to sets of interventions and priorities reflected by the proposed budget and compare that to a risk profile that is based on Navrongo Health Research Centre BoD

estimates. The contrast between budget BoD profiles and the pattern of risk provided an indication of whether plans conform to the pattern of need.

GEHIP has also used DiHPART to conduct broader training sessions with district and sub-district officials. This training was necessary because although grassroots political and administrative leadership for health development has been implemented in some districts, these strategies have not been implemented on a large scale, in part because leadership and governance have yet to be translated into a coherent training programme for managers. Shortages in trained leadership for district operations, especially in the areas of planning and implementation and community engagement, are undermining Ghana's efforts to strengthen its health system and foster CHPS expansion. The training combined hierarchical teamwork development with peer leadership engagement, and on-site field demonstration that equipped managers with skills required for building understanding and cooperation between community, health, development, and political leaders.

#### **1.1.5 Rationale for Health System Strengthening Approach to GEHIP**

Health system development in Ghana is largely fraught with several bottlenecks; access to primary health care services, vertical programming and external ownership, weak systems, bureaucratization without an open systems perspective, operational deficiencies with resource constraints and inadequate reliance on evidence-based strategies for strengthening systems. In addressing these challenges the Ghana Community-based Health Planning and Service (CHPS) Initiative was initiated in the 1990s to test various strategies for healthcare delivery. Despite the impressive results of CHPS, nationwide scale-up has been fraught with implementation challenges. This study was launched as a coordinated response to address these challenges as a means of facilitating the scale up of CHPS and sought to strengthen CHPS by strengthening the elements of the six WHO pillars of health systems development (Table 1.1). GEHIP is a plausibility trial for testing the hypothesis that health systems strengthening will accelerate achievement of Millennium Development Goal 4 for child survival.

Arising out of the GEHIP work, the study aimed at bringing together five years of systematic implementation of a health system project in the Upper East Region of Ghana and to document the implementation process and impact of the project on population health and survival. The study utilized mixed methodology to gauge the impact of the health system functioning on child survival using the six WHO health systems building block subsystems. Aggregate impact of GEHIP on child survival was tested with the Heckman "difference of differences" procedure using results from baseline and endline surveys in four treatment and seven comparison districts in the UER of northern Ghana. Qualitative systems appraisal used in-depth interviews

and focus group investigations of community stakeholders, frontline workers, supervisors, and district health managers to gauge reactions to the GEHIP system, clarify inputs by the health subsystem, reactions to these inputs, and recommendations for systems change. Economic evaluation of this work assessed the unit cost associated with net health benefits that accrued from GEHIP expenditures. To achieve this, cost and expenditure data were gathered at each level of the system to allow for estimation of benefits resulting from supplementary expenditures in intervention districts. Economic data were captured from project accounts and records, GHS expenditure records at all levels of project implementation (including start-up, development, planning, training, supplies and equipment) and all other implementation costs.

Two main overarching questions were addressed by the study: What is the effect of integrated strengthening of the six WHO health systems building blocks on district health system performance and does strengthening district health systems performance accelerate progress with Millennium Development Goal 4?

**Part II:**

**GENERAL OBJECTIVES AND METHODS**

## **2 Goals and Objectives**

### **2.1 Goal of the study**

The goal of this work was to determine the effect of evidenced-based health systems innovations and programmes on access to underserved populations and accelerated progress on child survival in rural northern Ghana.

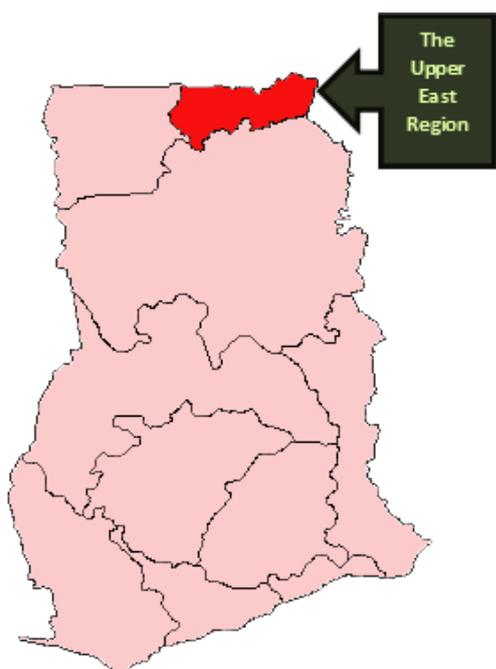
#### **2.1.1 Specific Objectives**

1. To provide the background, goals, design and component interventions of a community-based health system strengthening intervention The Ghana Essential Health Intervention Project in northern Ghana.
2. To describe the effect of strengthening elements of the six WHO health systems building blocks on health services delivery in rural northern Ghana.
3. To document barriers to the successful implementation and scale-up of Ghana's Community-based Health Planning and Service (CHPS) programme and the strategies engaged by Ghana Health Service when confronting those barriers.
4. To assess the usage and evaluate reactions to a district health implementation reporting toolkit in strengthening a rural health systems in northern Ghana and the implications of pilot experience to national scale-up.
5. To investigate the effect of implementation of a community-engaged emergency referral systems strengthening initiative in a remote, impoverished rural setting of northern Ghana.
6. To measure the impact of the Ghana Health Essential Health Intervention Project on health systems performance in northern Ghana.

### 3 Methods

#### 3.1.1 Study Area

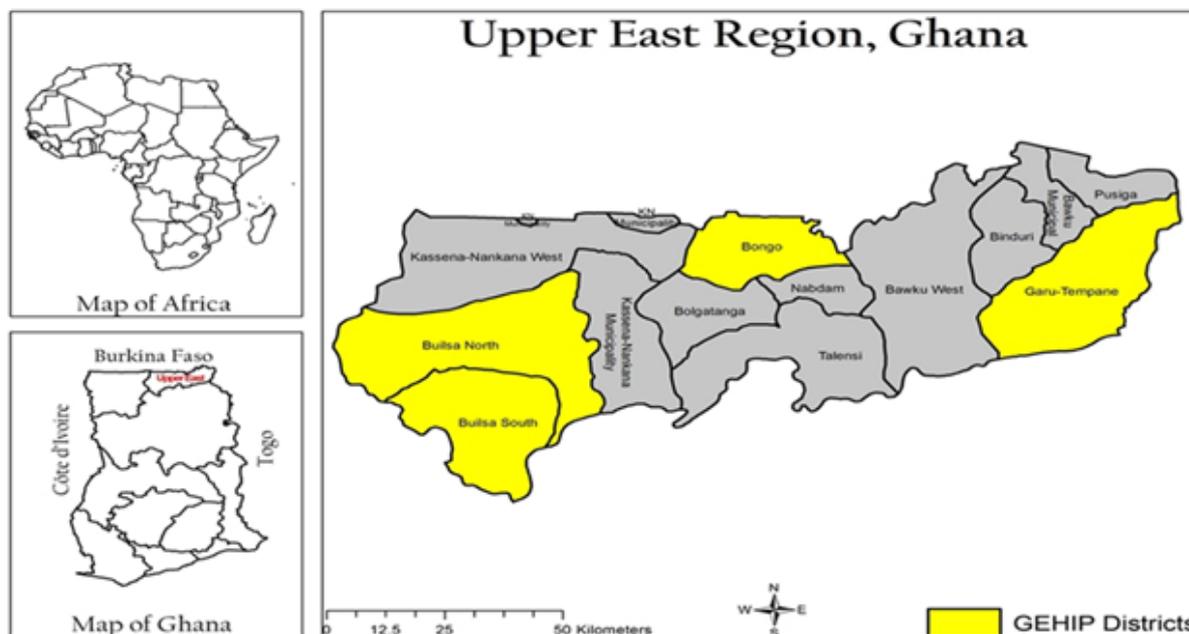
The study was carried out in the Upper East Region, one of the ten administrative regions in Ghana, with a population of 1,110,864 (projected 2010 population census) and a growth rate of 1.2%. The region is located in the north-eastern corner of the country between longitude 0° and 1° West and latitudes 10° 30'N and 11°N. It is bordered by Burkina Faso to the north, Togo to the east, to the west by Sissala District in the Upper West Region and to the south by the West Mamprusi District in the Northern Region (Figure 3.1).



**Figure 3.1: Map of the 10 Regions of Ghana showing the location of the Upper East Region (study area) shaded**

The vegetation of the area is primarily arid savanna grassland with a single growing season. Settlement pattern is highly dispersed in over 1452 communities. Most communities are inaccessible during the rainy season. The capital town of the region is Bolgatanga. The land area is about 8,842 sq. km, which translates into 2.7 per cent of the total land area of Ghana. The major ethnic groups are the Nankani, Bimoba, Bissa, Buli, Frafra, Kantosi, Kassena and Kusasi. The region's economy is dominated by subsistence agriculture, primarily cattle rearing and the cultivation of cereals like millet, sorghum and rice. The major religions in the area include African animism, Christianity and Islam. With regards to health care, the region has one regional referral hospital, five district hospitals, 49 health centres, 48 clinics and 233

Community-based Health Planning and Services (CHPS) Compounds. Apart from government health facilities, there are a few private facilities operated mainly by Christian missionary organizations. The region currently has 13 districts (with 91 sub-districts). However, at the time of commencement of the Ghana Essential Health Intervention Project, there were nine districts out of which seven (three intervention and four comparison) were study areas. In 2012, four additional districts were created as a result of Government agenda to further deepen its decentralization policy. As a result of this split, GEHIP intervention activities were then concentrated in four districts namely Bongo, Builsa North, Builsa South and Garu-Tempane, ranked among the poorest five percent of Ghana's 216 districts with per capita income about a quarter of the national average (Ghana Statistical Service Report 2008). Seven other districts Bolgatanga Municipal, Bawku Municipal, Bawku West, Binduri, Pusiga, Talensi and Nabdam districts serve as comparison districts. These seven were carved out of the original four comparison districts (Figure 3.2).



**Figure 3.2: Map of UER showing GEHIP and non-GEHIP Districts**

Two districts, Kassena-Nankana Municipal and Kassena-Nankana West were excluded from the study because these two districts were focused districts of the Navrongo Health Research Centre where several research activities were concentrated including the original Navrongo Experiment. A brief characteristic of the four GEHIP intervention districts are outlined below.

1. Bongo district (population 89,741), has a poorly developed health infrastructure, geographically isolated, and riddled with extreme poverty and adversity complicating efforts to improve health.
2. Builsa North (population 59,948) is isolated by lack of roads and poor transportation systems, electrification, or other development amenities and has high morbidity and mortality levels which are typical of other poor districts of the region.
3. Builsa South (population 38,758) was split from Builsa North, equally isolated by lack of roads and poor transportation systems, electrification, or other development amenities and has high morbidity and mortality levels.
4. Garu-Tempene district (population 137,993), is a densely populated farming district in the southeast of the region with a per capita income of less than US\$100 per year and no medical doctor in the entire district.

### **3.1.2 Study Design**

A detailed description of the methods for this study can be found in the respective chapters. Mixed method approaches utilizing both qualitative and quantitative data analyses was used. Overall in measuring performance of the health system, various process indicators in terms of improvements in coverage by comparing the situation at baseline and what obtains at the end of the project, both in the intervention and non-intervention districts was employed. A detailed analysis of both CHPS and the GEHIP programmes was carried out to describe the effect of strengthening the health systems delivery. A rigorous electronic CHPS monitoring database was used to generate indices for monitoring CHPS progress and eventually, evaluate the impact of CHPS on the health system performance and coverage. The monitoring system captures data on various milestones, including for example when a community has received a CHPS nurse to deliver services, services rendered, commodities available, stock outs, etc.

An in-depth discussion of the Ghana Community-based Health Planning and Services Initiative and review of the results of the Ghana Essential Health Intervention Project was conducted to understand and clarify how the project has responded to scale-up challenges and ways that the national community-based primary health care implementation can be reformed (Chapter 4).

A descriptive analysis of the Ghana Essential Health Intervention Project was conducted to provide understanding of the strategies employed and the impact of the project on CHPS performance and effect on community-based care coverage (Chapter 5).

Two sets of in-depth interviews from qualitative studies were conducted involving 47 participants to examine the scale-up of the CHPS programme in the region and to elicit information on barriers identified in the CHPS initiative and the strategies engaged by Ghana Health Service to address those barriers (Chapter 6).

A qualitative systems appraisal using in-depth interviews and focus group discussions with community stakeholders, purposefully drawn from a sample of health facilities stratified according to compliance with a pilot District Health Planning and Reporting Tool (DiHPART) was conducted. Various categories of health staff, made of various levels of health managers, supervisors and district directors were interviewed in order to gain understanding of trainers, managers, and developers experiences with the design, implementation and utilization of the DiHPART tool and to chart a course in its application to strengthening the health system in Ghana (Chapter 7).

A qualitative study was conducted to gauge and allow for an enriched learning around operational design, community needs and reaction, scalability, acceptability, and potential impact of implementing a community-based emergency referral system in a severely resource-constrained setting in northern Ghana (Chapter 8).

For measuring mortality as an endpoint, a combined baseline and endline surveys were conducted with the aim of quantitatively documenting the before-and-after situation in terms of mortality and other process indicators of interest (Chapter 9). The baseline survey was conducted in 2010 prior to the deployment of the interventions and the endline survey in 2015. These are population-based representative surveys that gathered data from more than 6000 women of reproductive age on various indicators, including mortality and fertility indicators. The surveys, conducted both in the four intervention districts and seven comparison districts allowed for the measuring of impact by estimating whether the interventions have created variance in mortality between the intervention and comparison areas over the period. For aggregate mortality impact, “difference of differences” of procedures was utilized to estimate the mortality impact.

### **3.1.3 Analysis procedure for Mortality Impact**

The basic model used for estimating the mortality impact of the study is based on a difference-in-difference framework diagrammed below. The specification is based on the fact that the study was an intervention trial where there are intervention (treatment) and comparison (control) districts which prior to the introduction of the intervention a baseline survey was conducted to establish the baseline characteristics. Then at the end of the trial period an endline survey was also conducted giving us the opportunity to conduct a difference-in-

difference analysis. The logic of this specification is based on the fact that the baseline and endline surveys were conducted in both intervention and comparison areas leading to specification as captured in the table below:

	Intervention	Comparison
Baseline	$A_0$	$B_0$
Endline	$A_1$	$B_1$

Difference-in-difference estimation

Given the table, the difference in difference (DD) estimation can be specified as:  **$DD = (A_1 - A_0) - (B_1 - B_0)$**

In simple terms, what this means is we examine the differences or variance that may occur by examining the changes that will occur in intervention districts from those of the comparison districts from the baseline (time=0) to the endpoint (time=1). This allows us to calculate the overall average intervention effect and then comparing changes in intervention districts (A) with changes in comparison districts (B).

However, given complications that arise in implementing the interventions where we have had to stagger the phasing of the various interventions that has tended to create variations in exposure time, multilevel problems arising out of the different levels of intervention, a specification was implemented that account for these complexity challenges. The model introduced a vector of time-changing cluster-level characteristics that brings into account the time-specific exposure of households to different intervention effects while at the same time adjusting for the multilevel problem.

Apart from the difference-in-difference analysis, we also examine changes that may have occurred as a result of the intervention from routine data collected by the Ghana Health Service through its data management system known as the “District Health Information Management System” (DHIMS2) which routinely collects detailed data of various health indices. DHIMS2 has a rich store of secondary data that was drawn upon to supplement the primary data that the GEHIP project collected.

## **4 Catalysing the Scale-Up of Community-Based Primary Health Care in a Rural Impoverished Region of Northern Ghana**

John Koku Awoonor-Williams<sup>1,2,3\*</sup>, James F. Phillips<sup>4</sup>, Ayaga A. Bawah<sup>4</sup>

<sup>1</sup> Ghana Health Service PMB, Bolgatanga, Upper East Region, Ghana

<sup>2</sup> Swiss Tropical and Public Health Institute Socinstrasse 57 4002 Basel, Switzerland;

<sup>3</sup> University of Basel, Peterplatz 4003, Basel, Switzerland

<sup>4</sup> Mailman School of Public Health, Columbia University, New York, New York USA

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This paper has been published in *The International Journal of Health Planning and Management* 2015 Jul 19. DOI: 10.1002/hpm.2304

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## 4.1 Abstract

Ghana's Community-based Health Planning and Service (CHPS) initiative develops accessible healthcare with participatory community support, using strategies developed and tested by a project of the Navrongo Health Research Centre. In 1996, the project was expanded to a district-wide four-celled trial. In response to evidence that strategies could reduce fertility and childhood mortality, a replication project was launched to develop methods for scale-up. Based on experience gained, CHPS scale-up was launched in 2000. Although CHPS now reaches all of Ghana's districts, the pace of scale-up has been slow. In response, the Ministry of Health conducted a review of factors that constrain CHPS scale-up and problems that detract from its original evidence-based design. To resolve problems that were identified, a project was launched in 2010 to test means of accelerating CHPS scale-up and expand its range of care. Known as the Ghana Essential Health Interventions Project (GEHIP), the project provided catalytic revenue to intervention district managers for three years, in conjunction with implementation of strategies for comprehensive leadership development and community partnership. Monitoring systems were developed to gauge CHPS coverage time trends in all nine study districts. GEHIP successfully accelerated CHPS implementation, producing 100% of its targeted community coverage within five years of implementation. Coverage in comparison districts also improved. However, the rate of coverage and percent of the population reached by CHPS in comparison districts was only half that of GEHIP districts. GEHIP success in completing CHPS coverage represents the initial stage of a national programme for strengthening community health systems in Ghana.

KEY WORDS: Ghana; community-based primary healthcare, scale-up; health system strengthening.

## 4.2 Introduction

The implementation of community-based primary health care programmes is being expanded throughout Africa (Freeman, Perry, Gupta, & Rassekh, 2008; Freeman, Perry, Gupta, Rassekh, & Rassehk, 2009; Perry & Zulliger, 2012; World Bank, 2005). Yet, clinic-focused services remain the mainstay of most community-based primary healthcare service designs, despite several convincing demonstrations that community-based operations can be more effective if low cost accessible essential health services are augmented with provision for active doorstep services (McCabe et al., 2012; Perry, Shanklin, & Schroeder, 2003). While pilot projects and special studies are often evaluated, factors that constrain the process of scale-up are rarely the subject of direct investigation; implementation research focused on accelerating scale-up are rarer still. Yet, researching the implementation of scale-up is typically needed. Reviews of scale-up have cited constraints to effective utilization of proven innovations, either because original pilot or experimental project service models are diluted or compromised with scale-up, or because the pace of organizational change is constrained by problems.

Challenges to effective scale-up are particularly prominent for projects focused on community-based primary health care. Providing community-based care is more than simply constructing and staffing village health posts. The process of supplementing fixed facility care with community-based outreach encounters requires the creation of a cadre of community-based workers who are championed by local leaders, welcomed by households served, and supported by the implementation of logistics, supervision, and leadership of the health system at large. But, the organizational challenges associated with community-based primary health care often requires new national policies and manpower plans, incremental resources, and actions that decentralise planning at each organisational level down to the periphery of service operations, changes which invite complex and often unanticipated challenges (Simmons & Shiffman, 2005; Binswanger & Aiyar, 2003).

These challenges have been evident in Ghana. Although policy commitment to achieving community-based primary health care in Ghana began in the early 1980s, impetus for this goal commenced in the 1990s with a continuous and growing role of implementation research that continues to date (Nyonator, Jones, Miller, Phillips, & Awoonor-Williams, 2005; Awoonor-Williams, Sory, Phillips, & Nyonator, 2013). As in many countries, by the early 1990s, achieving accessible care was a pillar of policy in Ghana, yet the specific means of achieving this goal remained unclear. Whereas research had described the nature of problems and established the rationale for national action, little evidence existed to guide programme development (Nyonator et al. 2005a).

An evidence guided community health systems programme was developed that was associated with considerable success as an approach to developing large scale primary health care implementation. We direct particular attention to an implementation research initiative that was directed to clarifying factors that have constrained the scale-up of this proven approach to community-based primary health care. Despite compelling evidence that its strategies could enable Ghana to achieve national Millennium Development Goals, the strategy has been slow to scale-up (Nyonator et al. 2011). We review results achieved by a project that has responded to scale-up challenges, accelerated implementation, and provided a body of evidence that could set the stage for reforming national community-based primary health care implementation (Awoonor-Williams, Bawah, Nyonator, et al., 2013; Awoonor-Williams, Sory, Nyonator, et al., 2013).

### 4.3 The Community-based Health Services and Planning (CHPS) Initiative

Community-based primary health care in Ghana is the outcome of a national programme for reorienting services from district hospitals and sub-district clinics to convenient community locations. Launched as a national policy promulgated in 1999 and implemented in 2000 as a national programme, the approach is termed the *Community-based Health Planning and Services (CHPS) Initiative*. Grounded in overlapping phases that commenced in 1994 and have unfolded over time, each phase has involved research activities and implementation in response to evidence, guided by phases portrayed in Figure 4.1 (Nyonator et al. 2008) .

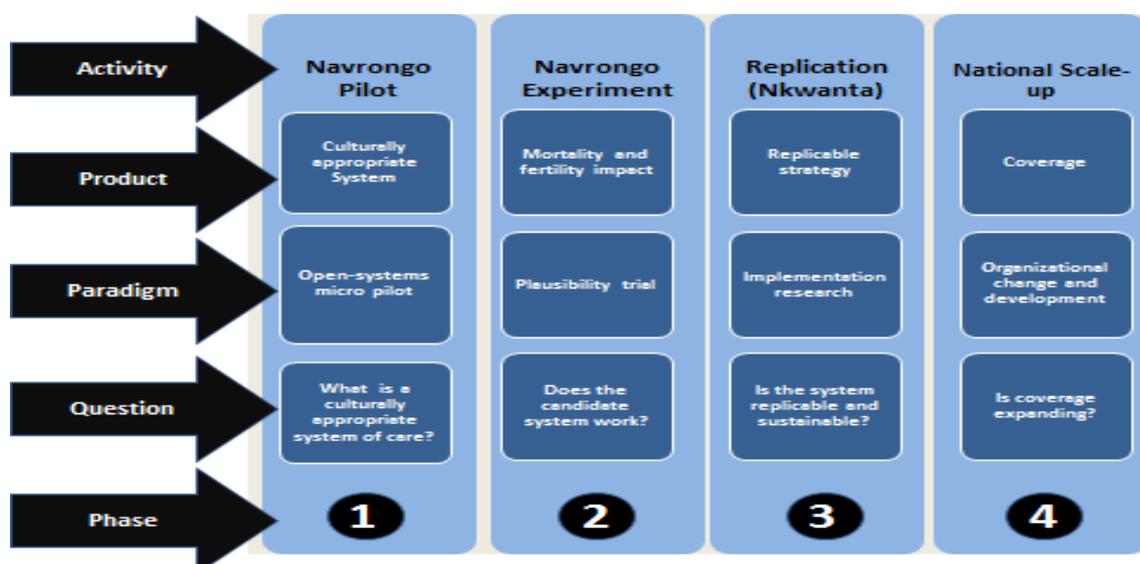


Figure 4.1: Phases in the development of the Community Based Health Planning and Services initiative. Source: Nyonator et al., 2005a

*Phase 1: Participatory planning.* In Phase 1, a three village micro-pilot extended over an 18 month period from 1994 to 1996. Qualitative research was conducted in combination with primary health care service delivery with the goal of adapting activities to the social context (Adongo et al., 1997). Services were introduced in conjunction with interactions with individuals and groups about matters that are strongly influenced by social norms and institutions, using methods that have been applied widely in other context (Sarri and Hasenfeld 1978). Qualitative techniques elicited community-member perspectives on ways to address gender problems (Bawah, Akweongo, Simmons, & Phillips, 1999), with particular focus on customs that restrict women's autonomy to seek health care (Ngom et al. 1999). Community advice was translated into strategies for engaging the support and participation of men in family planning (Adongo, Phillips, & Baynes, 2012) and establishing practical means of ensuring worker accountability to community members and traditional leaders (Nazzar et al. 1995a).

*Phase 2: A controlled experimental trial.* Strategic details of primary health care services developed in Phase 1 were tested in a Phase 2 plausibility design (Binka et al. 1995b). A district-wide trial was designed with communities grouped into two "arms" of service intervention:

The *zurugelu* (togetherness) approach involved mobilizing cultural resources of chieftaincy, social networks, village gatherings, voluntary activities and community support to provide gender-based outreach care. Closely resembling the UNICEF sponsored "Bamako Initiative," this arm of the project had mechanisms for recovering the cost of essential drugs, and supervision and support for volunteers that included the provision of bicycles, start-up kits of essential drugs and training in basic referral care (Knippenberg et al., 1990).

The 'community health officer' arm of the experiment reoriented existing paid nurses to conduct village-based service delivery. Nurses entering the programme had completed 18 months of training in basic curative health services and public health practice that included childhood immunisation and family planning. Reorientation to community-based work involved six weeks of intensive in-service training in methods of community engagement, outreach organization, and community healthcare planning. Communities were responsible for the maintenance and security of the compound, nurses' daily living needs and the costs of essential drugs. Nurses were provided with pharmaceutical kits, essential clinical equipment, salaries and motorcycles. Services were provided during household visits, augmented with daily care at the community health compound. Where volunteers were available, community nurses were designated as their supervisors.

Since these two arms of the intervention strategy could be implemented independently, jointly, or not at all, a four celled design was specified exposing communities to alternative primary health care service provision strategies.

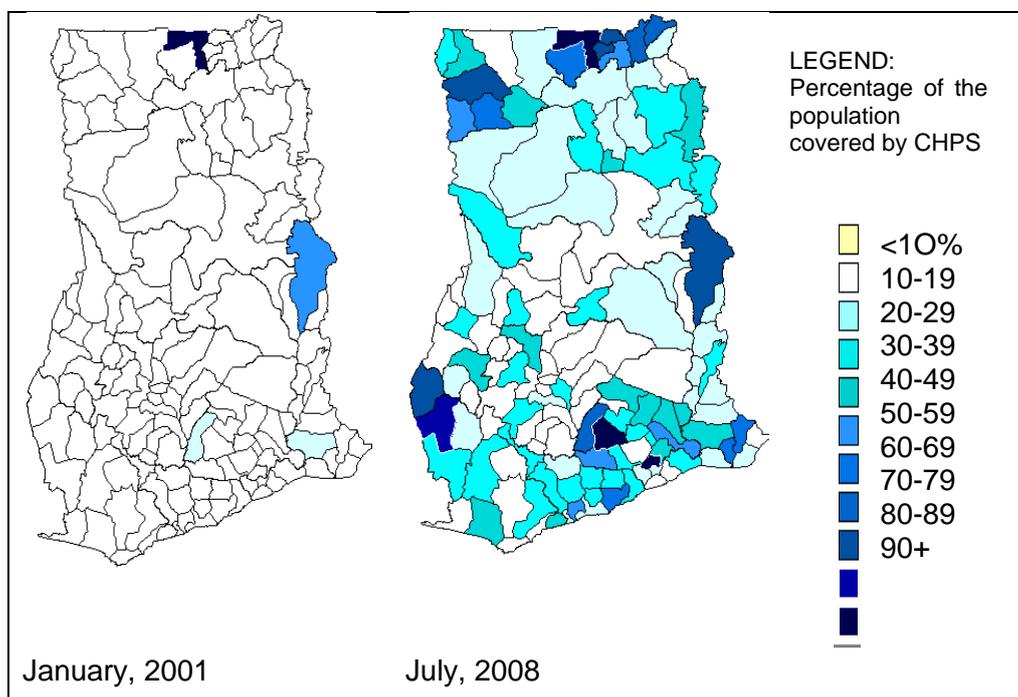
Results demonstrated that child mortality declined by half in five years wherever nurses were assigned, but that the *zurugelu* approach had no fertility or mortality impact (Pence et al. 2007, Binka et al. 2007a). Somewhat surprisingly, posting nurses to communities had no impact on family planning uptake or fertility unless their presence was combined with *zurugelu* volunteer deployment. To achieve national reproductive and child health goals, a combined *zurugelu* plus nurse deployment strategy was indicated (Debpuur et al. 2002, Phillips et al. 2006b, Binka et al. 2007a).

*Phase 3: Nkwanta validation and replication research.* In 1998, a National Health Forum was convened for all district and regional health system managers to review the initial Navrongo results. Debate ensued over the national relevance of results and the feasibility of changing routine district operations to the Navrongo approach. Participants argued that the logistics required would incur unsustainable costs for monitoring and supervision, equipment and health post construction. Many viewed community mobilisation as a potential risk that could raise community expectations for levels of service intensity that could not be met (Awoonor-Williams et al., 2013; Awoonor-Williams, Vaughan-Smith, & Phillips, 2010).

In response to this controversy, a participating team from Nkwanta District of the Volta region launched an implementation pilot to test practical means of adapting the Navrongo model to local circumstances and, in the process, clarify milestones and procedures for scaling up Navrongo results. When this replication trial succeeded, a second National Health Forum was convened in 1999 to announce results, build consensus for a national programme, and launch replication projects on the Nkwanta model in each of Ghana's eight other regions. Once pilots were functioning within these "lead districts" of each region, inter-district exchanges were convened to catalyse the scaling-up of operations elsewhere, setting the stage for national implementation of community-based primary health care in Phase 4 (Nyonator et al. 2005a, 2008). Nkwanta thereby catalysed the national scaling-up process by showing that the transfer of a service model from a research project to a district health service operation was feasible, by clarifying the essential milestones and resources for implementing the approach in a non-research setting, and by providing a learning locality for transferring the Navrongo approach to lead districts dispersed throughout the country.

*The Phase 4: National expansion.* Phases 1-3 led to a programme for scaling up a service model based on the lessons from Kassena-Nankana and Nkwanta districts into a national

programme for healthcare reform, as illustrated by the maps in Figure 4.2. By mid-2008, every region had some CHPS activity, and most districts had some degree of community-based primary health care coverage. Observation and monitoring showed that CHPS spread most rapidly in districts where pilots had been launched, suggesting that scale-up followed patterns of change that were characteristic of a diffusion process (Rogers 1962).



**Figure 4.2: The geographic density of Community-based Health Planning and Services (CHPS) coverage by district, January 2001 and July, 2008**

As Figure 4.2 shows, this process was more rapid in the Upper East and Upper West Regions than in the more populous regions of central and coastal Ghana. And, variance in coverage was pronounced, with some districts achieving advanced implementation while others making little progress at all. The national trend in the population covered by community-based care was unacceptably slow, reaching only 10% of the population covered by mid-2008. If the rate of coverage up to 2008 was projected forward, achieving the goal of universal health coverage would require nearly 50 years of programme effort. Clearly, action was needed to diagnose problems with scale-up and expedite progress.

## 4.4 The Ghana Essential Health Intervention Project (GEHIP)

Factors constraining Community-based Health Planning and Services scale-up

The slow progress with CHPS implementation in most of Ghana, with the relatively rapid increase in Ghana's two poorest, most remote, and most health deprived northern regions, prompted the Ministry of Health to sponsor a review of the determinants of regional and district variance in CHPS scale-up performance (Ministry of Health, 2009; Binka et al., 2009). Through comparative review of management opinion in advanced versus constrained implementation regions, the review identified factors that have constrained CHPS implementation. In response to findings from this review, the Ghana Health Service, the Mailman School of Public Health, and the University of Ghana formed a partnership for testing health systems solutions to problems constraining CHPS scale-up in a six year implementation research trial for gauging the impact of a package of system strengthening activities on childhood survival and fertility. This experimental initiative for testing ways to improve and accelerate CHPS scale-up is known as the Ghana Essential Health Interventions Project (GEHIP) (Awoonor-Williams, Bawah, et al., 2013a).

The systems problems and sets of interventions that emerged from the GEHIP diagnostic appraisal process are arrayed in column 1 of Table 4.1 according to their relevance to six "pillars" of essential components of any functioning health system (World Health Organization 2007). GEHIP is a project that is designed to strengthen district systems in ways that will accelerate CHPS scale-up and improve the quality of community-based primary health care services. Systems constraints to CHPS scale-up were the focus of a programme of intervention that has spanned the WHO six pillars, with particular attention to the roles and functions of frontline workers that could be improved by developing implementation capabilities of "District Health Management Teams" (DHMT), as summarized in the right hand column of Table 4.1. Beginning in 2010, GEHIP was implemented in four districts of the Upper East Region as a plausibility trial on systems strengthening, with intervention and comparison districts located in the most impoverished of Ghana's 10 regions. Five comparison districts serve as a control, with monitoring designed to record CHPS implementation progress. A baseline and end-of-programme of multi-level cluster survey research will assess the impact of GEHIP on parental health seeking behaviour, childhood survival, and fertility.

Ensuring access to essential services provided by a trained and knowledgeable workforce.

District managers are often reluctant to launch programmes that they believe will require technical skills that are not yet available or activities that incur costs that the GHS or the

National Health Insurance Scheme (NHIS) does not adequately finance (Nyonator, Jones, Miller, Phillips, & Awoonor-Williams, 2005). The most critical aspect of access, however, is the availability of community-based care and effective services. But, even where CHPS is available, critical deficiencies arise. In particular, the NHIS has yet to cover the cost of emergency transport and most communities have no system emergency obstetric and neonatal care (Baiden et al. 2006). Telecommunication and infrastructural problems, chronic supply chain bottlenecks, inadequate protocols for treatment of obstetric and neonatal emergencies, constrained systems of transportation and referral, and limited staff dedicated to the provision of essential care functions. Moreover, community health workers lack skills to manage normal deliveries and provide referral effectively (Awoonor-Williams et al., 2015).

**Table 4.1: Summary of Usual CHPS strategies and GEHIP Health System Strengthening Interventions**

Type of health system component:	Current strategy of the Ghana Health Service	GEHIP intervention additions for strengthening existing GHS strategies:
Essential services	Community Health Officer provision of IMCI, ANC, and comprehensive family planning at the community level.	<i>Improving community-based services.</i> Frontline workers are trained and equipped for saving new born lives by... Providing affordable equipment for emergency transport needs. Developing a community-engaged emergency referral system by organizing district coverage of referral costs that are not addressed by the national health insurance system. <i>Improving emergency management capacity:</i> GEHIP trained frontline workers in triage and emergency management to prevent neonatal mortality.
Essential personnel	Community Health Officers trained to provide primary health care, volunteers focused on health promotion.	<i>Developing service quality by</i> launching health and mortality audit procedures and responding to highlighted areas necessitating clinical care improvements. <i>Essential newborn care:</i> Midwives and community workers provide perinatal emergency care that includes use of appropriate technologies. All workers are trained in resuscitation, community engaged kangaroo mother-care, and other essential newborn care interventions. <i>Expanding volunteer skills.</i> Volunteers are trained in the management of childhood illness.
Information for decision-making	Complex paper registers without feedback	<i>Reforming information systems for decision-making.</i> Effective health care delivery requires essential information for decision-making. GEHIP works at two levels: <i>Information tools for frontline workers.</i> When cumbersome paperwork was found to be consuming excessive amounts of worker time, information systems were reformed to simplify data collection and support supervisory decision-making. <i>Knowledge management for decision-makers.</i> GEHIP has developed a knowledge management system which systematically disseminates lessons learned to district and regional health implementers across Ghana.
Provision of drugs logistics	Fees for family planning supplies;	<i>Ensuring access to essential equipment and supplies.</i> Health information tools monitor access to essential equipment and ensure essential supply and logistics needs. Fees for family planning services and supplies are removed.

Resources, budgeting, and planning	Annual budgeting; health sector financing	<i>Building district capacity for budgeting and planning by</i> developing a tool for the allocation of resources according to actual need so that budgeting is link to the relative burden of disease benefits associated with investment in alternative strategies for health care.
Leadership, governance, and accountability	Leadership training through workshops	<i>Strengthening leadership with</i> demonstration approaches that engage teams of political, traditional and health system leadership into a system of collaborative observation, participatory problem solving and peer learning with a target on expanding development sector investment in CHPS scale-up.

Although policy guidelines aim to support facility-based delivery by providing cost-free midwifery care, the transportation costs of emergency or routine referral is not covered by the NHIS. Problems associated with home delivery persist (Awoonor-Williams & Baynes, 2013a, 2014). Barriers to the effective implementation of primary health care in general concatenate in ways that compound problems associated with CHPS scale-up. Skill gaps stemming from limitation of the nurse training programme confront nurses with technical challenges upon their deployment. In particular, CHPS implementation is hampered by the lack of midwifery training; lack of training in emergency management and triage, and lack of participatory planning training for implementing community coordination and village diplomacy.

As a component of its initial response to gaps in essential services, GEHIP implemented a system of mortality audits to provide regional health managers with rapid feedback on preventable maternal and neonatal risks (Awoonor-Williams et al., 2015). In response to evidence that asphyxia was a prominent contributor to excess mortality, all frontline workers were trained in resuscitation management, referral services, and essential emergency management. A scheme of community-engaged emergency information management, logistics, and referral was piloted and implemented in all GEHIP districts, in conjunction with the retraining of all frontline workers in the WHO recommended “Integrated Management of Childhood Illness (IMCI)” (World Health Organization 2005). Particular attention was directed to improving the role and capabilities of volunteers in the provision of Integrated Management of Childhood Illnesses.

Baseline GEHIP research on worker time use showed that information management occupies more frontline work time than effort expended on care itself (Frimpong et al. 2011). Frontline care workers were obligated to maintain an unwieldy array of 27 registers each month. GEHIP streamlined this operation to five registers and improved information feedback to supervisors so that information captured by workers could actually be used to support their functions.

In summary, baseline research found that CHPS is not only failing to scale-up as a programme of service implementation, it was failing to achieve its life-saving potential. GEHIP responded

by targeting its frontline worker interventions on the most pressing contributing factors to this set of problems.

Developing systems of information for decision-making, managing essential resources, plans and budgets and developing leadership and governance.

Resources for primary health care in Ghana remain severely constrained. Yet budget lines for personnel, fuel, pharmaceutical costs and other critical requirements of primary health care are somewhat manageable once district managers are clear about operational goals and challenges and running costs of services, supplies, fuel, and salaries once operations are established and DHMTs undertake financial planning and programme implementation for such ongoing costs.

Despite this managerial flexibility for planning operating budgets, scaling-up CHPS incurs expenses that have no specified GHS budget line and therefore no mechanism for budgetary flexibility to be implemented. Expansion of costs for essential equipment, such as bicycles and motorbikes, and the start-up cost of constructing CHPS community health posts are not routine cost items that Ghana Health Service district managers can add to routine budgets. Lacking practical experience with managing these CHPS start-up budgetary requirements, health managers not only fear the unknown, but are also reluctant to engage in activities that could create grassroots political pressure if the cost of building health posts, purchasing equipment, and implementing care is unsustainable. Indeed, the original Navrongo project incurred incremental costs amounting to \$2.92 per capita for essential equipment and facility start-up needs. But, lacking a routine budget line for such costs in the national plan for earmarking resources for such CHPS implementation start-up costs severely constrained commitment to launch the programme.

The CHPS implementation budget gap problem has been compounded by the introduction of the National Health Insurance Scheme in 2008. The NHIS reimburses health providers for clinical services delivered, but provides no support for community activities, referral costs, or CHPS start-up expenses. As a scheme that reimburses district budgets for clinical services, the NHIS has driven CHPS into the mode of becoming a community clinic-based programme for curative treatment, to the detriment of preventive care, family planning, community engagement and promotional aspects of primary care.

To catalyse a process of reforming budgeting and developing leadership, GEHIP set aside supplemental district funds in the amount of \$0.85 per capita per year in the four experimental districts for three years. This investment supplemented routine primary health care revenue amounting to \$14 per capita. Committed to the health budget as a flexible fund, systems

change demonstration was designed to implement strategies for connecting DHMT, district political figures, and community leaders into a collaborative leadership system for implementing CHPS. As a practical process, this involved implementing community-engaged celebration of implementation milestones and other activities for connecting traditional leaders and grassroots politicians through community celebration of the completion of implementation milestones. The process was designed to ensure that grassroots politicians acquire prestige and community recognition for their commitment to CHPS thereby catalysing political support for the District Assembly process of committing development revenue to funding CHPS implementation. District level budgeting schemes were revised so that priorities could be shaped by prospects that strategies would optimize the impact of investment on the burden of disease, while simultaneously engaging the political sector in the health budgeting process.

This investment in leadership development involved participatory task planning for orienting DHMT to the milestones and tasks for achieving health care in every community, with outreach to every doorstep, including community case management of childhood illness, cost-free maternal health care and treatment of childhood illness; comprehensive community engaged referral services, with a deferred payment scheme for families confronting emergency logistics costs; and comprehensive and cost free reproductive health services on demand.

Once GEHIP district health and political officials understood the CHPS implementation process, they contributed development revenue to construction activities based on CHPS infrastructural needs. This commitment was possible because revenue from development mechanisms are controlled by “District Chief Executives” and locally constituted “District Assemblies.” In this manner, revenue was marshalled by collective engagement of health, local district and regional political and administrative authorities in budgetary review. Support for start-up costs of CHPS implementation and promotional activities were fostered by inter-sectoral engagement of representatives of the Ministries of Local Government, Food & Agriculture and Education. GEHIP inspired multi-sectoral engagement led to earmarked revenue for CHPS capital investments, such as construction or equipment procurement.

To address the essential need for multi-sectoral financing of CHPS start-up, GEHIP engages with district health managers who invite political figures to CHPS community gatherings with the goal of engaging politician into the budget, financing, and scaling-up process. When grassroots politicians witnessed popular support for CHPS, well managed implementation events could translate implementation in a pilot locality into grassroots political investment in CHPS implementation elsewhere. By starting with pilot zones where this process can be demonstrated, CHPS start-up activities set the stage for community to community diffusion. By providing intervention districts with \$0.85 per capita per project year in supplemental

funding, GEHIP could sponsor catalytic activities for fostering CHPS understanding and scale-up, District Assembly's commitment for financing for CHPS facility and equipment costs.

The MoH review determined that CHPS was found to mean different things to different stakeholders, despite concerted efforts directed to training, policy directives, conferences and reports. In its simplest formulation, the programme was viewed by district health managers as a means of constructing community clinical facilities and posting nurses into these facilities and little else. Because health workers at all levels are accustomed to clinic-based work routines, instructions to relocate nurses to communities were interpreted through the prism of clinic managerial experience with health service delivery, as if community posting simply replicated sub-district clinical functions. Doorstep outreach, community organizational work, engagement of men, and other social strategies of the Navrongo initiative were side-lined by the absorption of CHPS into the bureaucratic functions of a fixed facility clinical primary health care programme.

Discussions with nurses illuminated concerns that attention to expanding the role of nurses as community-based providers and organisers would dilute service quality. CHPS priority on mobilizing and engaging the community in the health system was lost in the implementation process. Because of this, the necessary partnership among stakeholders—local government, communities, NGOs and development partners—and their shared participatory buy-in for CHPS, never materialized due to contrasting understandings of the CHPS concept.

The GEHIP based its response to these problems on evidence from existing implementation research (Awoonor-Williams et al., 2004; Awoonor-Williams et al., 2010; Nyonator et al., 2011, 2005; Frimpong et al., 2013). In districts located elsewhere in Ghana, where CHPS has expanded rapidly, teams of service providers had experienced direct contact with the Navrongo or Nkwanta project operations. Implementation team exposure to functioning systems generated experience with implementation that could be shared by community implementers, their supervisors, and district managers to implementation counterparts. Combined systems experience provided a basis for understanding CHPS implementation at each operational level. By cascading this implementation experience forward, with implementation in place in a few communities, district management teams could plan district-wide roll-out, guided by measurable progress indicators, budgets and peer learning that involves stakeholders at the district headquarter level and below. This political engagement process, originally developed in Navrongo and refined in Nkwanta, involves joint implementation of community mobilization “durbars” –a traditional function of chieftaincy systems in Ghana that is often co-opted by politicians during election campaigns to mobilize electoral support. But, as Navrongo and Nkwanta have demonstrated, health workers can also

utilize such traditions for building community consensus and action that supports CHPS. Corporate institutions of lineage, social networks, and chieftaincy can be aligned with political institutions and health systems engagement needs. By combining social systems, political systems, and health delivery systems to revitalize CHPS, GEHIP has marshalled community demand for health care into Ghana's grassroots system of political accountability.

This system of participatory CHPS knowledge management, focused on community engagement and systems learning, was crucial to building community commitment to scaling up CHPS in Nkwanta, and instrumental to catalysing replication of CHPS scale-up elsewhere. But the formalization of the national CHPS scale-up agenda had drifted from this crucial "scaling down to scale-up" strategy (Nyonator et al. 2011). Indeed, participatory engagement strategies that work with CHPS have been critical to catalysing scaling up elsewhere (Rosato, Laverack, Grabman, Tripathy, Nair, Mwansambo, Azad, & Morrison, 2008).

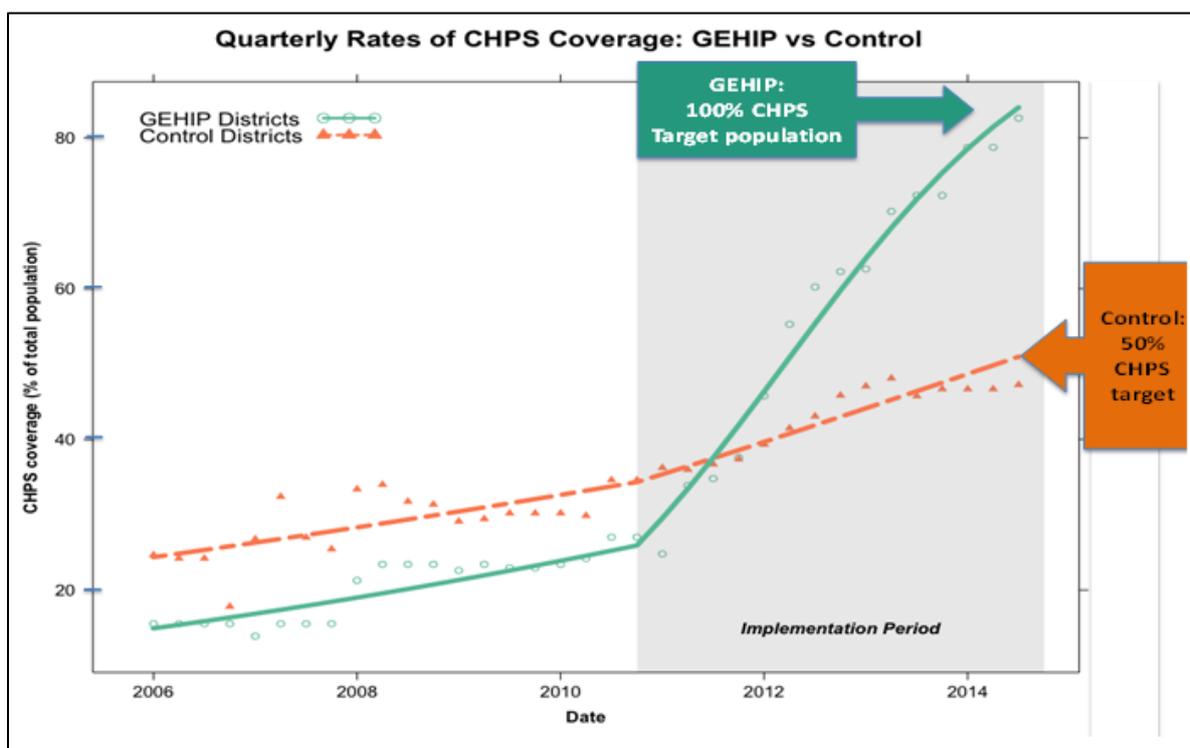
Pursuing this multi-sectoral resource mobilization process for CHPS implementation process in the GEHIP intervention districts involved agile political engagement, community outreach, and organisational savvy conducted by an experienced regional "CHPS coordinators" who trained district counterparts in essential liaison functions. Work routines, monitoring, budgeting, logistics, and other routine management processes were altered to ensure consistent administrative leadership focusing on these requirements. The Regional Health Management Team provided the regional CHPS coordinator with time at monthly staff meetings to discuss activities, budgets, performance data and other routine implementation functions that catalyse the diffusion of lessons learned from successful CHPS implementation. CHPS monitoring and evaluation activities, and the visualization of CHPS coverage information were effective investments in support for evidence-based discussion of CHPS performance and problems (Nyonator et al. 2005a). National leadership training initiatives have failed to fill this gap, however. Rather than to finance peer exchanges, demonstration, and catalytic finances, the GHS has typically convened workshops for didactic training that disconnects CHPS leadership training from practical implementation-based management. GEHIP leadership development is a systems concept, however, with leadership extending from managers, to supervisors, to workers, and ultimately to the communities that are served.

## **4.5 Results**

The GEHIP initiative has aimed to overcome challenges to CHPS scale-up through replicable, affordable, and sustainable mechanisms to strengthen leadership, partnership, and community engagement. In addition, critical emergency referral services are now widely available, and the scope of care provided by frontline workers has been broadened to include

a range of life-saving skills for mothers and newborns, especially, the need to revisit the original Navrongo model for community-based primary health care while adding to that model elements that have been missing from CHPS in the past: i) catalytic financing of only \$0.85 per capita per year in the primary health care programme was combined with strategies for community-engaged celebration of implementation milestones, ii) engaging traditional leaders and grassroots politicians in programme implementation activities that incur prestige and community recognition for their commitment and leadership with the goal of translating development revenue into funding for CHPS implementation, iii) implementing health care in every community, with outreach to every doorstep, including community case management of childhood illness with mechanisms for ensuring community oversight of all service activities; iv) providing cost-free maternal health care and treatment of childhood illness in conjunction with community-engaged referral services financed with a deferred payment scheme for emergency logistics costs; and vi) comprehensive and cost free reproductive health services on demand. Taken as a package of activities and capabilities, GEHIP has accelerated CHPS coverage and achieved universal healthcare (UHC) in the challenging context of the Upper East through the strategies outlined in Table 4.1.

The GEHIP's impact on the CHPS implementation process has been immediate and pronounced: starting from a low level of CHPS coverage when the programme started in 2010 to September 2014, GEHIP achieved 82% coverage of the total population with community service activities in intervention areas and corresponding to 100 percent of the targeted rural population reached by routine CHPS services in its four treatment districts within four years (Figure 4.3). Coverage also increased in comparison districts, starting at higher levels reached by CHPS in the baseline, but increasing at half the quarterly rate of scale-up, leading to 50% of the target population reached by September 2014. In intervention districts, GEHIP strategies have also improved the range and quality of primary health care services, with particular focus on maternal and newborn care and the development of sustainable referral services.



**Figure 4.3: Quarterly Rates of Community-based Health Planning and Services (CHPS) coverage: Ghana Essential Health Interventions Project (GEHIP) versus Control**

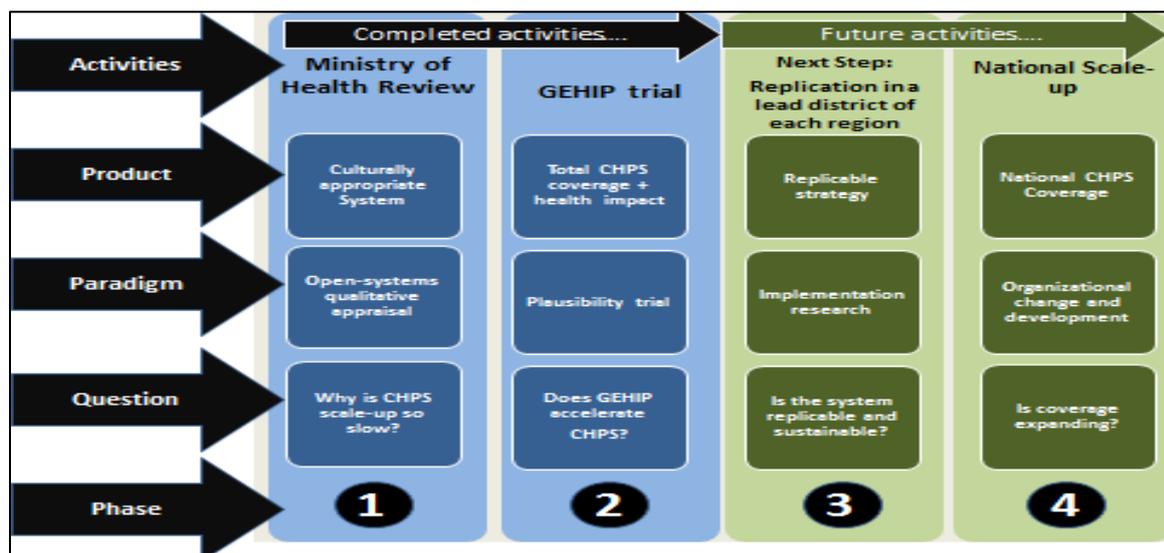
## 4.6 Conclusion

Despite the challenges that have been identified, the CHPS initiative has begun to improve access to primary health care throughout Ghana. Its origins are grounded in evidence-based strategies for adapting implementation to local realities and needs. Yet CHPS scale-up has encountered implementation delays that require national corrective action. GEHIP implementation research results attests to the practicality of accelerating CHPS scale-up. While CHPS is a complex story, its core agenda, is quite simple for stakeholders to understand and embrace if it is witnessed by implementation teams who have catalytic revenue for fostering scale-up and practical experience with grassroots social and political engagement. Achieving the transition from CHPS as it has evolved into a clinic focused programme into a fully people-centered and community engaged programme requires strategic attention, focus, and simple to replicate action.

If CHPS succeeds at scale, it will have demonstrated mechanisms for bringing primary healthcare services to every Ghanaian household by aligning health sector policy, evidence and action, with vibrant systems of traditional leadership, communication and volunteerism. By demonstrating ways for CHPS to achieve its potential, GEHIP is not a project. Rather, it is the initial stage of a national programme for strengthening community health systems in

Ghana. The success of GEHIP is therefore a matter of considerable policy significance for Ghana.

Yet, just as CHPS represents a challenging initiative to implement at scale, systems strengthening activities in keeping with GEHIP will require strategic planning, replication monitoring and research, and evidence-based scaling up. We are therefore recommending a phased approach to GEHIP utilization that embraces scaling up lessons learned in the early stages of CHPS (as in Figure 4.1) with a new beginning that builds upon GEHIP success (Figure 4.4). In this perspective, the Ministry of Health review used qualitative systems appraisal to identify systems constraints to GEHIP scale-up and clarify needed action (phase 1, Figure 4.4). GEHIP has demonstrated that a process can be implemented for accelerating CHPS scale-up (phase 2, Figure 4.4). A new phase is now needed that will replicate GEHIP elsewhere in Ghana, starting with scale-up in the Upper East Region, but with concomitant activities in replication districts elsewhere in Ghana where the implementation requirements of large scale utilization of the GEHIP approach can be tested, refined and used to develop national plans and learning localities.



**Figure 4.4: Phases for the experiment in improving and accelerating CHPS scale-up: the Ghana Essential Health Interventions Programme (GEHIP)**

Milestones, resource allocation procedures, and regional health administration roles and functions could be tested through “Phase 3” GEHIP implementation research. Placing a GEHIP district in each of Ghana’s nine other regions would set the stage for phasing in the utilization of GEHIP, positioning its lessons to become a solution to the need for rapid

implementation of CHPS for all rural communities: a new “Phase 4” for bringing community-based health care to every doorstep in Ghana.

### **Acknowledgements**

The GEHIP is an initiative of the Ghana Health Service that is supported by grants to the Mailman School of Public Health, Columbia University from the Doris Duke Charitable Foundation Africa Health Initiative under grant number 2009058B and by grants to the University of Ghana, School of Public Health by the British Charity Comic Relief.

### **Declaration of conflict of interest**

The authors of this paper declare that they have no conflict of interest or financial interest arising from the direct application of this research.

## **5 Researching the utilization of research: A health systems experiment on accelerating the scale-up of community-based primary health care in Ghana**

John Koku Awoonor-Williams<sup>\*1,2,3</sup>, James F. Phillips<sup>4</sup>, Mallory C. Sheff<sup>4</sup>, Christopher B. Boyer,<sup>4</sup> Ayaga A. Bawah<sup>4,5</sup>

<sup>1</sup> Policy Planning Monitoring and Evaluation Division, Ghana Health Service PMB, Accra, Ghana.

<sup>2</sup> Swiss Tropical and Public Health Institute, Socinstrasse 57, 4002 Basel, Switzerland.

<sup>3</sup> University of Basel, Peterplatz 4003, Basel, Switzerland.

<sup>4</sup> Columbia University, Mailman School of Public Health, 60 Haven Avenue, NY, NY 10032.

<sup>5</sup> Regional Institute of Population Studies, University of Ghana, Legon, Ghana.

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This paper has been submitted to *Social Science and Medicine*

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## 5.1 Abstract

In 2000, the Ghana Health Service launched a programme designed to scale-up results of an experimental health service study of the Navrongo Health Research Centre. Known as Community-based Health Planning and Services (CHPS), this research utilization initiative was observed to be progressing so slowly that a new project was launched to address the need for more effective and expeditious scale-up. Termed the Ghana Essential Health Intervention Project (GEHIP), this project pursued a “community engaged” approach to decentralized worker selection, training and deployment while simultaneously engaging district health managers in the process of people-centered planning. Implemented in the Upper East Region of Ghana, frontline workers, district managers and local political leaders were engaged in a process of participatory demonstration, community-dialogue, and district political engagement with the aim of developing leadership for accelerating CHPS scale-up. Building on the organizational resources of community-based leadership, health posts could be constructed with volunteer labour, accelerating implementation of community care without delays arising from costly construction and dependence upon external support. GEHIP strategies achieved total CHPS coverage in less than five years, double the density of community-based care coverage in comparison districts. The completion of this successful implementation research signals the need for scaling-up. This paper reports on research that improves scale-up. Results demonstrate the utility of researching research utilization. Policy implications of researching the utilization of research are reviewed and discussed.

**Keywords:** Community-based health care; scale-up; research utilization; implementation science; health systems; Ghana

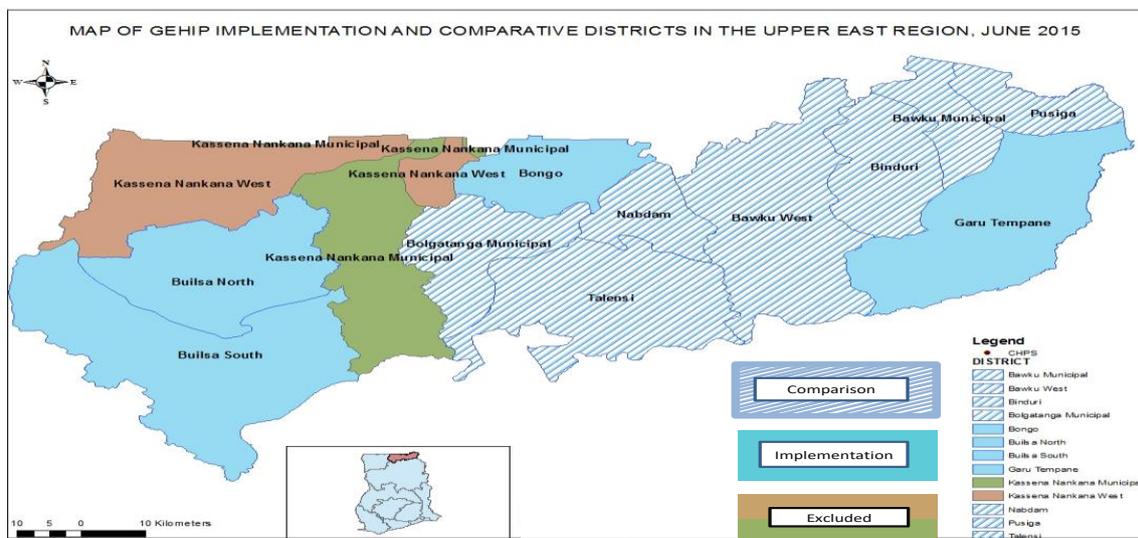
## 5.2 Introduction

In recent years, Ghana has been at the forefront of health systems development in Africa. Considerable progress has derived from the country's successful development of community-based primary health care following the successful pilot of service strategies in Navrongo over the 1994-1996 period (Binka et al. 1995a, Nazzar et al. 1995a), the implementation of the Navrongo Experiment from 1996 to 2003 (Debpuur et al. 2002, Phillips et al. 2006a, Binka et al. 2007a), and subsequent replication of the Navrongo model in other regions of Ghana (Awoonor-Williams et al. 2004). In response to evidence that the project service model could save lives and reduce fertility, the Ghana Health Service launched the Community-based Health Planning and Services (CHPS) Initiative policy in 1999 to scale up the Navrongo approach (Awoonor-Williams et al. 2004, Nyonator et al. 2005a, 2011). Beginning as an implementation strategy in 2000, CHPS monitoring evidence is grounded in the promise that Navrongo research connotes: if a programme can mobilize rural villages to develop systems for stationing primary healthcare, the Navrongo approach could accelerate achievement of the Millennium Development Goals. Indeed, long term monitoring has substantiated the results of the original Navrongo trial: demographic monitoring in study areas has showed that childhood mortality could be reduced by 68 percent within seven years; Africa's first confirmed demonstration that Millennium Development Goal 4 is attainable at the district level (Phillips et al. 2006a, Binka et al. 2007a).

Despite this success, a variety of service delivery, manpower, communication, logistics, resource management, and leadership bottlenecks have constrained the pace of CHPS scale up. Moreover, some proven interventions have yet to be introduced into the CHPS programme. Most importantly, planning activities at the district level lack appropriate tools for enabling managers to implement strategies that respond to actual need. In response to monitoring evidence, the Ministry of Health launched a review of the CHPS programme in 2009 which aimed to clarify operational and policy barriers to effective utilization of the Navrongo model as the framework for CHPS scale-up. The review was designed to compare leadership responses to questions about CHPS implementation in regions and districts where CHPS was progressing well versus corresponding responses in regions and districts where the pace of implementation was unacceptably slow. Results of this review provided a set of systems development needs and agenda that have provided the operational design of a project designed to research factors that would improve utilization of the Navrongo model.

Launched in the Upper East Region (UER) in 2010, the Ghana Essential Health Interventions Project (GEHIP) is based in a cultural and economic zone that is both challenging and isolated (Figure 5.1). The UER is a locality that ranks among the most impoverished, remote and health

deprived regions of Ghana (Ghana Statistical Service 2008a). According to national statistics at the GEHIP baseline, infant mortality in Ghana was 50 per 1000 live births, and under-five mortality was 80 per 1000 person-years (GSS et al. 2009). Rates that are comparable to national levels prevail in the UER (46 and 78, respectively), even though this is the poorest part of the country. Research results suggest that the wider implementation of CHPS, and more robust compliance with the original Navrongo model, largely explains this apparent paradox. Yet, the relative success of health development in the UER was hardly cause for celebration: high mortality, common illness from preventable causes, missing elements of essential care, low family planning use, and pervasive organizational challenges position the UER to be a point of health systems strengthening, trial, and evaluation leading to its selection for the GEHIP trial. And, despite a decade of implementation policy, CHPS coverage in the UER was reaching only a quarter of all households - a level of achievement that was advanced by national standards, but far from complete and well short of national CHPS coverage targets.



**Figure 5.1: Map of the Location of districts in the Upper East Region**

CHPS occupies the “ground-level” of the health system (Figure 5.2). Clusters of villages, comprising about 3,200 residents, are grouped into “CHPS zones” that represent service units where one or more Community Health Officers (CHO) and volunteers are posted, with the expectation that these workers will provide services at the doorstep and at CHPS Compounds. In all sub-districts of Ghana, the Ghana Health Service (GHS) has developed clinics where trained paramedics provide primary health care for catchment populations ranging from roughly 20 to 30 thousand people staffed by paramedics. Clinicians provide surgical and other specialty care at district hospitals.

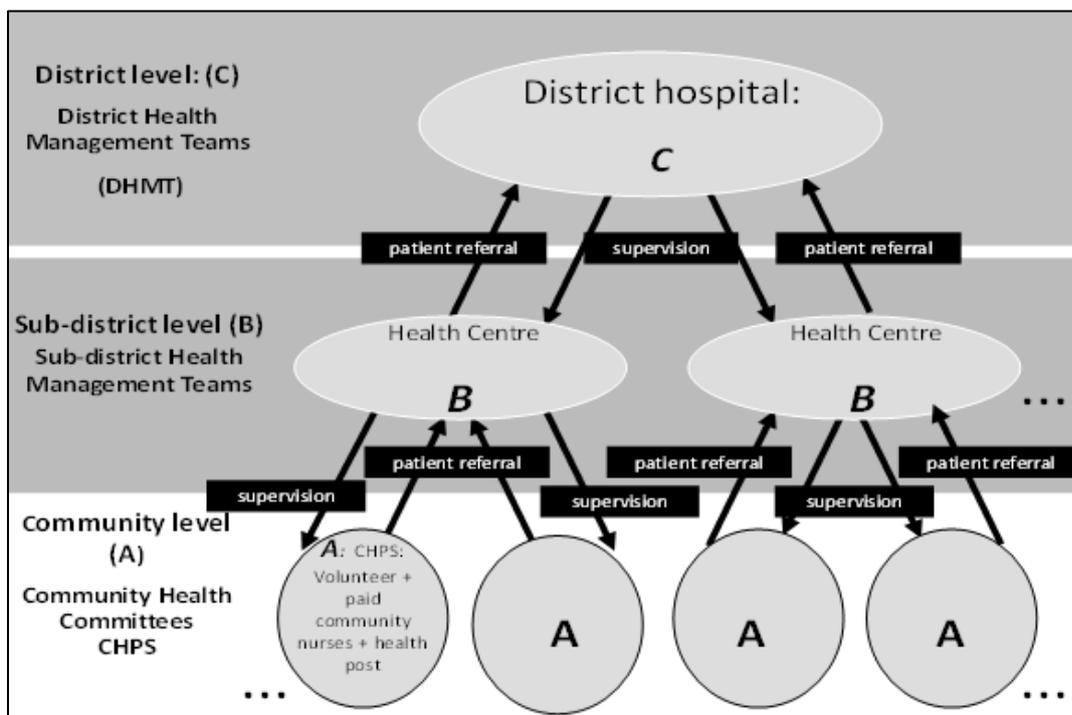


Figure 5.2: The District Primary Health System in Ghana

### 5.3 The Community-based Health Planning and Services (CHPS) Initiative

The Navrongo experiment tested the relative fertility and mortality effects of alternative strategies for community-based care. One arm posted trained professional nurses to community locations; the other assessed the impact of volunteer based care. Since strategies could be implemented either independently or jointly, four experimental cells were implied, one of which was a comparison area that lacked community-based care demonstrated the limitations of basing child survival programmes on access to commodities and/or clinical care alone. Cells of the project tested in one of the cells, briefly trained, unpaid volunteers were deployed to refer cases and provide antipyretics, vitamins and other non-prescription drugs. Over the short term, child mortality actually rose in this area compared to a control area where no interventions were offered, other than those routinely offered by the Ghana Health Service. Research subsequently showed that syndromic intervention by credible but poorly trained volunteer workers delayed parental health seeking for effective curative care (Pence et al. 2007). Although the volunteer-only communities had mortality levels that were no worse than rates in the treatment areas, only when comprehensively trained and fully paid nurses were posted to these areas did child mortality begin to fall substantially (Phillips et al. 2006a). This crucial lesson still has yet to be internalized by many international donors, many of whom

continue to favour interventions based on the distribution of simple commodities or health promotion by untrained volunteers alone, eschewing more substantial health system interventions because they seem complicated and expensive (Bryce et al. 2010).

Moreover, properly trained and equipped community health workers can have an impact on health equity. In the Navrongo experiment, nurse posting offset the detrimental effects of low parental educational attainment and relative household poverty on immunization, health seeking behaviour, and child survival. Volunteer services had no comparable equity effects (Phillips et al. 2006a, Bawah et al. 2013). However, if nurse-provided community-based care was combined with health promotion activities of volunteers, family planning gained credibility and fertility declined, as well as maternal and child mortality (Phillips et al. 2006). Thus, the combined approach was adopted as the organizational model for CHPS (Ghana Health Service 2005).

Where CHPS leadership is well articulated, district political leaders have directed resources to the incremental start-up costs. Qualitative appraisal, involving district managers, supervisors, and frontline workers have suggested effective means of developing this commitment (Nyonator et al. 2005a). By 2008, CHPS implementation had commenced in all of Ghana's districts, but scale-up within districts had stalled or was incomplete nearly everywhere. CHPS, as it was originally envisioned, was reaching only 12 per cent of Ghana's households (Nyonator et al. 2011). Where Regional Health Administration support involved the financing of exchanges between districts, active engagement with political and development authorities, and routine discussion of CHPS at staff meetings, small investment in CHPS generated pilot implementation zones within districts. These demonstration communities, in turn, were instrumental in establishing a process of demonstration of CHPS implementation within a given district that was rapid and straightforward. The Nkwanta experience showed that proper introduction within a given district, with strategies for community engagement, could catalyze political and Non-Governmental Organizations' (NGOs) investment in scale-up. Through peer-to-peer exchanges, district leaders who had implemented CHPS were successfully able to persuade those in other districts to do the same, but this "catalytic leadership" was inadequately defined and complex to document for programmatic sustainability, and has not been instituted on a national scale (Nyonator et al. 2011). Donor support for some aspects of CHPS expansion has been generous but has tended to support technical assistance and workshops rather than the political mobilization that seems necessary to transfer implementation capacity from one district to another.

## 5.4 Operational Challenges to the CHPS Model

The fundamental problem constraining progress was counter-systemic programming in the initial policy development era that CHPS was originally conceived as a community-based trial rather than a systems initiative for developing district and regional leadership for community-based services. Its research was focused on identifying the best way of delivering services and sustaining community engagement for primary health care. However, scaling up CHPS is a district systems issue that requires improved capabilities in regional and district management, planning, budgeting, and resource development. This, in turn, requires political mobilization beyond the community level.

In the absence of these regional and district capabilities, fidelity to the original CHPS model developed at Navrongo has dissipated with passing time—a scaling-up phenomenon noted elsewhere (Carroll et al. 2007, Breitenstein et al. 2010). For example, the Navrongo Project encouraged communities to construct interim health posts for CHOs from donated materials with volunteer labour so that services could start without delay. Construction of permanent facilities was meant to be a reward for this community activity. However, some district managers delayed nurse deployment until revenue became available for financing outside contractors to construct health posts (termed “CHPS Compounds”). As a consequence, construction has become a constraint to implementation rather than an incentive for community action. Using funds to hire outside contractors also substantially raised the potential cost of scaling up, creating a further disincentive for donors and others to support the project.

The package of services was also often incomplete and proven life-saving components were needlessly excluded from the regimen. For example, supervision of nurses and volunteers was inadequate in many districts and information systems were so cumbersome that they were useless to CHOs. Another problem was that district leadership often prioritized ambulatory clinical care of adults rather than building community and political engagement to encourage community-based preventive health services and early treatment of the leading causes of childhood morbidity. In addition, owing to official national Nurses and Midwifery Council objections, CHO training excluded emergency obstetric care, life-saving skills such as the management of asphyxiation and haemorrhaging, and proven approaches to saving newborn lives. In CHPS zones that were as yet incomplete, IMCI services were often inaccessible because there was no CHO. Volunteers might have been able to provide some of these services, but since they were often poorly trained and supervised, the GHS policy did not allow them to provide antibiotic therapy or to engage in direct care of any kind. Thus, despite evidence that community-based primary health care was scalable and affordable,

health conditions remained needlessly poor and health services remained unresponsive to basic needs.

## **5.5 The Ghana Essential Health Interventions Project**

The Ghana Essential Health Interventions Project was a quasi-experimental test of the proposition that improved planning, resource allocation, and district leadership can foster utilization of the Navrongo research, accelerate CHPS implementation, and in the process improve the health and survival of children under age five (Awoonor-Williams et al. 2013b). GEHIP has been introduced in four of the most impoverished rural districts in Ghana's Upper East Region. GEHIP's primary objective is to utilize evidence-based solutions to strengthen district-level capacity to expand access to services, improve quality of care, and enhance district management and resource allocation capabilities, all within Ghana's existing primary health care model, CHPS (Awoonor-Williams et al. 2013b).

To attain these objectives, GEHIP focused on identifying gaps and problems within the current CHPS model, but with the goal of changing the scaling up strategy in response to this diagnostic research. The general insight that has emerged concerns the absence of systems thinking in CHPS planning, and a consequent lapse in focusing on the implementation capacity building needs of district managers. Experimentation in Navrongo, policies to scale-up CHPS, and training programmes that the project inspired have focused entirely on frontline workers. As Table 5.1 shows, GEHIP represents a response to the need to compliment this focus with a district systems leadership development strategy, but with activities that cut across pillars of the WHO framework for health system strengthening (World Health Organization 2007). District directors have been provided with responsibility for scaling up CHPS without training, demonstration and peer guidance on how to translate their authority into actions that make CHPS work (Binka et al. 2009).

GEHIP baseline appraisal research showed that constraints to scale-up will persist if the focus of the initiative remains restricted to the construction of CHPS health posts, the training and deployment of community workers to staff them, and the provision of equipment and pharmaceuticals. In fact, developing and scaling up CHPS is fundamentally a systems problem, involving all levels of the District Health Management Team operation, and coordinated leadership of levels of the system earlier portrayed in Figure 5.2. Addressing these challenges has led to the development of a comprehensive package of systems strengthening activities, which include the following key interventions:

- i) *Enhancing District-level leadership:* A coordinated programme of building leadership at the district levels was introduced with aim of building management capacity and supervisory skills through an interactive programme based on experiential instruction and peer coaching.
- ii) *Building district capacity for resource allocation and budgeting:* Ghana's health system leadership developed a partnership with Tanzania-based Ifakara Health Institute to improve district leadership and planning capacity. This collaboration led to the redesign and introduction of Tanzania's evidence-based model for district-level planning (DeSavigny et al. 2001, 2008, Neilson and Smutylo 2004) into a new system tailored for Ghana, known as District Health Implementation and Reporting Toolkit (DiHPART).

**Table 5.1: Research on utilizing research on Navrongo primary health care strategies by WHO health systems strengthening building block**

Critical elements of the Navrongo model of community-based primary health care			Strategies and GEHIP research for fostering the utilization of Navrongo research		
Implementation Objective	Strategy	Diagnostic results: Departures from the strategy	GEHIP responses to improving research utilization	GEHIP results	
WHO Building block #1: Leadership and Governance					
1	Improve governance and political commitment	Form health committees with community leaders	District level leadership support and political backing is inadequate.	Link grassroots political leaders with CHPS rollout celebrations to enhance political support for CHPS	Development investment in start-up costs
2	Develop community support for primary health care	Link operations with traditional social institutions and networks	Community engagement lapses with scale-up	Revisit Navrongo strategy of integrating community engagement into leadership training.	Results as in rows 8 and 9.
WHO Building block #2: Health Care Financing					
3	Finance start-up costs	Add \$2.92 per capita for start-up costs + \$1.96 for incremental running costs	While running costs are sustainable, no budget line or mechanism for start-up costs	Add \$0.85 per capita "catalytic financing" for three years to foster diffusion of implementation.	Demonstration activities fostered development sector co-financing
4	Improve planning and budgeting	No strategy or intervention	Budgets lack links with actual need, as defined by the burden of disease	Develop a budgeting scheme for fostering health and development sector partnership.	Enhanced community investment in CHPS
WHO Building block #3: Health Workforce					
5	Expand the climate of service options and choice	Train workers in outreach and community liaison methods	Focus on outreach limited to outreach clinics. Doorstep services abandoned	Revise volunteer training for comprehensive care; retrain workers in household outreach; implement facilitative supervision	IMCI coverage improved; childhood mortality reduced
WHO Building block #4: Medical products, technologies					
6	Ensure reliable provision of equipment and supplies	Procurement of equipment; backstop the supply system to prevent stock-outs	National supply and logistics reform has worked	No intervention needed.	Not applicable.
WHO Building block #5: Information and Research					
7	Ensure community-based coverage	Register development to replace loose forms; monitoring tools for supervision	Proliferation of registers and reporting procedures that consume time, focus, and attention to field work	Registers simplified replacing 23 registers with 5, setting the stage for mechanization and paperless HMIS	National scale-up of the GEHIP simplified register
WHO Building block #6: Service Delivery					

8	Improve access to primary health care trained community workers to convenient village locations	Relocate trained and paid Community Health Nurses to accessible community health posts	Costly construction policies slowed the facility development process. CHPS expansion was delayed by construction delays.	Volunteer-based construction of interim facilities. Construction implemented as a reward for community initiative.	CHPS coverage increased from 25% to 100% in four years
9	Implement functional CHPS as a community-led initiative	Utilize volunteers to develop functional CHPS facilities, focusing roles on health promotion and male outreach for family planning	Volunteers targeted on component health service activities; family planning community engagement abandoned.	Community implemented construction + development sector financing	Accelerated expansion of functional CHPS
10	Improve perinatal health	Develop functional surgical care and referral training	Referral services at the community level were dormant.	Develop community-engaged support for referral services, information, and logistics	Facility based maternal mortality reduced

- iii) *A strategic approach for accelerating CHPS scale up:* Challenges identified with the scaling up of CHPS have been documented by an official review of the CHPS programme (Binka et al. 2009), leading to the design of a series of GEHIP guiding measures to overcome these barriers. These actions have been used to create a package of implementing steps aimed at enhancing district-level capacity towards supporting CHPS scale up.
- iv) *Introducing a coordinated response for community-based emergency referral:* Emergency referral is a serious challenge across Ghana, especially in rural areas. In response, an innovative community-based emergency referral programme, known as the Sustainable Emergency Referral Care (SERC) initiative, was introduced. This programme, integrated into CHPS operations, involves the strategic use of both transport and communications technologies to improve access to emergency services in even the most remote localities.
- v) *Clinical capacity development:* Both regional and community-level surveillance systems have highlighted areas necessitating clinical care improvements, including perinatal and maternal health. In response, a coordinated programme for midwives was introduced to build perinatal and emergency obstetric clinical capacity, including education and skills on the use of appropriate technologies.
- vi) *Developing and testing an urban model of CHPS:* In an area of informal settlements in the sprawled out capital of Accra, an urban CHPS pilot was introduced to examine the feasibility of introducing this rural-developed model within an urban context. Evidence generated can be utilized to help tailor the CHPS strategy to better address the unique primary health needs of the people of Ghana.

## 5.6 Issues addressed by the GEHIP Trial

GEHIP was designed as a Ghana Health Service response to national evidence that the Community-based Health Planning and Services (CHPS) Initiative was not scaling up, despite compelling evidence from the original Navrongo Experiment that CHPS, if implemented as tested, could dramatically accelerate the achievement of MDG-4 and contribute to the attainment of MDG-5. By 2005, national data showed that scale-up was slow. In 2009, the Minister of Health commissioned an external review of the CHPS scaling up problem. A distinguished panel of reviewers visited all 10 regions and several districts to clarify why some regions and districts were succeeding with CHPS scale-up while others were not (Binka et al. 2009). This report, based on a qualitative systems appraisal of stakeholders at each level of the system, and other sources of information, identified three sets of problems:

*Failure of CHPS to scale up:* This is a district leadership, planning, and resource allocation problem. There is a need for a district resource planning capacity that would equip leaders with objective tools for basing strategic plans on actual need. The original Navrongo Project neglected the district management and leadership dimension of health development. If districts could be equipped with a Tanzania-like “District Health Planning and Reporting Toolkit” (DiHPART), this critical gap could be filled. With extra revenue, DiHPART and leadership training, it would be possible for “Total CHPS” to replace the dysfunctional “Fixed facility CHPS” that has taken hold.

*Resistance to change:* The Binka et al (2009) review determined that stakeholders in CHPS development often have contrasting views of what CHPS is, or lack understanding of the possible contribution of CHPS to health development. A qualitative appraisal of CHPS leaders noted a climate of resistance to change, fostered by the view that launching CHPS would develop political and community pressure to sustain a programme that had marginal funding, at best, and little discernible support from either national or local political officials. Starting a process that was politically popular, but financially unsustainable, generated a climate of what has been characterized as a “fear of the unknown.”

*Failure to sustain the “active outreach” service model:* Even if CHPS were to scale-up, it would fall short of its potential. CHPS has become a passive dispensary-like model where workers wait for clients rather than engage communities. This passive service approach ignores the needs of newborns and mothers who require support at the time of delivery and the first 48 hours of life. Moreover, emergency management must be developed and this requires doorstep care. Reorienting CHPS from its passive fixed facility mode to its original active client-seeking approach could more effectively address excess mortality. Family planning, in

particular, has been shown to require active community engagement, focusing on the needs of men (Ngom 1997, Bawah et al. 1999a, Adongo et al. 2013). The focus of CHPS on community engagement has atrophied with time (Baatiema et al. 2013).

In addition to these operational limitations of CHPS, important gaps in the service model are noteworthy. In particular, even if CHPS were meeting its potential as a service system, unaddressed excess mortality would remain. Once CHPS functions effectively, workers are increasingly confronted with cases that they are unable to manage in the village. The matter of triage, emergency intervention, expeditious transport, appropriate communication, and information feedback requires an appropriate strategy for district referral planning.

As noted, these problems arise as a result of district leadership and planning lapses, and inadequate strategies for addressing the burden of disease. Ever since CHPS was launched, official policy in Ghana has aimed to expand CHPS to all communities by the end of 2015, with finances provided largely through government resources. Despite this goal, there is no health sector budget provision for the cost of launching CHPS. As the year progressed, monitoring suggests that less than half of the communities targeted for CHPS are actually receiving these services. Although additional support is provided by NGOs, District Assemblies, and the global community, facility and equipment start-up costs and other essential start up investments are not routinely available.

A core problem concerns the widespread perception that community CHPS Compounds (clinics) must be constructed before CHPS can begin. Costly construction priorities are fundamentally at odds with national budgeting for CHPS. Revenue lines exist for on-going primary health care functions, staff, and commodities, but the start-up costs of CHPS have never had a budget line. Without fiscal clarity about where CHPS initial costs are to be charged, engaging communities is fraught with risk: CHPS has been popular and in demand at the community level, but if there is demand for a programme that is under-financed, leaders can perceive such programmes to be a threat rather than a resource (Krumholz et al. 2014).

But, flexibility for financing these costs exists in the development sector. In particular, development revenues of the World Bank, the European Union and some bilateral donors are committed to flexible revenue accounts managed by District Chief Executive and District Assembly development decision-makers. Whereas policies of the "Sector Wide Approach" once provided flexible revenue to district health managers, all fiscal flexibility is now managed by district political authorities. This pool of resources is combined with Government of Ghana flexible financing as well as by communities in the form of material and volunteer labour. But claiming these resources is not solely within the purview of the health sector. Yet, as the

GEHIP team learned in its baseline approach, the development common fund could involve investment in health, providing a source of revenue that could bring to CHPS crucial district development resources that are external to the health sector. In particular, local development revenue could be used to finance the essential \$2.92 per capita in CHPS start-up costs. Since only about \$14 per capita is available for all health expenditures combined, any meaningful contribution to the \$2.92 per capita represents a major catalytic investment in CHPS expansion.

Such investment is the subject of considerable political dialogue and debate in District Assemblies. District political and development officials must decide whether to make and sustain this investment for CHPS start-up investments, or focus instead on the competing demands of other critically important development sector needs. Such deliberations often occur in an information vacuum, without consideration of health as a development challenge. Bridging the gap between development and health requires diplomacy, dialogue, and political support from communities where investment is to be made. Achieving development partnership requires district health leadership and proactive extra-sectoral engagement. As the Binka, et al. report noted, this vision of health sector district leadership responsibility is typically lacking; “leadership training” in turn focuses on strategies for managing teams and maintaining accountability. The practical steps and strategies for connecting health with development is largely ignored.

Although the pace of scaling-up is constrained by organizational and resource problems, the CHPS initiative has made considerable progress. At the onset of the national programme in 2001, only 22 of 110 districts reported implementing activities. Eighteen months later, 87 districts had taken steps to launch the programme. By mid-2004, 105 of the 110 District Health Management Teams reported having undertaken preliminary planning activities. In 2005, the Government of Ghana split 14 districts, making 138 in all. By mid-2005, nearly all 138 District Health Management Teams had launched some element of the CHPS programme. Planning CHPS and starting some form of implementation thus spread quickly across Ghana.

Although every district in Ghana has joined the scaling-up process, a number of obstacles to within-district scale-up have emerged. The pace of launching programme planning – involving mapping, traditional leadership identification, selection of sites for CHPS Compounds, and other start-up activities, progressed more rapidly than the pace of actually implementing community-based services. One core problem has impeded progress: too often, implementation is viewed as a process that starts with expensive Compound construction rather than community-engagement for supporting nurse posting to temporary quarters. Although approximately two thirds of the district teams report having completed community-

based planning, relatively few have actually launched services. At the beginning of 2003, only 42 percent of the districts had completed the process of community entry in at least one service zone, even though community entry is a low cost and simple-to-implement strategic component of the programme. By 2005, this situation had not changed. A greater proportion of zones had completed 'Community Health Compound' construction or renovation, suggesting that facilities are being developed without community involvement, and that community posting of the nurse or volunteer development lags behind all other milestones.

This commitment of district resources for construction, without resource leveraging from communities, represents a departure from the CHPS model of community engagement that deprives the programme of community resources for facilities and community ownership of the programme itself. Qualitative systems appraisals show that communities which mobilize resources for CHPS develop a sense of ownership of its services. Constructing facilities without community engagement is tantamount to bypassing social support for CHPS in general. Staff engaged in the programme tend to be supportive of CHPS, but workers who are not familiar with the initiative resist its introduction, in part because change requires unanticipated effort, but also because community engagement can generate community commitment to CHPS that requires resources that managers believe that they lack (Nyonator et al. 2005b). Three general themes explain this reluctance:

***The resource gap:*** Resources for primary health care in Ghana are severely constrained. Navrongo cost analysis has showed that CHPS adds \$1.92 per capita per year in costs to the \$6.80 that was available for primary health care services in the late 1990s. National economic analyses indicate current costs of CHPS implementation to be low by international standards, but higher than Navrongo estimates. Increasing the coverage of community health services expands demand for health care that translates into higher costs of pharmaceuticals, fuel, equipment, and supplies. Health Sector Reform has conferred authority on District Health Management Teams, but not the necessary resources for implementing the general health service agenda. In the absence of earmarked donor or government funding for CHPS, incremental start-up costs severely constrain efforts to launch the programme. Given the financial and manpower constraints confronting districts, many are understandably reluctant to engage in "community entry" activities that will arouse public interest in services they are ill-equipped to launch and sustain.

***The capability gap:*** District Health Management Teams often are reluctant to launch a programme that they believe will require technical skills not yet in place. Management information systems, logistics systems, and community outreach operations lack essential tools for ensuring that quality services will be maintained and that community health care

delivery will adequately respond to community needs. Community nurses often are ill equipped to make independent clinical decisions, having grown accustomed to the continuous technical supervision that sub-district health centres afford. Once they are deployed to communities they immediately confront major technical challenges. For example, communities typically expect arriving nurses to have midwifery skills that few are trained and equipped to provide. CHPS requires new training protocols and procedures that are not yet in place.

***The knowledge gap:*** CHPS continues to mean different things to different stakeholders despite the considerable effort that has been directed to training, policy directives, conferences, and reports. In its simplest distortion, the programme is viewed as a means of putting nurses in communities, and little else. Because health workers at all levels were accustomed to clinic-based work routines, instructions to relocate nurses to communities were often interpreted through the prism of clinic management experience. When interviewed in the GEHIP formative research appraisals, frontline workers often amplified managerial concerns about the feasibility of shifting operations from clinics to communities (Nyonator et al. 2005a). Nurses who are relocated to communities must leave behind the relative comfort of sub-district assignments, where work is routinely supervised, and technical demands are minimal. Very practical and personal concerns were of paramount importance. For example, staff assigned to sub-district health centres or hospitals either have housing provided for their families or access to local housing that can be rented or borrowed from kin. But, a nurse sent to the community must have housing, utensils, and personal effects that are costly for an individual to acquire. And, living arrangements that ensue isolate nurses from their family and social networks. Work arrangements were also a matter of concern. Nurses expressed concern about the challenge ahead and managers were anxious about embarking upon changes that may be complicated to manage. Many of the key staff involved in decision-making have responsibility for clinical roles and little extra time for organizing community health care. While the potential difficulties in launching CHPS are anticipated, personal motivational rewards associated with the provision of CHPS services are not readily anticipated. By contrast, workers actually participating in the programme express satisfaction about their contribution to health service improvements and their appreciation of the support that communities render (Sory et al. 2003).

## **5.7 Interventions**

People-centered systems development

The WHO framework is both compelling and deficient. For at least four decades, organizational scientists have emphasized the critical importance of “open systems thinking”

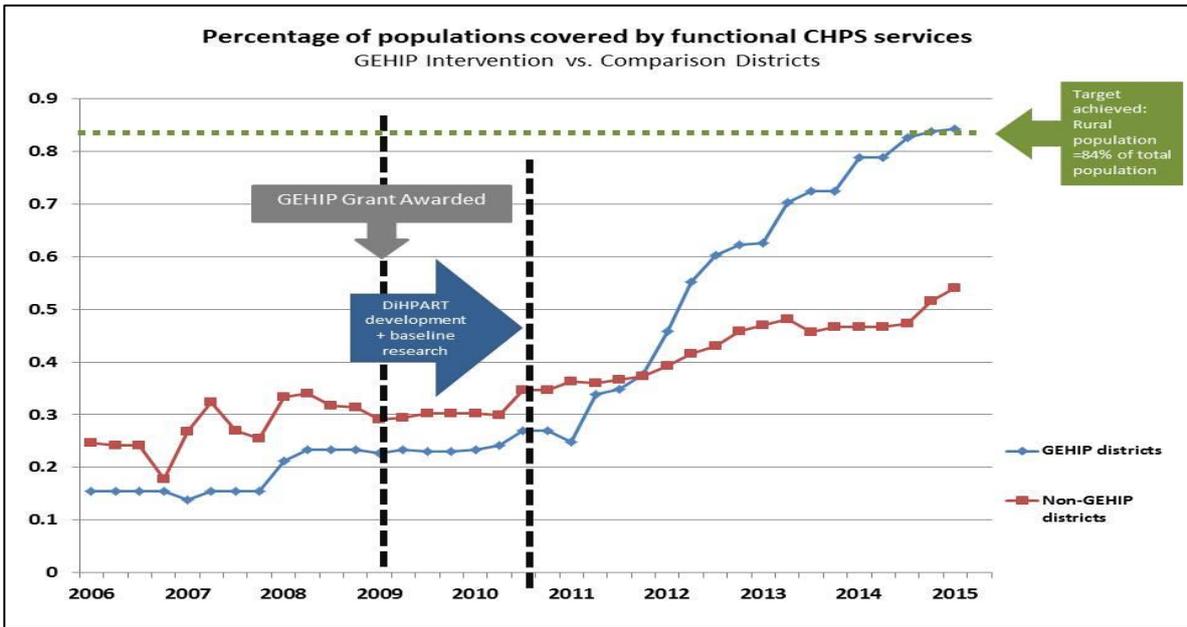
in the design of service programmes (Katz and Kahn 1978). In this perspective, organizations are more effective if their operation and design reflects the social organizational context. Recent advocacy of systems development approaches have embraced this perspective with terms connoting “people-centered” approaches to systems development (Gilson et al. 2005, Gilson and McIntyre 2005, Goudge et al. 2009, Sheikh et al. 2011, Ooms et al. 2013).

This “people-centered thinking” is grounded on the perspectives of open systems theory. In this view, health service systems are more successful, more sustainable, and more scalable if their design brings into account the social context of the population served (Simmons and Shiffman 2005, Fajans et al. 2006). GEHIP takes this approach beyond the point of health communication with the goal of building service organizational structure and functioning on a platform defined by social organizational structure. Institutions of social networking, governance, communication, consensus building, and leadership are not only important for advocating services; social organizational structure can be a mechanism for strengthening worker supervision and accountability, service quality, and resource management. In response to the organizational opportunities that robust social traditions can provide to a programme, GEHIP has adapted the WHO model to an open systems framework.

Two avenues of exchange are particularly important to community-based primary health: an effective and resilient system of care has mechanisms for ensuring convergences with traditional governance systems and grassroots political institutions; and services are tailored to the needs of families for convenient and high quality people-centered services.

## **5.8 Results**

Time trends in the coverage of CHPS in GEHIP intervention and comparison districts are presented in Figure 5.3.



**Figure 5.3: Percentage of populations covered by functional CHPS services (GEHIP Intervention vs Comparison Districts)**

As the figure shows, GEHIP impact on CHPS was immediate and pronounced, with the combined population of communities covered in 2010 comprising 16 percent of district populations increasing to 82 percent of the populations of these districts by the end of 2015. Thus, in five years of GEHIP implementation, the target of 80% of CHPS coverage in four districts was reached and exceeded. Progress in CHPS coverage in comparison districts is equally noteworthy, but much more gradual than has been achieved in intervention districts. Comparison area coverage was 25% in 2010 and 50% by the end of 2015. While this gain in coverage is impressive, the trend produced only half of the household coverage in comparison areas than was achieved by GEHIP. GEHIP also improved the range and quality of primary health care services, particularly maternal and newborn health, as well as the development and implementation of sustainable referrals through the provision of community-engaged emergency referral services.

Table 5.2 presents the results of a regression analysis of the distance from GEHIP sample households to nearest CHPS functioning service “Compound.” Data from a baseline survey were merged with endline survey data compiled in the same sample clusters as used in the baseline. Distances from sample households to CHPS service points were assessed with geographic information system coordinates so that changes in distance to CHPS could be assessed as a parameter in the analysis. Results presented in Table 5.2 show that the intercept, representing the mean distance to CHPS provided service points, was 7.27 kilometres, the regression intercept. This was reduced by 4 kilometres during the GEHIP era,

with an additional 1.5 kilometre reduction attributable to GEHIP activities. Findings thus suggest that GEHIP improved access to CHPS services.

**Table 5.2: The difference-in-differences effect of GEHIP on distance to nearest CHPS facility**

Covariates		Coefficient	Distance to nearest CHPS facility (km)
		B	95% CI
Treatment	Intervention	+0.74	(0.72, 2.21)
Time of Survey:	post 2011	-4.03***	(-4.75, -3.3)
DiD	intervention # post 2011	-1.46*	(-2.75, -0.1)
Constant		+7.27***	(6.37, 8.17)

\* p < 0.05 \*\* p < 0.01 \*\*\* p < 0.001

Thus, while CHPS scale-up has encountered implementation delays in the past that now require national corrective action, GEHIP implementation research results attests to the practicality of accelerating CHPS scale up considerably with a set of district leadership interventions. While CHPS is a complex story, its core agenda, is quite simple for stakeholders to understand and embrace if it is witnessed by implementation teams who have catalytic revenue for fostering scale-up and practical experience with grassroots social and political engagement. Achieving the transition from CHPS as it has evolved into a clinic focused programme into a fully people-centered and community engaged programme requires strategic attention, focus, and simple to replicate action.

## 5.9 Conclusion

As a field project, GEHIP aimed to develop, deploy, and evaluate a programme strategy for strengthening the primary health care system that would be guided by the WHO framework building blocks for health systems strengthening (HSS), with the overarching aim of achieving universal health coverage (UHC) in four of Ghana’s most impoverished and remote districts. Research had already demonstrated the impact of this approach and strategies for scaling it up. But, implementation research has also showed that the pace of scaling up has been constrained by district leadership problems. By researching the utilization of research, GEHIP has identified strategies for solving the scaling-up problem.

Projects often end with a dissemination activity and an end to funding arrangements that dissipates teamwork, and dilutes prospects that the project will impact on the way that large scale programmes actually work. To avoid this pitfall, GEHIP has been designed to anticipate scale-up ownership and strategic integration. GEHIP is a programme for reforming CHPS rather than proving that community-based care can impact on health – results that were already established by the Navrongo trial. As a project that responds to an official review of

problems and generates results with terms of reference to the policy establishment, GEHIP is an experiment that has tested ways to improve the utilization of research. Its results are positioned to guide the national CHPS reform. Rather than representing an initiative that must be “sold” to policy stakeholders, its purpose, design, and outcomes are already part of a programme of evidence-based action that will reform the implementation of the national CHPS programme.

## **6 A qualitative systems appraisal of constraints to scaling up a community-based primary health care initiative in rural Ghana**

Lauren Archer<sup>1</sup>, John Koku Awoonor-Williams<sup>2,3,4</sup>, Robert Alirigia<sup>5</sup>, Rofina Asuru<sup>5</sup>, Mallory C. Sheff<sup>1</sup>, James F. Phillips<sup>1</sup>,

<sup>1</sup> Heilbrunn Department of Population and Family Health, Mailman School of Public Health, Columbia University, 60 Haven Avenue, New York, NY 10032

<sup>2</sup> Policy Planning Monitoring and Evaluation Division, Ghana Health Service, Private Mailbag, Accra, Ghana

<sup>3</sup> University of Basel, Peterplatz 4003, Basel, Switzerland

<sup>4</sup> Swiss Tropical and Public Health Institute Socinstrasse 57 4002 Basel, Switzerland

<sup>5</sup> Regional Health Administration, Upper East Region, Ghana Health Service, Bolgatanga, Ghana

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This paper has been submitted to *Global Health Science and Practice*

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## 6.1 Abstract

Community-based primary care programmes are becoming a priority in global health interventions. However, little is known about the potential implementation barriers within these programmes and what can be done to improve programmatic effectiveness and scale-up. To gain better understanding of the implementation of the Ghana Essential Health Intervention Project (GEHIP), we analyzed in-depth interviews of 47 participants comprising of health staff, political and development officials during July-August 2012 and July-August 2013 from qualitative studies conducted as part of the project. This is to enable us examine the barriers identified in the Community-based Health Services Planning (CHPS) initiative and the strategies engaged by Ghana Health Service (GHS) officials when confronting those barriers. The Ghana Health Service staff use a variety of approaches and strategies when confronted with barriers in the CHPS programme. Five types of barriers were identified: human resources, transportation/logistics, infrastructure, general lack of funding, and unpredictable funding. Four approaches were identified by participants as strategies for facing these barriers: Ghana Health Service staff leadership, facilitative supervision, engaging communities for support, and leveraging local political support. The variety of strategies and the range of approaches suggest that there is no single solution and that implementation of community-based primary care programmes must take into account the complex nature of health systems. Particular emphasis should be placed on engaging communities in the implementation process as well as increased collaboration with local political bodies. Doing so expands grassroots political support for CHPS that can generate catalytic development sector investment in start-up costs.

## 6.2 Introduction

Few African countries will have reached the 2015 United Nations Millennium Development Goals (MDGs) for the reduction of child mortality (MDG 4) and the reduction of maternal mortality (MDG 5). The case is no different in Ghana (Bryce et al. 2006). While the country's under-five mortality rate has declined from 122 per 1,000 live births in 1990 to 74 in 2010 (UNICEF 2015), it is unlikely that the goal of 53 deaths per 1,000 live births will have been attained by the end of 2015 (United Nations 2013). In a worldwide effort spurred by MDG targets to combat child mortality and to lower maternal mortality, new comprehensive health systems approaches have been introduced in many resource-poor countries. There is increasing evidence and recognition that programmes which function by involving the community and going outside the walls of health care facilities have great potential for reducing under-5 mortality. Community-based initiatives are especially effective in addressing high fertility rates, high child mortality rates and generally poor community health indicators through the provision of "door step" primary care services by trained nurses (Freeman et al. 2012; Perry & Zulliger 2012).

An experimental study - the "Navrongo Experiment" - demonstrated the effectiveness of community-based primary care programmes in rural, resource-poor settings. Based in the Upper East Region (UER) of Ghana in the early 1990s, the "Navrongo Experiment" tested the impact of relocating primary healthcare services from static, district-level facilities to one where skilled nurses delivered door-to-door care at the community level (Binka et al. 1995; Pence, Nyarko, Phillips, et al. 2007; Binka et al. 2007a; Phillips et al. 2006). In response to the success demonstrated by the Navrongo Experiment in reducing child mortality, the Ghana Health Service endorsed the national scale-up of a plan called the Community-based Health Planning and Services (CHPS) initiative (Nyonator et al. 2005; Awoonor-Williams et al. 2010). The CHPS programme aims to extend primary healthcare services to formerly underserved rural populations with the placement of trained health workers at the community level to deliver "doorstep care" to the population. CHPS represents a national scaling-up initiative that has been cited as a case study in the utilization of field research for national systems development (Fajans et al. 2006).

Since its inception, the nationwide scale-up of the programme has had mixed results, with programme coverage only beginning to increase at discernable rates in the last two years. Nationally, the population reached by CHPS increased from nearly zero in 2000 to 16.4% by 2009 and to 21.78% in 2011, the fastest acceleration of programme coverage to date. Yet the pace of expansion was far more pronounced in the UER where coverage was over 20 percent in 2008, and nearly 70% by 2015, making the UER a national lead region for CHPS coverage

despite its status as one of Ghana's poorest and most remote areas (Awoonor-Williams et al. 2013c).

In response to the slow national scale-up of the CHPS initiative, the Ghana Essential Health Intervention Project (GEHIP) was launched with the aim of identifying CHPS implementation gaps and testing the effectiveness of a set of health systems strengthening interventions in overcoming implementation barriers. Identifying the constraints to scale up faced by Ghana Health Service (GHS) officials and the effectiveness of responses to implementation gaps has implications for the implementation of decentralized approaches to scaling up the CHPS initiative (Armstrong-Schellenberg et al. 2004, Bryce et al. 2010). This paper describes the implementation phases of the CHPS programme and the constraints to scale up that exist as identified by officials of the GHS and the District Assemblies. The paper also discusses the approaches and strategies used by health officials in their efforts to overcome the implementation barriers and accelerate scale up of the CHPS initiative.

## **6.3 Methods**

### **6.3.1 Study Design and Participants**

Two sets of in-depth interviews were conducted that examined the scale-up of the CHPS programme in the UER of Ghana and to explore barriers to CHPS scale-up and possible mechanisms for addressing these constraints during the GEHIP project: i) A series of in-depth interviews were conducted with staff of the GHS, with each set of interviews intended to represent levels of the health system leadership including the Regional Health Director, District Health Directors, District CHPS Coordinators and District Financial Managers, and ii) a corresponding set of interviews of political and development sector officials including members of the District Assemblies, Coordinating Directors and Planning Officers. The sampling frame was limited to those individuals who were current or former staff members of the GHS or District Assemblies and who had played a role in the implementation of the CHPS programme in the UER of Ghana. In total, 47 participants were identified for in-depth interviews during July-August 2012 and July-August 2013, and 46 interviews were analyzed for this study (one interview was not transcribed due to audio recorder error). All GEHIP intervention and comparison districts were represented.

### **6.3.2 Interview Protocol**

Participants read and signed an informed consent form before participating. The study protocols and data collection instruments were approved by the Navrongo Health Research Centre as part of the overall GEHIP protocol. Interviews were conducted in English at the

participants' places of work, which included the offices of District Health Management Teams and District Assemblies in the UER. Each interview ranged from 30 to 90 minutes, was audio recorded, and subsequently transcribed by the interviewer or an administrative project staff member.

The structure of interviewing was informed by findings from implementation research on CHPS. CHPS has been a programme that is decentralized to the district where services are implemented sequentially in village clusters termed "zones", each representing a catchment and service outreach area where a team of community nurses are based. Initial research showed that establishing each zone is appropriately conducted in six phases, with this process repeated for each zone (Nyonator et al. 2005; Awoonor-Williams et al. 2005; Nyonator et al. 2008): 1) area mapping, planning, and community leadership identification; 2) "community entry" involving meetings with traditional leaders for the creation of programme governance mechanisms; 3) community health compound development which can involve volunteer construction of temporary facilities or actual construction of a health post, if resources permit; 4) the procurement of essential equipment and supplies; 5) nurse selection, training and deployment; and 6) volunteer selection, training and deployment. Results of field trials show that if all six milestones are implemented, community-based care will be functional, even if the full range of investment in CHPS facilities and equipment is incomplete (Awoonor-Williams et al. 2010b, 2013c). Since early CHPS era implementation research identified these milestones, interviewing was designed to understand the barriers to implementing CHPS in general, as well as respondent understanding of the milestones and the strategies used by Ghana Health Service officials to overcome constraints to their implementation.

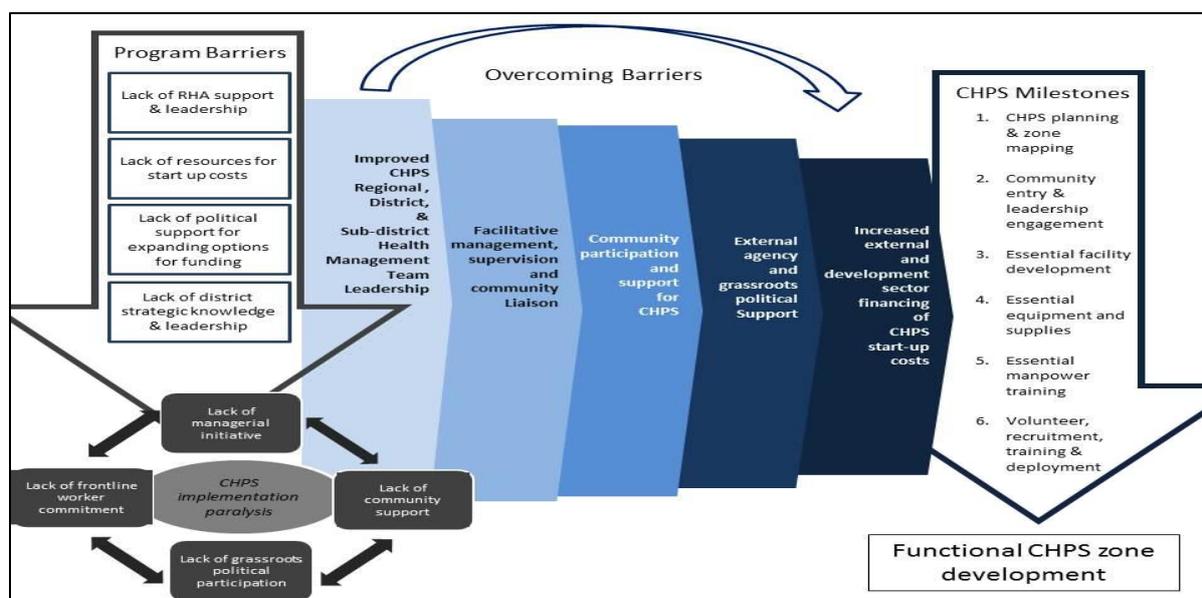
### **6.3.3 Qualitative Analysis**

Interview transcripts were analyzed using a thematic analysis approach, which is a descriptive qualitative method used for "identifying, analyzing and reporting patterns (themes) within data" (Braun and Clarke 2006) according to six phases of thematic analysis: 1) familiarization with the data; 2) generating initial codes; 3) searching for themes; 4) reviewing themes; 5) defining and naming themes; and 6) producing the report. Data analysis followed this procedure, commencing with researchers review of the transcripts and relevant published literature on primary healthcare systems in developing countries, scale-up of health programmes, and related interventions in Ghana. This preliminary process resulted in a series of marginal notes and an initial list of codes (Cresswell 2007).

The initial set of codes were compiled into a draft codebook, the development of which was guided by a revised research question: What are the implementation barriers that exist and how do staff of the GHS and District Assemblies approach these identified barriers during the

scale-up of the CHPS programme in the UER of Ghana? Atlas.ti software was used throughout the analysis process, which began with open coding - the process of assigning initial codes to the data based on the draft of the codebook (Strauss and Corbin 1998).

In keeping with the phases of thematic analysis approach, the codebook was revised based on emerging themes and applied to additional portions of data until a final version was completed. The researchers engaged in a combination of line-by-line and sentence coding to apply the final version of the codebook to the data, which involved phrase-by-phrase examination of the text and coding by major themes brought out in select sentences. Based on the emerging themes related to CHPS barriers and strategies used by GHS staff to approach those barriers, a thematic framework guided by principals of complex adaptive systems theory was created (Figure 6.1) (Adam and de Savigny 2012).



**Figure 6.1: Programme barriers to CHPS implementation with GEHIP strategies for implementing CHPS programme milestones**

During data analysis, several steps were undertaken to ensure the validity and reliability of the study. In order to maintain internal validity during the analysis process and to protect against researcher bias, the researchers engaged in a process of reflection and memo-writing to engage with personal subjectivities that could have potentially impacted the analysis process. Sustained dialogue with colleagues, referring to relevant literature and to the thematic framework, also reduced threats to validity. Reliability was maintained during the process by adhering to a defined codebook to ensure that analysis procedures were consistent.

### 6.3.4 Limitations

The reliability of the data collection process may have been somewhat compromised by the fact that the interviews were conducted in English rather than in local languages (for both the interviewer and the participants). However, the UER is culturally heterogeneous, with seven local languages represented by participating districts. English is the usual medium of communication in office settings.

The analysis would have been strengthened by engaging in group-based coding in order to better assess inter-rater reliability. One researcher conducted the entire coding process, so information on the reliability of individual codes is lacking.

## 6.4 Results

### 6.4.1 Barriers to Implementation

The five most common constraints to implementation as identified by GHS staff were: 1) human resource availability and clear understanding of the CHPS programme; 2) the availability of essential transportation/logistics; 3) access to essential community-based infrastructure; 4) a general lack of adequate funding, but mainly inadequate resources for start-up costs; and 5) unpredictable and delayed funding. Infrastructure and transportation/logistics were the most widely mentioned barriers, and include problems that range from lack of a CHPS compound where nurses could live and work to inadequate supply of electrical power, and shortages of fuel and motorbikes for service delivery.

Since the CHPS programme relies heavily on new infrastructure and additional modes of transportation in order to relocate health services to the community level, the identification of infrastructure and transportation constraints by almost all the participants was not surprising. Indeed, in the GHS budgeting system, personnel and running costs of primary health care services have specified budget lines. However, routine budgeting procedures make no provision for the start-up costs of developing CHPS health posts and relevant equipment. Table 6.1 provides examples of participant discussion of these barriers in relation to the CHPS programme.

**Table 6.1: CHPS Implementation Barriers Identified by Participants**

Human Resources	Transportation/ Logistics	Infrastructure	General Lack of Funding	Unpredictable Funding
Definitions				
Insufficient human resources for health system	Lack of a system or means of transporting Community Health	Lack of the basic physical and organizational structures and	An overall lack of funds, particularly and funds	Financial resources that are available inconsistently or

functioning; Community Health Officer availability and willingness to work within the programme.	Officers and medical supplies; particularly, the lack of motorcycles for Community Health Officer transport.	facilities needed for the operation of the programme, particularly related to CHPS compound construction.	specifically budgeted for CHPS programming	only for the short-term
<b>Examples</b>				
"Human resources are key. We need nurses. Without them we cannot operate"	"We needed means of transport for the CHO's to move."	"The greatest obstacles will be infrastructure; slow pace of the construction of the CHPS compounds"	"...at the district level we don't have money anywhere. We don't generate funds"	".....it delays implementation of activities, because there will not be enough funds to complete those projects"

#### 6.4.2 Key Factors and Strategies when Approaching Barriers to CHPS Implementation

The results show that in general, participants engaged in a variety of strategies when faced with CHPS implementation barriers and that, as of 2012- 2013 in the UER, the most common implementation challenges were those that occurred after the initial planning and community entry phases.

Participants identified various strategies used to overcome the implementation constraints they face when scaling up the CHPS programme. The four most commonly identified were: 1) Ghana Health Service staff leadership qualities; 2) facilitative supervision; 3) community commitment and support; and 4) local political commitment and support.

The particular leadership qualities identified by participants include the ability to adapt and be proactive when faced with constraints to scale up. These leadership qualities were identified by health workers as ways to influence and improve their abilities to identify and carry out various strategies that are used to overcome implementation barriers, including their ability to leverage community and political support for CHPS as well as to provide facilitative supervision of the programme. Table 6.2 outlines the four most commonly identified strategies used by the participants and provides definitions and examples of each.

**Table 6.2: Approaches and strategies used by Ghana Health Service members**

<b>Improving Ghana Health Service Regional, District, and Sub-district CHPS Leadership</b>	<b>Facilitative CHPS management, supervision, and community liaison</b>	<b>Generating community participation and support for CHPS</b>	<b>Generating external agency and grassroots political support for CHPS</b>
<b>Definitions</b>			

<p>Ghana Health Service members actively taking control of events and problems related to the CHPS programme; influencing others with the aim of achieving a more desired result for CHPS programme implementation.</p>	<p>Consistent and efficient supervision related to CHPS programming provided to community health officers with the aim of improving CHPS performance</p>	<p>Ghana Health Service members placing priority on engaging communities as a way to overcome implementation barriers and accelerate CHPS scale up.</p>	<p>Leveraging support in the form of financial resources and/or time from the District Assembly for the planning and implementation of CHPS.</p>
<p><b>Examples</b></p>			
<p>“...and also writing of proposals, soliciting funding to buy the comfort items that will motivate the Community Health Officers to move to the CHPS zones”</p> <p>“I think what we are doing in particular is more innovative, because when you look at the steps it's like you have to wait until you have a compound and this and that...so we thought that if the community members are able to give us the structures - the locally made structures .....</p>	<p>“There are some leaders who no matter what you do; you are still not the best. Praise or motivation does not necessarily mean, ‘collect this number of Cedis’ but it can be ‘oh, you have done well.’ Or, ‘can you share with me why you were able to do this’ and the person shares with you. Based on that, you can sell that idea to another CHO – that staff did this and this is what he got - can you also do that or can you also deploy another strategy to see what you can do to bring up coverage?”</p>	<p>“So we had to take the strategy to get the community members to provide us with temporal structures – so currently most of them are having the temporal structures and it's functioning.”</p>	<p>“We also are always on the Assembly to provide the necessary infrastructure support so that they can build some of the CHPS compounds for us.”</p>

### 6.4.3 Ghana Health Service Leadership Qualities

The CHPS initiative aims to relocate primary health services from district facilities to the community level, which requires a similar change in leadership and management of the programme. District and sub-district health officials are responsible for identifying the need for new CHPS zones as well as planning and scaling up the initiative in their respective geographic areas. The CHPS initiative relies heavily on the support of the District Assemblies and the communities themselves, especially for start-up and infrastructure costs. District health officials are in a unique position that allows them to influence the health agenda in their district and to influence CHPS scale-up by acting as a liaison between the health sector, individual communities and local political bodies. Participants discussed various individual leadership efforts that led to both accelerated scale up of the CHPS initiative in their districts as well as more effective response to the problems that arise during CHPS implementation.

Certain individual characteristics of district-level leaders, including the ability to adapt and be proactive, were identified as factors related to CHPS scale up.

The Ghana Health Service staff embraced flexibility in their efforts to overcome implementation barriers, particularly after problems arose. For example, when discussing the lack of resources available for community health officer training, which is an essential step in the implementation of CHPS, one District Director described how he adapted to the situation by moving forward with implementation despite the fact that he could not fully address capacity building needs:

*“When we talk about refresher training it [should go] beyond two weeks so what I did, I [would] call more or less orientation because I didn’t really have enough money to do the training for two weeks”.*

Participants’ proactive leadership also enabled them to overcome constraints to CHPS scale up, such as leveraging community or local government support. The proactive efforts of one District Director led to support from an international organization for the construction of CHPS compounds:

*“...we also sold it to our partners that we [were] working with. Catholic Relief Services was the partner that was working with us. We made a point to include it in our action plans so they bought into it and also decided to put funds up”.*

Participants’ proactive efforts surrounding CHPS and adaptation to changes during programme implementation were most often mentioned in relation to phase five of CHPS scale-up: nurse selection, training and deployment. A District Health Director took a proactive approach to recruit community health officer candidates for work in a rural catchment area:

*“...first of all we identify the CHOs and then we call them, sell the idea to them that we want to send you to this place and the benefits they can get if they agree to work there and the incentives we give them...so we dialog with them to set their interest on the job”.*

District health managers also adapted their approaches to CHPS implementation by embracing a new definition of functional CHPS – one where a formally constructed compound is not necessary for deploying a health worker to the zone. Infrastructure is one of the most commonly identified barriers to CHPS scale up, particularly because of the financial investment involved, and district health managers have adapted to find ways to initiate doorstep health services without relying on formal compounds. Some of these strategies

involve leveraging additional support from the community for CHPS start-up. Other health managers chose to focus their resources and attention on the additional components needed for CHPS programming, such as motorcycles, staffing, and identifying temporal structures. One District Health Official described how the scale up of CHPS in the district accelerated when health officials' adapted their implementation approach:

*“Well, we have the [designated] CHPS zones and at first what we used to do is we would sit down and think that when the structures are there everything is Ok and then we can start. But with this idea about running CHPS without a CHPS compound we have been able to identify some [alternative] structures where the community health worker can go and sit as a point where she'll always go to render service”.*

The leadership qualities and scale up experiences described by participants demonstrate the impact that a proactive and adaptive manager can have on the implementation of CHPS particularly in overcoming constraints to scale-up.

#### **6.4.4 Facilitative Supervision**

The CHPS initiative in Ghana restructured the health system such that primary care services were relocated from district-level facilities to communities and individual households. Facilitative supervision is important for the effective management of primary healthcare systems in rural areas (Frimpong et al. 2011, Aikins et al. 2013) and study participants describe strategies they use to provide facilitative supervision to community-based staff. While participants noted that supervision activities have improved recently, they pointed out that there are still significant challenges to overcome when trying to effectively manage a decentralized system. The two main supervision challenges discussed by study participants include the difficulties that arise when trying to adhere to a set supervision schedule as well as the transportation challenges faced by health workers needing to carry out supervisory visits. One District Health Director described how hard it can be to carry out a monthly supervision schedule, particularly when those who are responsible for supervision and monitoring fill many roles in the district health administration office that require them to attend meetings and activities unrelated to CHPS:

*“There are challenges – in terms of the supervision I'm talking of - most often in the sub-districts [and] even here [at the district level]. We might have drawn up our schedule for supervision but with the other interruptive programs we don't follow the schedule. We would have said, ‘Oh this day we are going out to monitor or do this’, but another programme will come maybe from the regional*

*level – come for a meeting or come for a training. So whatever we have planned to implement that day, we are called for other activities. At the sub-district level it is also the same”.*

District and sub-district health officials described transportation challenges that oftentimes make it difficult to provide sufficient supervision and support to the community health workers based in CHPS zones. Participants consistently noted transportation barriers as one of the main problems they face when implementing CHPS, including lack of a sufficient number of vehicles, consistent breakdowns, and mechanical problems and the lack of funds for fuel. One District Health Official noted how these problems impact supervision of CHPS at the community level:

*“I would be saying that I cannot go out because I can’t walk to go [do] monitoring and maybe the vehicle might be there but I don’t have fuel so I cannot go”.*

While these challenges exist, district health officials, in partnership with the regional health administration and the GEHIP project described how recently they began to address these issues by emphasizing the need for close supervision of CHPS activities and by streamlining reporting processes at the CHPS compounds to make supervisory visits more efficient. Participants noted that these efforts have positively impacted their abilities to supervise CHPS activities and community health workers. One District CHPS Coordinator described how supervisory visits are more common and more streamlined:

*“...the introduction of the [simplified] registers...made it easy for data validation and all that. So when supervisors go into a [CHPS] facility maybe they go to identify the challenges and all that, but also the [community health worker’s] performance as far as EPI, defaulter tracing, maternal issues, newborn and child care issues are concerned - they do take time to make comparisons with the registers, checking the registers and all that. But formerly, because it was difficult to even use the registers to actually assess performance, those things were not done and now there is also more frequency in visits than before. [Before], we used to have problems with fuel but those problems have become minimal since the introduction of the GEHIP programme”.*

Additionally, participants described how increasing facilitative supervision and monitoring of the CHPS programme accelerated scale up and improved the quality of the CHPS programme at the community level. Health officials noted that increased supervision improved staff morale, staff capability, and staff accountability as well as serving to further engage the community with regards to CHPS implementation:

*“...things changed because now we go very often...I came in 2010, but I’m told that before, when they had only the seven CHPS compounds the staff were not even staying there. They were just CHPS compounds by name. But because now we are capable of going there and visiting often, they don’t know when you’ll come. So, we are [monitoring] them - they know that you can visit [more easily] and most of the times they’re at post”.*

Frequent supervisory trips to CHPS compounds were also noted as an effective strategy for the health sector to further engage with communities, resulting in more collaborative relationships that improve CHPS functioning and accelerate scale up. One District Director remarked that more exposure to community members led to “encourag[ing] the opinion leaders to freely come to us and tell us how they feel about the services provided in the various CHPS compounds – if there is one community health officer that is not [fulfilling duties] the way they want we find a way of correcting the situation”.

#### **6.4.5 Increasing Community Support and Commitment**

Participants described community support for the CHPS initiative as one of the most important factors in overcoming infrastructure and funding barriers. When discussing the role of community support in facing infrastructure problems, most participants mentioned one of the following three factors: donation of land for a structure, identification of alternative/temporal structures, or support of construction activities. These share a common theme in that the support provided by the community was in the form of in-kind donations. One participant described how “[the community] gave us the land for construction”. A District Health Director described how

*“...when we were renovating the CHPS compound the chief organized [the community] and they provided community labour”.*

Participants also discussed the efficacy of community support as a way to approach infrastructure delays and problems, alluding to the fact that because of a community’s effort, especially pre-implementation or during the initial stages of the programme, CHPS programming was improved or accelerated. One District Director described how the community’s support enabled the CHO to begin providing services before a compound could be constructed:

*“there [were] no structures for the CHO to stay, but with the support of the community members, the CHO has a place to [store] his/her basic things...[and]*

*where he/she can sit if it has to do with treating minor ailments or giving immunizations”.*

Another participant described how:

*“[the community] gives us land for construction [or] they identify structures for us to use even before the construction of the main CHPS compound”.*

In addition to the role that communities play in CHPS scale up and implementation, district health officials also discussed how they strategically engage with communities as a way to overcome infrastructure and implementation constraints. Participants described accelerated CHPS scale up and increased success introducing the CHPS concept when they improved community engagement efforts. One District Health Director describes how they were able to scale up the programme and begin service provision because of the emphasis they placed on community engagement as a strategy to overcome infrastructure barriers:

*“The strategy we used particularly in [our district] was to lobby directly with the community members – we went directly to them. In this district we have about 7-8 of the CHPS compounds where accommodation is provided by community members – we call them temporal structures. So when you work directly with the community members, then you are able to improve”.*

Similarly, another health official noted how initial service provision started in a CHPS zone thanks to health officials taking a different approach that focused on engaging community members and using them as a resource to accelerate CHPS implementation even with a lack of formal infrastructure:

*“I think what we are doing in particular is more innovative, because when you look at the [CHPS implementation] steps it’s like you have to wait until you have a compound. So we thought that if the community members are able to give us the structures - the locally made structures - the health staff would live in those structures as a way to get started”.*

Participants identified community engagement as a way to overcome initial constraints to scale up of CHPS, in particular with regards to in-kind donations related to start-up and infrastructure costs. Further efforts to overcome implementation constraints involve seeking additional support from outside individual communities.

#### 6.4.6 Leveraging Local Political Support and Commitment

CHPS implementation relies heavily on the identification of existing structures or construction of new structures to be used by health workers to provide services at the community level. Funding for the initial infrastructure costs does not exist or is insufficient within the health sector and was consistently identified by participants as one of the main constraints to scale up of the programme. District Assemblies, Ghana's local government bodies, are generally tasked with providing a majority of the financial and logistical support for the construction of formal CHPS compounds. This is increasingly the case with the expansion of the CHPS programme as its primary focus is centered at the local level. A District Assembly Coordinating Director described how the decentralization of the health sector changed the District Assembly's role:

*“... as a result of the decentralization there is now the need for the various district assemblies to take it up on themselves to ensure that the health needs are well cared for”.*

The increasingly important role that District Assemblies play in providing the start-up costs for CHPS compounds requires increased cooperation and coordination with the health sector. Health officials described their roles in leveraging local political support for CHPS through the District Assembly, resulting in the District Assembly providing financial support and management of CHPS compound construction as well as occasional support through the provision of equipment and furniture. One District CHPS Coordinator noted that

*“... the [district] assembly, what they do mainly is they have helped us build the permanent compounds for the scale up of CHPS”.*

Participants also mentioned District Assembly support in terms of equipment or upgraded infrastructure once the original compound had been built. One District Director remarked that she received support “from the Assembly in terms of equipment and comfort items for the staff”.

District Assemblies provide significant support for the construction of CHPS compounds, but they often work with limited resources and must also prioritize non-health sector development initiatives. As described by one District Planning Officer, the lack of resources means that they have limited capacity to complete the needed CHPS infrastructure:

*“Normally it delays the implementation of the activities, because there will not be enough funds to complete those projects...”*

Moreover, one health official described how leveraging the District Assembly is important, but not sufficient for quick scale up. She describes how she concurrently seeks community support to supplement what the District Assembly is able to do:

*“In fact, basically what we expect [the District Assembly] to do is the construction and that is also something that is also in their favour because it is something they can show [for their constituents] - that this is what the Assembly has done. But sometimes it is not as rapid as we expect. And we are going around [to communities] – we keep on telling them that the assembly too has a lot to do. Because everybody in the district is looking up to the Assembly and the funding is not there. So we tell the community members: if you have any people who would want to help their communities they can do it”.*

Participants discussed the importance of the relationship between the GHS and District Assemblies with regards to supporting the CHPS initiative as well as ensuring that constraints to scale up are minimal. Participants also described the need for multi-sectoral coordination between the health sector, development sector, and individual communities.

## **6.5 Discussion**

This study aimed to identify factors that prevent the GHS constraints related to the implementation of a community-based primary healthcare initiative and to provide evidence and insight for future programming and national scale up efforts. Efforts have emerged to draw attention to the complex nature of health systems and the need to address health systems interventions with a complex adaptive systems theory lens in order to increase effectiveness (Plsek and Greenhalgh 2001, Plsek and Wilson 2001, McDaniel et al. 2009). The results of this study demonstrate the complexity inherent in implementing and expanding a community-based primary healthcare initiative. Responses attest to the systemic character of constraints to scale-up. Consider, for example, factors portrayed in the framework in Figure 6.1. Responses convey a sense of uncertainty about the possible risk that managers take by launching CHPS. Resources are constrained, but the popularity of community health services is manifest. Despite community interest in CHPS, frontline worker, supervisor, and managerial leadership is often reluctant to take action. Political and community pressure to launch operations may not be compatible with sustainable financing support systems. Inaction is embedded in a system of concerns that are reinforced by lack of systems support.

Yet, there are ways forward. The variety of strategies engaged and described by participants suggests that there is no single “magic bullet” solution when it comes to addressing

implementation barriers in a primary healthcare system. Participants described the interrelated and complementary nature of many of their efforts and the importance of engaging more than one approach in order to be effective (i.e. supporting both community engagement and leveraging support from the District Assembly). The centre panels of Figure 4.1 illustrate the types of actions that respondents have identified. Facilitative leadership from the regional leaders, political system, and community leadership system can emerge if leaders understand CHPS and undertake appropriate proactive actions to demonstrate their support. Results demonstrate that much of the success of the CHPS initiative at the regional and district level depends on the personal efforts made by GHS staff to prioritize CHPS by emphasizing the importance of community engagement, providing close supervision and actively seeking out programme support from sources outside the health sector and establishing mechanisms whereby CHPS implementation can be demonstrated for participatory planning. Experiencing such leadership through exchanges, observation, and interaction can spread the seeds of strategic commitment to CHPS.

As the central panel of Figure 4.1 shows, interaction of supportive leadership with support from outside the health sector was influential in the participants' efforts to address implementation barriers, particularly with regards to catalytic financing for CHPS infrastructure needs. As was expected based on the design of the CHPS programme, infrastructure was the most commonly referenced challenge faced by health officials. Furthermore, the strategies noted by participants for dealing with infrastructure constraints relied heavily on concurrently engaging multiple partners, highlighting the complex nature of health systems implementation. What emerged from the study and what should be noted for future programming is that there are clear and effective strategies that can be engaged. These include the engagement and education of the community to increase community volunteerism for constructing health posts, as well as leveraging more support from the District Assembly for assistance with incremental costs of infrastructure-related needs. Both community and District Assembly support were described as being an effective approach to overcome infrastructure barriers, and therefore future programming should emphasize strengthening cooperation with the development sector.

## **6.6 Conclusions**

Health systems take on many characteristics of complex adaptive systems: Operations, leadership, and functions reflect the broader institutional and cultural environment in which systems must function. This study provide useful lessons for GEHIP implementation. Future research and programming related to the introduction of comprehensive systems interventions should be based on the assumption that health interventions work within a system of

concurrently functioning, overlapping and interrelated parts that must be understood and factored into strategic planning.(Plsek & Greenhalgh 2001; Pourbohloul & Kieny 2001). The trend away from vertical disease-specific health interventions to system-wide health programming is warranted, but should be guided by an understanding of the complexity of integrated systems within which systems strengthening interventions are based. The successful introduction of community based primary health care policies via the CHPS initiative exemplifies this principle of complexity management.

Despite identifying numerous challenges in scaling up a community-based primary healthcare system, health workers and local political leaders in the UER identified ways to overcome barriers and expand the CHPS programme. Within five years, functional CHPS services were launched in every target community of four districts; whereas in comparison areas that lacked this programme of community engagement, only half of the households were covered by the CHPS programme (Awoonor-Williams et al. 2015b). The experience in the UER suggests that a multi-sectoral approach that acknowledges the complexity inherent in a health system will accelerate the scale up of CHPS elsewhere in Ghana. By emphasizing community ownership of CHPS, building partnership with grassroots politicians, and devoting resources to community mobilization activities, health officials were able to marshal local resources that accelerated expansion of the programme while also developing a practical means of fostering sustainability.

This study identified several areas where additional research is warranted. A closer look at the funding of the CHPS programme is needed in order to assess what potential impacts a change in the funding structure could have on the programme, particularly with regards to start-up costs and infrastructure needs. Additionally, the literature related to health systems lacks substantial work related to leadership and management within health systems. More in-depth examination of how the personal leadership attributes of participants impacted the implementation process is warranted as well as further exploration of ways to expand the leadership skill base within the health sector. While the findings in this study are particular to the CHPS programme in the UER of Ghana, the lessons learned from this research may provide insight for the implementation of CHPS in other areas of the country as well as the implementation and scale-up of community-based primary health care initiatives in other resource-poor settings.

## **7 A qualitative appraisal of stakeholder reactions to a tool for burden of disease-based health system budgeting in Ghana**

John Koku Awoonor-Williams<sup>1, 2, 3</sup>, Margaret L. Schmitt<sup>4</sup>, Janet Tiah<sup>1</sup>, Joyce Ndago<sup>1</sup>, Rofina Asuru<sup>1</sup>, Ayaga A. Bawah<sup>4</sup>, James F. Phillips<sup>4</sup>

<sup>1</sup> Regional Health Directorate, Ghana Health Service PMB, Upper East Region, Bolgatanga, Ghana

<sup>2</sup> Swiss Tropical and Public Health Institute Socinstrasse 57 4002 Basel, Switzerland;

<sup>3</sup> University of Basel, Peterplatz 4003, Basel, Switzerland

<sup>4</sup> Columbia University, Mailman School of Public Health, NYC, NY

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This paper has been published by *Global Health Action* 2016, 9: 30448 - <http://dx.doi.org/10.3402/gha.v9.30448>

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## 7.1 Abstract

**Background:** In 2010, the Ghana Health Service launched a programme of cooperation with the Tanzania Ministry of Health and Social Welfare that was designed to adapt Tanzania's "PLANREP" budgeting and reporting tool to Ghana's primary health care programme. The product of this collaboration is a system of budgeting, data visualization, and reporting that is known as the District Health Planning and Reporting Tool (DiHPART).

**Objective:** This study was conducted to evaluate the design and implementation processes (technical, procedures, feedback, maintenance and monitoring) of the DiHPART tool in northern Ghana.

**Design:** This paper reports on a qualitative appraisal of user reactions to the DiHPART system and implications of pilot experience for national scale-up. A total of 20 health officials responsible for financial planning operations were drawn from the national, regional and district levels of the health system and interviewed in open-ended discussions about their reactions to DiHPART and suggestions of systems development.

**Results:** The Findings show that technical shortcomings merit correction before scale-up can proceed. The review makes notes features of the software system that could be developed, based on experience gained from the pilot. Changes in the national system of financial reporting and budgeting complicate DiHPART utilization. This attests to the importance of pursuing a software application framework that anticipates the need for automated software generation.

**Conclusion:** Despite challenges encountered in the pilot, the results lend support to the notion that evidence-based budgeting merits development and implementation in Ghana.

**Key words:** burden of disease; budgeting; evidence-based planning; health systems; qualitative appraisal; Ghana.

## 7.2 Introduction

Widespread commitment of governments to decentralize planning has arrived at a time when budgetary pressures on health sectors are mounting. This situation has generated international interest in developing tools to support officials in engaging in budgeting and financial planning in ways that shape priorities according to evidence of actual need. Despite increased efforts and commitments for strengthening health systems, many countries lack evidence-based budgeting capacity. This problem is especially prominent in resource-constrained programs of sub-Saharan Africa (SSA) where evidence-based planning is needed most (DeSavigny and Binka 2004, Chretien et al. 2008). The process of allocating resources across competing programs and interventions occurs at all levels of the health system, involving a range of players and impacting differently on different segments of populations (Kapiriri and Norheim 2004). Decision-making processes are complex, oftentimes *ad-hoc*, with decisions grounded in political considerations or past budgetary decisions rather than actual need (Ham 1997). Shifts in priorities often lack transparent criteria for governing the process of change (Kapiriri et al. 2009).

These inadequacies are exacerbated by disease-specific vertical programs, each with separate systems that overburden health personnel (Chen et al. 2004, Chretien et al. 2008). In response, some countries have implemented policy reforms to arrest this situation including revisiting the primary health care strategy (Frenk 2009). For example, recent health budget system reforms in Ghana have led to the decentralization of discretionary budgeting responsibilities to the district-levels, despite a lack of attention to equipping managers with tools for this important new planning, budgeting, and monitoring responsibility. Previously, allocation of resources at the district level was based on past expenditure schemes that were driven largely by vertical programs rather than the needs of the entire health system (Nyonator et al. 2015). Persistent health equity challenges still exist in many parts of Ghana due to poor planning and a failure to link resource allocation to the burden of disease (Couttolenc 2012).

Although budgeting has been decentralized, tools for facilitating the planning process have been lacking. There is a need for mechanisms that are guided by well-reasoned criteria that facilitate the planning process and increase transparency. In response, many types of criteria for priority setting in health have been developed, including the cost effectiveness of an intervention, the severity of disease, and the concept of burden of disease analysis (Cookson and Dolan 1999, Kapiriri et al. 2004, Baltussen and Niessen 2006). While there is widespread consensus that systems thinking is needed, debate exists on which criteria should be the most important in setting priorities (Kapiriri, et al. 2009). For example, research conducted in Uganda that assessed health workers' perceptions of the development of criteria found that many considered the severity of

disease as the leading criterion to follow (Kapiriri, et al. 2009). Others contend, however, that burden of disease analysis, which measures ill health in terms of population morbidity and mortality, should be used to assist the process of priority setting and enable planners to promote interventions targeting the most prevalent diseases (Baltussen & Niessen 2006). To support resource allocation practices, a variety of tools are being developed to aid planners in more effectively utilizing these criteria. However, evidence suggests that, due to low perceptions of credibility, such facilitative tools are rarely used in low-income settings (Kapiriri, et al. 2009; Youngkong et al. 2009). Owing to growing interest in improving the access, motivation, and utilization of decision-making tools for the allocation of limited resources, several types of health care prioritization tools have emerged in recent years, many of which are intended to serve the needs of low-income countries, including the Marginal Budgeting for Bottlenecks tool developed by UNICEF and the World Bank (Knippenberg et al. 2003, Fryatt et al. 2010), the Johns Hopkins University's Lives Saved Tool (Victora 2010), and the World Health Organization's WHO-CHOICE (Choosing Interventions that are Cost-Effective) tool (Edejer 2003, Adam et al. 2005). More contextualized country-specific models have also been developed, including the Essential Health Research approach in Cameroon and South Africa, the Combined Approach Matrix in Malaysia and Pakistan, and the PlanRep tool in Tanzania (DeSavigny et al. 2001).

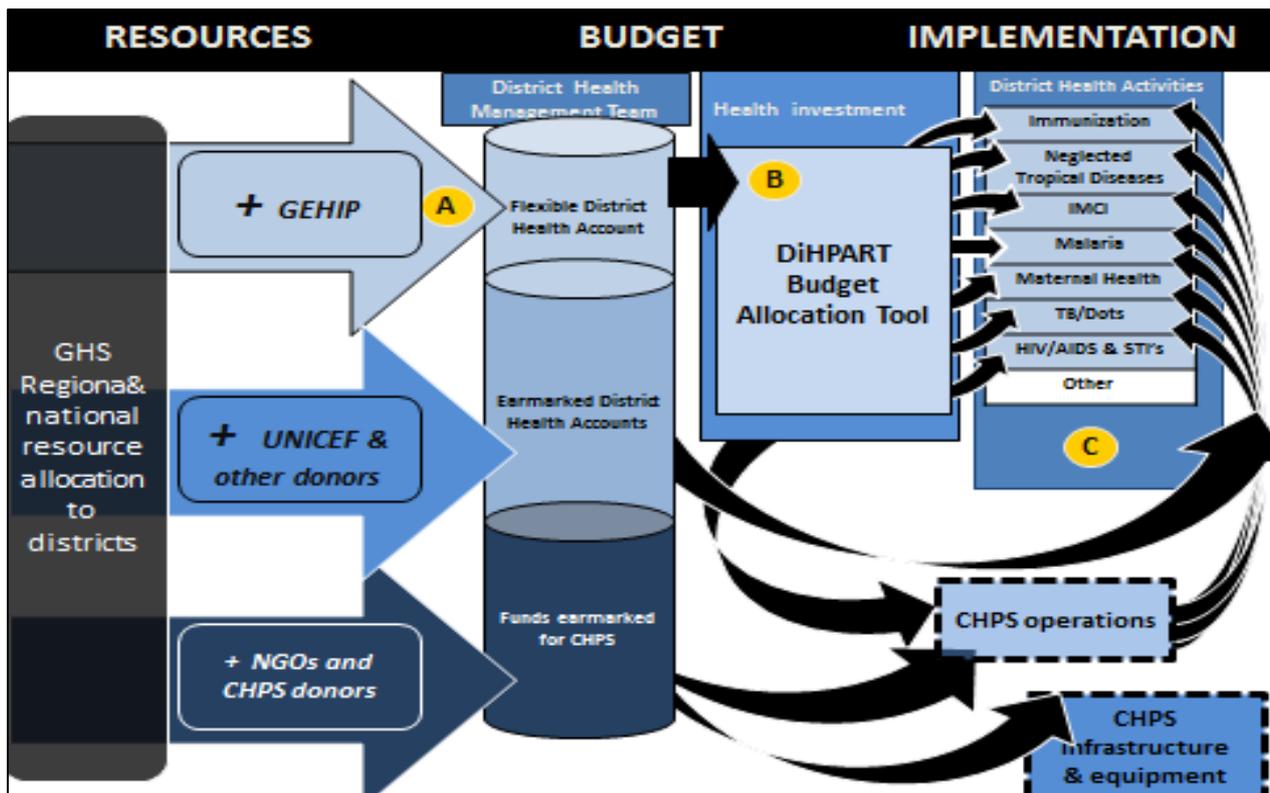
As yet, Ghana lacks a system for district managers to analyze and allocate resources in this manner (Sullivan 1971, Hill et al. 2007). Rather, most resource allocation is conducted at the district level and based on previous expenditure schemes, which are grounded on prior budgets and projections of programmatic needs that are based on conjecture rather than evidence. The need for budgetary system reforms increased with the introduction of Ghana's Sector-wide Approach and associated policies, which expanded discretionary budgetary authority to district authorities (Cassels 1997). District health management teams (DHMT) facilities were advised in 2004 by the Policy, Planning, Monitoring and Evaluation (PPME) division of the Ghana Health Service (GHS) to develop needs-based budgets. However, an analysis of the 2004 plans by the established budget management centers indicated that the needs-based budgets and proposals far exceeded the available government funding allocated for health, by nearly USD \$275 million. In addition, it was found that many of the activities proposed by the districts did not target the major causes of Ghana's burden of disease, thus illustrating how such plans would fail to capitalize on the possible gains that would be associated with the utilization of cost effective and proven interventions. This appraisal indicated that simply increasing funding to health directorates would not adequately address the serious health challenges in districts. Rather, health planners and national directors needed to not only increase funding allocated to districts but also provide tools that would enable the districts to more effectively allocate resources based on need, as indicated by the burden of disease patterns in a given district.

To address this need for systems development, an initiative known as the *Ghana Essential Health Intervention Project* (GEHIP) developed and implemented a qualitative and quantitative district health planning tool, referred to as the *District Health Planning, Analysis, and Reporting Tool* (DiHPART). This tool was developed in collaboration with the Tanzanian Ministry of Health and Social Welfare and the University of Dar-es-Salaam Computing Centre. Based on the logic of the Tanzanian system (PlanRep), DiHPART adapted Tanzania's use of the burden of disease analysis to Ghanaian budgetary requirements, basing its financial profiling on integrated mortality data from the demographic sentinel surveillance Navrongo Health Research Centre. DiHPART aimed to provide district managers guidance on resource allocation, with a focus on the gaps in service delivery, especially those with the greatest potential for reducing maternal and under-five mortality. These objectives are critical for Ghana as the country continues to strive towards achieving the Millennium Development Goals (MDGs).

DiHPART aims to assist DHMTs to improve their planning capabilities through the utilization of evidence-based indicators and to support the allocation of resources based on reliable quality data. DiHPART also seeks to improve managers' ability to align their budgets and plans with the districts' priority needs (Nyonator 2015). In addition, the tool intends to enhance district management capacity in the preparation of plans that effectively take into consideration cost-effective interventions which can tackle the health priorities of that district with their budget ceiling, analyze plans against actual outcomes, and compare planned targets against actual performance.

### **The Financial System and DiHPART**

The DiHPART tool was introduced as a pilot in September 2010 in three GEHIP study districts in the Upper East Region (UER): Bongo, Builsa, and Garu-Tempene. The introduction of this tool embraced certain assumptions such as need for health workers to sustain existing budgeting procedures, while structuring all use of flexible funds according to a model for optimizing investment impact on the burden of disease.



**Figure 7.1: A Model for the posited impact of DiHPART on the burden of disease**

Figure 7.1 portrays the operational assumptions underlying the DiHPART system. As the figure shows, primary health care is supported by Government of Ghana resources that are either earmarked or flexible, with much of the earmarking related to personnel rules that obligate the GHS to prioritize budgetary planning on existing staff salaries and benefits. However, donors contribute to earmarked budget allocations. UNICEF, in particular, is a major supporter of primary health care development. Ghana’s Community-based Health Planning and Services (CHPS) has no budget line for initial start-up costs, apart from a modest annual budget for launching new zones each year. However, NGOs and other donors sometimes invest in construction or equipment costs. DiHPART is predicated on the assumption that there are flexible funds from the GHS that GEHIP could augment with \$0.85 per capita for three years, with the tool used to optimize this investment (Figure 7.1, “A”). Because CHPS is a strategy that offsets the burden of childhood disease, DiHPART was assumed to be consistent with the allocation of flexible resources to CHPS start-up costs (Figure 7.1, “B”). Taken as a set of investments and activities, the combined configuration of investment was posited to improve health and survival, most prominently the health and survival of vulnerable children (Figure 7.1, “C”).

The objective of this study was to evaluate the design and implementation processes (technical, procedures, feedback, maintenance and monitoring) of the DiHPART tool in northern Ghana. We consulted with stakeholders in DiHPART implementation, gauged their views of resource allocation process (as illustrated in Figure 7.1) and then sought opinions on the use of the tool during the pilot, its ease of use, usefulness, influence on budget priorities and challenges with design. We sought to utilize the information we received to chart a course for DiHPART implementation and development in the future.

## **7.3 Methods**

### **The Setting**

The UER of Ghana, where the DiHPART tool was implemented, borders both Togo and Burkina Faso and is comprised of 13 rural districts. The UER is the poorest of Ghana's 10 regions (Ghana Statistical Service 2008a). However, due to concentrated scale up efforts, the UER has the highest coverage of the CHPS initiative, Ghana's national primary health care programme, than any other region (Nyonator et al. 2011, Awoonor-Williams et al. 2013c). About a third of the population was covered by doorstep CHPS services at the start of pilot activities (Awoonor-Williams et al. 2013c). The UER is known to be the most impoverished region of Ghana and a setting where resource constraints are profoundly challenging to local health authorities.

### **Study Design**

A qualitative systems appraisal was employed as a means to gain understanding of the experience of trainers, managers, and developers experiences with the design, implementation and utilization of the DiHPART tool. This included 12 members of DHMT responsible for utilizing the tool, including district health information officers, district accountants, and district directors. In addition, four members of the national GHS PPME division who were integral in the design and development of the tool were interviewed, including the technical engineering leads and training facilitators. Lastly, four members of GHS staff at the regional level responsible for training and monitoring the usage of the tool were also interviewed, including the regional health information officers and GEHIP Program coordinators. Participants were purposefully drawn from the sample of district health directorates utilizing the tool and stratified according to experience with the DiHPART tool and exposure to training activities to provide a range of understanding among facilities in using the tool.

### **Data collection and analysis**

A total of 20 in-depth interviews (IDIs) were conducted with respondents representing the three types of officials who are engaged in routine budgeting in the Ghana Health Service system: 1) national planners responsible for inter-regional budgeting (four officials); 2) regional officials who are responsible for coordinating district financial planning (four officials); and 3) 12 DHMT members, of whom four were district directors of health services for each GEHIP study district and eight were other members of the DHMT who were responsible for planning and financial management in the four GEHIP districts. In addition, we consulted with an internationally known software engineer, as well as participating Ghana Health Service software technicians. .

All IDIs were conducted in English, audio-recorded and transcribed. The questions covered how regional-and district-level health staff utilized the DiHPART tool, if at all; their perceptions on its ease of use and the usefulness and appropriateness of the training and technical support systems; ways to improve the design and roll out of the DiHPART tool to better address the needs of the district-level health planners; whether using the tool had influenced the budget priorities assigned to different interventions and in what way; and the greatest challenges with the design, implementation and usage of the DiHPART tool. The transcripts were reviewed and key themes were identified by three researchers using deductive content analysis methodology (Elo and Kyngäs 2008). Practical experience, institutional documentation and organizational history were all used to inform and guide this process. A codebook was developed based on the predominant thematic categories that emerged from the data. These include reactions to the design of the tool, perceptions of training procedures, opinions on the benefits and drawbacks of the tool, and the perceived impact of DiHPART. The transcriptions from the IDIs were coded using the Nvivo software package. Sample codes used included *utilization challenges*, *impact benefits*, *impact negative consequences*, and *teamwork*. Several transcripts were double-coded to ensure inter-coder reliability at the onset of coding activities. All data was reviewed systematically by a team of researchers to ascertain predominant themes.

### **Ethical Considerations**

This study was approved by the Institutional Review Board for the Protection of Human Subjects at both the Navrongo Health Research Centre and Columbia University. All study participants were notified of the study purpose and provided informed consent prior to the interview.

## **7.4 Results and Lessons Learned**

A total of 10 challenges were identified by respondents, comprising three general domains of systems limitations. The technical design of the tool was associated with 1) systems integration, 2) systems design dysfunction, 3) systems architectural dysfunction, and 4) systems inflexibility.

The implementation process domain was associated with three additional sets of limitations: 5) training problems, 6) participant computer literacy limitations, and 7) staff turnover problems. Finally, the organizational context for systems change was a domain associated with 8) leadership challenges, 9) pilot fatigue, and 10) incompatibility of the systems output with the decision-making context. The study participants provided strategic guidance on these domains and topics, together with potential solutions for resolving the identified challenges and improving future re-engineering of the tool. Discussions also explored the broader challenges related to the organizational context of the health system, including reasons for staff resistance to change and strategies that could address problems.

#### **7.4.1 Technical challenges**

As is commonly observed when new technologies are introduced, a range of technical challenges were identified that hindered users' utilization of the tool. Both users and engineers who developed the tool described in details these issues and their recommendations for improvement.

##### **1. Systems integration**

For a computer system to function effectively, its interface with other essential functions represents a critically important element of effective systems design.

A key limitation of the current DiHPART prototype is the lack of appropriate systems linkages to existing government financial reporting systems. Ministry of Finance Payroll reforms (IPPD) introduced in 2001 included major modifications to government personnel salary structures. This update resulted in an immediate disconnect between the DIHPART tool and revised IPPD policies. For example, sector budget templates have changed, and at present the new procedure of the Ministry of Finance (MoF) is incompatible with the DiHPART algorithm. In order to complete both the government-mandated reporting requirements and utilize DiHPART, participating DHMTs were required to complete both financial planning and reporting practices independently. This problem generated critical commentary by users who perceived DiHPART as an imposition of 'double work' owing to redundant data entry. Furthermore, annual district planning and reporting requirements involved utilization of a MoF-mandated software product known as *Activate Template*. Because this reporting tool does not synchronize with DiHPART, DiHPART was perceived to be a stand-alone program without relevance to the national financial management system. A national policy maker explained:

*"Administratively the challenge was that because that was something that we were hoping to do in future when we scale it up, rather, 'how does it integrate into the national planning tool? And also do another entry into the national planning tool, as required by the Ministry of Finance. So it's kind of a double work".*

Integration of DiHPART with the MoF-developed Microsoft Access-based Activate software component of the Activate Template system required continuous update information from MoF developers that was lacking, complicating DiHPART development. This problem was compounded by a MoF decision to migrate its software off the Activate Access-based platform to an Oracle product known as *Hyperion*. In theory, software bridges can be developed, but the changes that were instituted complicated the integration of the DiHPART software into MoF-compatible technology. Without sophisticated bridging systems, Oracle-based software is incompatible with the MS-Windows-based software that was driving the DiHPART application.

## 2. Systems design dysfunction

Systems integration challenges were compounded by DiHPART's design as a stand-alone software program that lacked Internet or server connectivity. This absence of connective linkages constrained user access to the tool, imposed technical complications that hampered software updating and file sharing procedures, and enhanced virus vulnerability. DiHPART was initially intended for usage on a shared desktop PC computer at each district health directorate, a measure designed to enhance collective usage by DHMT members and that was deemed to be appropriate for the introduction of non-Internet based software. It is noteworthy that Internet connectivity during the initial deployment of the tool remained low in the pilot districts; thus, this software limitation impeded the use of DiHPART as a collective tool. Both staff preferences for using the tool on personal computers and the high frequency of computer viruses that this security risk incurred impaired the effective functioning of the system. The process for updating and transferring updated DiHPART files between personal computers and the communal GHS desktop computer with external storage devices (namely USB drives) was found to be the main mode for virus transfer between devices and as such was responsible for debilitating viruses and subsequent operating system crashes. The DiHPART tool could be readily copied onto additional devices and personal laptops. DHMT staff members typically preferred to run DiHPART on their personal laptops, owing to the mobility and familiarity of personal devices. However, this fragmented approach to DiHPART access complicated the process of merging files that had been resident on personal devices with the central files of the DHMT office. Moreover, the use of personal computers by some DHMT members was associated with perception that the DiHPART

tool was the personal property of individuals who had the requisite personal equipment and skills. As one regional health manger noted:

*“Because the programme was sitting on their computers, then they will be more involved....So when it’s on the Health Information Officer’s [computer], then because he is the one in charge of that he uses it more and then the District Director’s also copied it on their laptops, so they were using it more.”*

### 3. System architecture dysfunction

Study participants often noted that to mitigate these challenges DiHPART needed to be reengineered into a web-based program, enabling broader use by all members of the team. Engineers who reviewed the system proposed a process for transitioning DiHPART to a web-based design that would facilitate the introduction of technical updates needed to keep operations abreast of shifting national standards. Furthermore, web-based capabilities can mitigate challenges associated with updating, sharing, and merging files between individuals and devices, while enhancing virus protection. Both national and regional participants described the benefits of shifting DiHPART to a web-based platform, explaining:

*“If it is web based then most of the difficulties that the DHMTs are facing will be phased out, and centralized on, and they wouldn’t have to be importing and exporting and copying files and then consolidating them.”*

*“We should be thinking of something that is web based, it shouldn’t be standalone that you would have to go there [district directorate], so you can imagine somebody leaving all the way to Garu to go and resolve an issue on DiHPART, while it could be resolved remotely.”*

A web-based programme would also facilitate the provision of routine remote technical support, which could be particularly advantageous in rural and distant localities. However, if DiHPART were shifted to a web-based program platform, the GHS would be required to improve the Internet access capabilities of all regional health directorates and all DHMTs in Ghana.

#### 4. System inflexibility

The technical recommendations of pilot project users attest to the need for a software redesign that is an application framework rather than a closed system. Budgeting and disease modelling will change in the future, just as change has occurred in the past. However, if every modification requires a complete systems redesign, the DiHPART concept will be challenged by change of any kind. Software innovations in recent years have responded to the need for automating the generation of code revision (Peischl et al. 2014). If this approach were rigorously imposed on DiHPART, software would be developed that automates the generation of a DiHPART system from parameters that are imposed by technicians without requiring costly and complicated re-engineering support from developers. Change in the software system that arise from changes in the accounting system or the underlying model for translating strategic action into burden of disease outcomes could be anticipated in ways that would enable the next version of DiHPART to automate updates. Trained developer capacity would be required to support system operation, as is now the case, but engineering flexibility could facilitate adaptation of the system to changing needs. This software concept represents an important required feature of DiHPART that is not adequately addressed by the current system. A re-engineering of DiHPART could anticipate the “cloud capability” needs, computing architecture, automated software generation, and user-oriented features that facilitate change (Johnsonl et al. 2005).

#### **7.4.2 The Implementation Process**

The implementation process can be described as a combination of strategies and practices aimed at introducing and supporting the adoption and utilization of DiHPART tool by district health staff and regional-level supervisors. This includes training procedures, management and supervisory practices, and other external factors which can impact such processes. The DiHPART tool was introduced through an initial orientation and training in which both the Districts Directors and District Accountants were invited.

#### 5. Training and technical support

The training procedures for introducing the tool were found to be inadequate in both frequency and the breadth of content. Furthermore, sessions were considered to be too short in duration, generally lasting only a day, and delivered under the premise that sessions were “Refreshers” building from existing basic competencies. In fact, such capabilities were often lacking. Initial trainings involved attendance by three members of each DHMT, including the positions of director,

district accountant, and health information officer. However, the tool was designed for utilization and input by the entire DHMT team, which is generally comprised of seven or eight members, including broader roles such as disease control officer, public health nurse, and health promotion officer. Some participants noted that making the initial trainings exclusive in attendance diminished the collective ownership and responsibility of the tool. As one DHMT member noted:

*“If all the units could be involved, so that in case one is not there, you can call on any member to come and support, key in certain information. Because it shouldn’t be like only three people, what if the three people are not there. So one must think that many members of the DHMT should be involved and even some of the districts heads.”*

## 6. Computer literacy limitations

Training was pursued on the assumption that basic computer literacy were in place. However, issues with low baseline computer literacy were cited as an initial barrier to usage, resulting in heavier reliance on more computer-conversant members of the team and considerable resistance to systems utilization among some trainees.

## 7. Staff turnover problems

A high frequency of staff transfers in addition to perceptions of the role of DiHPART as being for data extraction rather than utilization purposes may have also contributed to weak ownership. The high staff transfer rate was a serious impediment to tool adoption. Staff transfers, a routine and frequent practice among Ghana Health Service personnel, resulted in the constant rotation of health workers unfamiliar with the tool and its technical requirements. Follow-up trainings, which occurred once a year, were cited as inadequate for handling the constant influx of untrained personnel. As one national facilitator indicated:

*“The transfer, that was very harmful to the system and there were a lot of transfers that occurred. There were some people who were trained but transferred out which virtually collapsed the whole system. In one or two of the districts it happened like that, they took out those who were trained and those who came knew nothing DiHPART.”*

### 7.4.3 Organizational contextual challenges

#### 8. Leadership challenges

The high frequency of staff transfers in addition to perceptions of the DiHPART's role being for data extraction rather than utilization purposes may have also influenced for weak ownership. Not all members of the DHMTs perceived DiHPART as a tool for supporting their own work, but rather see it introduced due to the time constraints of data entry and existing and routine data extraction expectations. One regional supervisor indicated this disconnect, alluding to the need to:

*“...help them to do proper budgeting at their level and they should own whatever output they derived from the software and it shouldn't be like somebody somewhere wants them to do the entries and will come for the report later on.”*

#### 9. Pilot fatigue

Managerial skepticism about DiHPART was grounded to some extent in perceptions of pilot fatigue, with indications that some DHMT members failed to embrace DiHPART due to wariness of its sustainability, for as one manager noted, it is not being used

*“....because it is another pilot, and we have not fully adopted it or that kind of thing, we don't use it mostly very often.”*

#### 10. Incompatibility of the system output with the decision-making context

DiHPART visualizes the burden of disease implications of budget scenarios, under the assumption that DHMTs have the authority and capability to allocate resources according to categories of decision-making that data visualization portrays. In fact, the visualization criteria were so heavily borrowed from Tanzania that their relevance to strategic planning in Ghana was compromised. Discussion of budgeting as portrayed by DiHPART was inconsistent with operational decision-making options that DHMTs could actively embrace. DiHPART displays bar charts that compare the pattern disease burden that is consistent with estimated patterns relative to the pattern implied by proposed systems investments. Classes of outcomes displayed, however, represent a mixture of activities such as integrated management of childhood illnesses (IMCI) and disease syndromes, such as malaria or HIV/AIDS. Activity classes are too broad to define optimal resource decisions. IMCI, for example, involves both facility-based investment and

community-based care. Community care, in turn, is comprised of volunteer activities and the activities of paid nurses. Lumping all such investments into a single indicator constraints the decision-making contribution of DiHPART. A new model for classifying categories of actions and outputs is needed.

A challenge related to the compatibility of DiHPART with the organizational context concerns the emergence of multisectoral financing plan. Figure 7.1 posited a framework for the flow of resources and the role of automated planning in the rationalization of priority setting. The GEHIP program, however, has developed a multisectoral approach to leadership development in response to national programming for the decentralization of revenue sharing. In this policy framework, budgeting and finance for the health sector can involve partnership with the development sector. In response, the project developed a program of community engagement that has had the direct benefit of implementing program functioning of CHPS with backing from local politicians and development partners. This approach responds to the broad-based policy shift in Ghana toward revenue pooling at the periphery into common funds that are multisectoral. The DiHPART approach, to be effective, must adapt to this decision-making reality. The allocation of district flexible resources involves a variety of development options, each with potential impact on well-being. For the health sector to contribute to the process of decision-making about these funds, approaches limited to the burden of disease may be appropriate, but only if options for resource allocation include investments that district political leaders and the development partners and officials can embrace. The start-up costs of CHPS is an example of a component of DiHPART that is inadequately addressed. Moreover, visualization tools in the DiHPART system are not yet focused on decision-making options that officials can consider.

Figure 7.2 illustrates the conceptual challenges of resource allocation in a multisectoral environment. As the figure shows, health sector flexible financing is a minor factor in the more general resource allocation environment. First, as the diagram shows, direct financing of the health sector is complex, with little flexibility vested in the common fund. (Pathway A, Fig. 7.2). Some latitude for district financing is associated with Regional Health Administration flexibility, but the amounts available are marginal to the overall level of financing. Earmarking is important and can convey more flexibility than accounting systems connote. For example, UNICEF is a major donor of motorbikes, clinical equipment, and essential supplies. These critical resources support the system in general, enabling integrated services to be provided and CHPS implementation to progress even though resources are targeted on specific items or needs. However, the underlying assumption of DiHPART that flexibility can be a resource for rational data-driven planning is unrealistic. Once the bare essentials are addressed, no remaining funds exist for DiHPART-informed priority setting.

The lower panel of Fig. 7.2 portrays a level of complexity that is realistic but missing from the framework of Fig. 7.1. If interchange between the health sector and the development sector well planned, well informed with evidence, and grounded in community-engaged support for health development, then DiHPART, at least in theory, could be a resource for demonstrating to grassroots politicians and officials the survival potential of appropriate investment could foster CHPS implementation through the allocation of resources that have no budget line in the health sector but are crucial to getting CHPS started. Once even the most makeshift and temporary community facility exists, GHS staff are available to fill essential posts. Budget lines are available for resource planning for running CHPS, but start-up costs are not available. GEHIP could provide a visualization tool for advocating catalytic investment in starting CHPS operations.

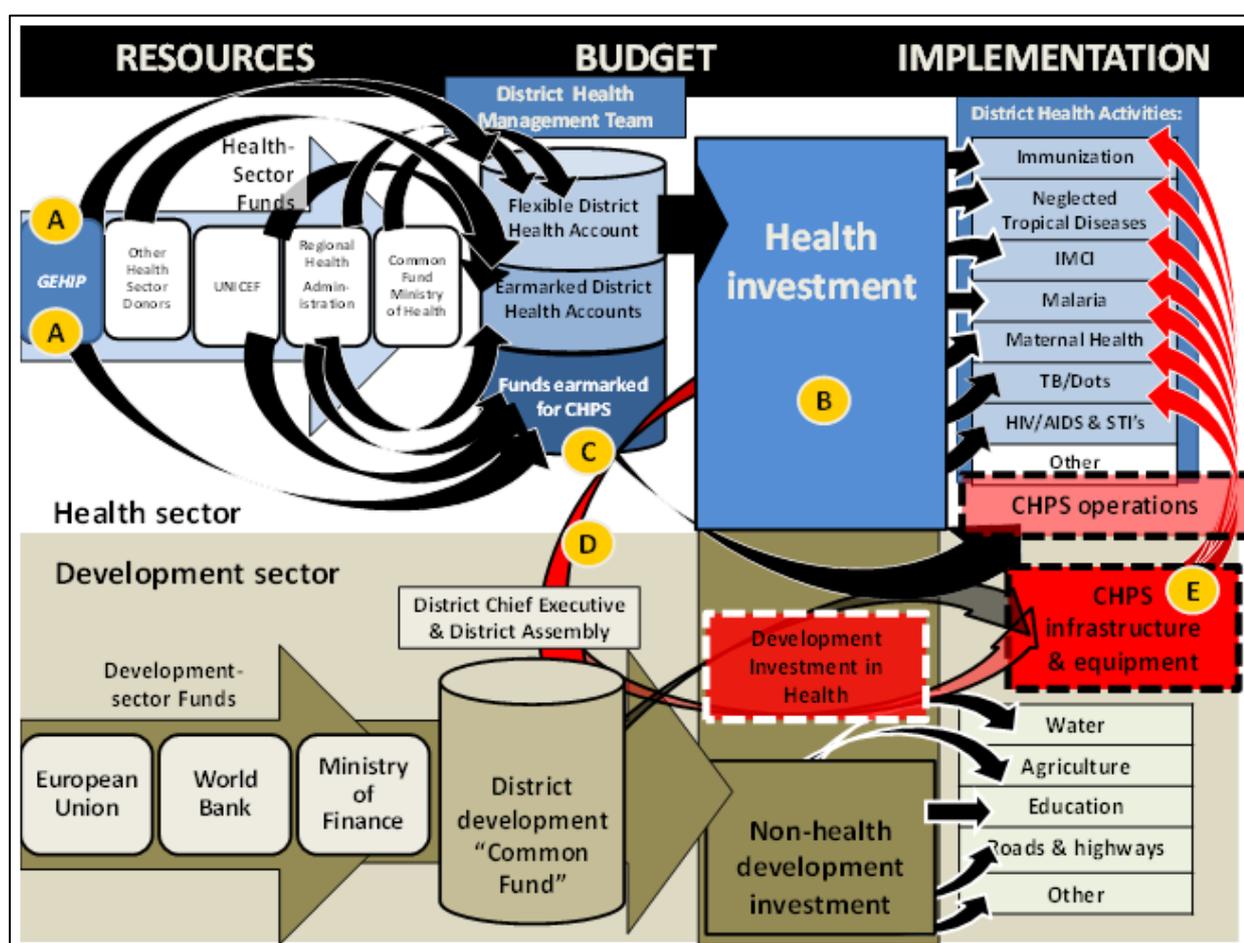


Figure 7.2: The complex resource decision-making environment implied by the context of a multi-sectoral common fund arrangement

## 7.5 Discussion

### 7.5.1 DiHPART results visualization

As consequence of the 10 themes noted in the course of the IDIs, it was apparent that DiHPART could not be sustained as a health sector budgeting tool and was not at all compatible with multisectoral planning: At no point in the discussion sessions was there any mention of using DiHPART results to communicate health sector priorities to district chief executives or other local officials. Moreover, respondent skepticism of the utility of the tool for routine budgeting was expressed in some form by all study participants. Nor was there discussion of shifts in the operation of the program that were attributed to DiHPART data visualization. As yet, the system lacks the format and content of visualize outcomes of health investments that would be appropriate for motivating intersectoral exchanges about the benefits of health investment to district populations or even structural resources allocation within the health sector. For example, if CHPS is to be supported by incremental development investment, then DiHPART health visualization tools should include bar graphs for relevant development decision-making options and DHMT operational planning or other displays that show the burden of disease or life-saving potential of investment in CHPS implementation or other service strategies. Models for such a display have yet to be configured, but their design is feasible given the existence of relevant data from the Navrongo Health Research Centre. Clearly, a new DiHPART tool is needed, not only because objective data-driven tools are welcomed by participants in the present study and because data resources exist for the requisite modelling task, but also because the context for DiHPART application is shifting in ways that require new strategies and a new system.

Our conclusion that a 'DiHPART-2' is needed, despite the problems that were noted, is grounded in the general respondent consensus that DiHPART had a beneficial impact on critically important aspects of workflow operations. Such benefits included enhancing collaboration and communication between DHMT positions, improving planning procedures, and promoting greater planning transparency within DHMTs. DiHPART was an instigator for greater interaction between DHMT roles for planning processes and budgetary discussions, a process that in the past was typically conducted by a select few individuals (generally the district directors and district accountants). As one Regional Supervisor noted,

*“It had worked very well in that it would bring everyone on board because there was no way one single person could sit and use the tool, everybody at the DHMT in a way had an input into the system so in a way it would have improved a lot of team work at the district level.”*

Improving planning processes was also an identified area in which DiHPART was found to impact DHMT operations. DiHPART served as a mechanism for aiding planning discussions, with a clear focus on the utilization of evidence. Chief planning and decision-making responsibilities in DHMTs are generally designated to district directors, whose decisions are subject to personal intuitions and other external determinants; thus such practical guidance was considered as imperative. DiHPART was able to provide practical guidance on how money was being spent and programs delivered in relation to the burden of disease realities of that particular district. Visualizations were claimed as useful in guiding DHMT-based discussions, especially in promoting for a greater sense of transparency in decision-making processes. This clarity was noted to occur on both the of spending and disease burdens, and was also identified as a means for enhancing directors who were provided with the tool.

The DiHPART case represents a promising approach to health development with positive outcomes. However, experience also attests to the unrealized potential of the system. If DiHPART were a continuing activity with a standing software team, links between users and developers, and a process for systems adaptation over time, the ideas that underlie DiHPART could have been more effectively developed, positioning the system for scale-up.

## **7.6 Conclusion**

It is evident that there is a clear need for improved budgetary decision-making tools to enhance the efficiency and effectiveness of health systems, especially in low-income settings. However, such tools must be both developed with and accepted by their intended users. With the proliferation of mobile health applications (mHealth application) around the world, there is mounting evidence of the importance of piloting procedures that highlight the complexities of the health system for which they are intended to operate and adapt technology to the realities that piloting can identify. Valuable systems learning emerged from the DiHPART pilot, demonstrating the value of systems thinking as integral to the process of improving budgeting decision-making. However, piloting requires a total systems approach that includes coordination of new applications with all relevant sectors and units within the health and financial systems to ensure that the introduction of new tools streamlines the workloads and facilitates the decision-making of intended users. Furthermore, the introduction of a new technology is an on-going process, and cannot be considered as a singular event. Bringing about change needs to be an iterative process, requiring continual trainings and updates, like other existing training programs already in place within the health sector. If the recommendations for improvement can be integrated into an improved version

of the DiHPART tool, there is great potential for it to improve district-level health operations, and ultimately the health of the population they serve.

### **Authors' contributions:**

This study is part of the Ghana Essential Health Intervention Project (GEHIP), which was implemented in the Upper East Health Directorate of the Ghana Health Service. JKAW and JP conceived and designed the study. JKAW, JT, JN, MLS and RA conducted the data collection, analysis, writing and revision. JKAW, JP and AB participated in planning, writing and revision of the manuscript. All authors approved the final version of the manuscript.

### **Acknowledgements:**

The authors acknowledge the contribution and assistance of the staff of Ghana Health Service in the Upper East Region. Particular thanks go to the three Ghana Essential Health Intervention Project (GEHIP) implementing districts and the PPME Division of the Ghana Health Service for their immense contribution to the study.

### **Conflict of Interest and funding:**

The authors declare no competing interest. JKAW is the Regional Director of Health Services in the Upper East Region. The development of DiHPART and this research were components of GEHIP funded by the Doris Duke Charitable Foundation Africa Health Initiative.

### **Paper Context**

With decentralization policies that are introduced throughout Africa, district managers often have expanded responsibilities for planning and budgeting. However, software supporting this function is often poorly designed, and suitable for centralized budgeting only. In response to this problem, the Ghana Health Service collaborated with the Tanzania Ministry of Health and Social Welfare to transfer and adapt a burden of disease-based planning tool to Ghana's needs. This paper describes the transfer process and the tool that emerged.

## 8 Benefits and Limitations of a Community-Engaged Emergency Referral System in a Remote, Impoverished Setting of Northern Ghana

Sneha Patel<sup>1</sup>, John Koku Awoonor-Williams<sup>2,3,4</sup>, Rofina Asuru<sup>2</sup>, Christopher B Boyer<sup>5</sup>, Janet Awopole Yepakeh Tiah<sup>6</sup>, Mallory C Sheff<sup>7</sup>, Margaret L Schmitt<sup>7</sup>, Robert Alirigia<sup>8</sup>, Elizabeth F Jackson<sup>7</sup>, James F Phillips<sup>7</sup>

<sup>1</sup> New York City Department of Health and Mental Hygiene, New York, NY, USA.

<sup>2</sup> Regional Health Directorate, Ghana Health Service, PMB, Upper East Region, Bolgatanga, Ghana.

<sup>3</sup> Swiss Tropical and Public Health Institute, Socinstrasse 57, 4002 Basel, Switzerland

<sup>4</sup> University of Basel, Peterplatz 4003, Basel, Switzerland

<sup>5</sup> Innovations for Poverty Action, New York, NY, USA.

<sup>6</sup> University Research Corporation, Accra, Ghana.

<sup>7</sup> Columbia University Mailman School of Public Health, New York, NY, USA.

<sup>8</sup> Jhpiego Ghana, Accra, Ghana.

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This paper has been published by Global Health: Science and Practice 2016 Volume 4 Number 4

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A low-cost emergency and communication transportation system used 3-wheeled motorcycles driven by trained community volunteers. Delivery referrals were redirected from health centers to hospitals capable of advanced services including cesarean deliveries, which was associated with reduced facility-based maternal mortality.

## 8.1 Abstract

Although Ghana has a well-organized primary health care system, it lacks policies and guidelines for developing or providing emergency referral services. In 2012, an emergency referral pilot—the Sustainable Emergency Referral Care (SERC) initiative—was launched by the Ghana Health Service in collaboration with community stakeholders and health workers in one subdistrict of the Upper East Region where approximately 20,000 people reside. The pilot program was scaled up in 2013 to a 3-district (12-subdistrict) plausibility trial that served a population of approximately 184,000 over 2 years from 2013 to 2015. The SERC initiative was fielded as a component of a 6-year health-systems-strengthening and capacity-building project known as the Ghana Essential Health Intervention Program. Implementation research using mixed methods, including quantitative analysis of key process and health indicators over time in the 12 intervention subdistricts compared with comparison districts, a survey of health workers, and qualitative systems appraisal with community members, provided data on effectiveness of the system as well as operational challenges and potential solutions. Monitoring data show that community exposure to SERC was associated with an increased volume of emergency referrals, diminished reliance on primary care facilities not staffed or equipped to provide surgical care, and increased caseloads at facilities capable of providing appropriate acute care (i.e., district hospitals). Community members strongly endorsed the program and expressed appreciation for the service. Low rates of adherence to some care protocols were noted: referring facilities often failed to alert receiving facilities of incoming patients, not all patients transported were accompanied by a health worker, and receiving facilities commonly failed to provide patient outcome feedback to the referring facility. Yet in areas where SERC worked to bypass substandard points of care, overall facility-based maternal mortality as well as accident-related deaths decreased relative to levels observed in facilities located in comparison areas.

## 8.2 Introduction

African nations achieved considerable progress in child health during the Millennium Development Goal era. Despite this progress, maternal and perinatal mortality remain among the leading causes of death throughout Africa. According to the World Health Organization, approximately 800 women die from pregnancy or childbirth-related complications everyday (World Health Organization 2014). Nearly 99% of these deaths occur in developing countries and over half occur in sub-Saharan Africa, where only 7% of the global population resides. Most maternal could be prevented if women received timely care when emergencies arise from associated causes, such as hemorrhaging, unsafe abortions, obstructed labor, infection, or eclampsia (Bhutta et al. 2008).

Nearly all maternal deaths are accompanied by associated neonatal deaths. Although most neonatal deaths are preventable if skilled attendants assist during deliveries (Kinney et al. 2010, Liu et al. 2012), rates remain high even where child health and survival are otherwise improving. Yet evidence repeatedly shows that facility delivery and appropriate support for newborn care can reduce neonatal mortality if referral services are functioning and attendants are skilled in recognizing problems and immediately providing post-delivery interventions such as “Kangaroo Mother Care,” asphyxia management, care for febrile illness, and tetanus prevention (Razzak and Kellermann 2002, Murray and Pearson 2006, Hsia et al. 2010, 2012).

Public health systems in Africa are therefore making the development of emergency care systems a priority (Razzak and Kellermann 2002, Hsia et al. 2010). The World Health Organization defines 3 core components of emergency care: care provided in the community, during transportation, and at the health facility (Murray & Pearson 2006; (WHO/UNFPA/UNICEF/World Bank/ 2003). Each component incurs corresponding sources of risk that elevate death and disability: delays in (1) seeking care (Campbell Oona et al. 2006) (2) reaching care (Kowalewski et al. 2000, Ganga-Limando et al. 2014), and (3) receiving care upon arrival at the referral facility (Lule et al. 2000). In rural Ghana, and elsewhere in Africa, these delays are driven, respectively, by (1) lack of awareness of the importance of emergency care (Olukunde TL, Awoonor-Williams JK, Tiah JA, Alirigia R, Asuru R, Patel S 2015), lack of family resources to cover referral costs (Macintyre and Hotchkiss 1999, Ghana Statistical Service 2014), and concerns about the quality of care (Thaddeus and Maine 1994); (2) poor road conditions (Bawah et al. 2014), a scarcity of vehicles (Adamtey et al. 2015, Atuoye et al. 2015), and limited means of communication (Krasovec 2004); and (3) inaccessibility of competent providers of essential acute care (Macintyre et al. 2003).

While Ghana has a well-organized, decentralized primary health care system, the country has yet to develop clear emergency referral service guidelines. The Upper East Region is one of Ghana's most impoverished and remote localities: The 13 districts of the region are characterized by a scarcity of vehicles, poor road networks, impassible terrain, and geographic barriers to reaching health services (Ghana Statistical Service 2008b, Ghana Health Service 2012). Patients in urgent need of acute care reach health facilities by walking or riding bicycles, donkey carts, or motorbikes. In all districts of the Upper East Region, ambulances are typically absent, in disrepair, or located so remotely from communities that they fail to address emergency needs. Even where equipment is available, there is no organized emergency communication system to link one level of care to another and ensure that referrals are successfully executed. Cultural norms can also constrain timely care seeking behavior. Moreover, since Ghana's National Health Insurance Scheme does not cover costs associated with emergency transportation, referral can be prohibitively expensive, with costs further increasing people's hesitation to seek acute care.

The Ghana Essential Health Intervention Programme (GEHIP) is a systems-strengthening initiative that was designed to increase universal access to health care (Awoonor-Williams et al. 2013a). GEHIP's aims are to expand coverage of the national primary health care system with the Community-Based Health Planning and Services (CHPS) initiative at the community level (Ghana Health Service 2005b), and to identify gaps in care for newborns, children, and pregnant women at multiple levels of the health system. In addition to addressing issues that had hindered CHPS scale-up, GEHIP has trained midwives in neonatal resuscitation, provided frontline CHPS community nurses with skills in emergency delivery, and trained CHPS community nurses and community volunteers in community-based newborn care (Awoonor-Williams et al. 2013a).

GEHIP also documented the urgent need for emergency referral services, including emergency obstetric care, in the Upper East Region. In response, the Ghana Health Service (GHS) pilot tested an emergency referral program, the Sustainable Emergency Referral Care (SERC) initiative, for all types of medical emergencies. This article provides a summary of the initiative components and evaluates the effectiveness of the program using results from mixed-methods implementation research.

### **8.3 The SERC Initiative**

The SERC initiative aimed to develop a community- and subdistrict-level emergency referral system that would improve survival in impoverished rural Ghanaian communities. To address common access, organizational, and knowledge barriers to emergency care services, SERC was designed as a low-cost emergency transportation and communication system together with

community education activities. The program aimed to facilitate rapid transport of patients from their community locations or subdistrict health center to higher levels of care.

GEHIP used the tools and methods of participatory planning (Cornwall and Jewkes 1995, Nazzar et al. 1995b, NYONATOR et al. 2003) to design and implement SERC in collaboration with community members as well as community, subdistrict, district, and regional health system officials. GEHIP research staff held meetings, focus group discussions, and in-depth interviews with community members, frontline workers, and supervisors throughout the planning process to solicit stakeholder advice. Project research assistants were recent graduates of local universities who were hired by GEHIP and assigned to each District Health Management Team to support SERC implementation activities and liaise across levels of the health system.

SERC was conducted initially as a 5-month pilot program with community stakeholders and health workers in a subdistrict of Bongo District in 2012. In July 2013, the program added 12 subdistricts of the Upper East's Bongo, Builsa North, and Builsa South districts for a trial that served a population of approximately 184,000. Remaining districts of the Upper East Region, where social, economic, and ecological conditions are comparable to the SERC coverage areas, served as comparison areas for evaluating the program. The SERC interventions included a referral strategy informed by an assessment of population needs and health systems capabilities; adequately resourced referral centers; active collaboration between referral levels and across sectors; formalized communication and transportation arrangements, with specific protocols specified for referrer and receiver and mechanisms for ensuring supervision and accountability; affordable service costs; capacity to monitor effectiveness; and policy support.

SERC was developed as a component of the health systems development program GEHIP, and SERC scale-up was led by GEHIP staff based at the Upper East Regional Health Directorate (RHD).

### **8.3.1 Transportation**

For the expanded pilot study that began in 2013, GHS procured a fleet of 3-wheeled motorcycles known as Motorkings to serve as emergency transport vehicles. The 24 SERC Motorkings were distributed among 12 subdistricts of Bongo, Builsa North, and Builsa South districts in the Upper East Region. Based on driver advice from SERC's pilot phase, structural modifications were made to the Motorkings to enhance patient safety and comfort. These adjustments involved installing a welded frame and tarpaulin to provide privacy and protection for patients during transport, extended rearview mirrors for maximum visibility, a mattress and safety belt for patients, a seat for an accompanying health worker, and a hook for intravenous drips. To identify the Motorking

vehicles as ambulances, each was marked with the GHS logo and a red cross. Each vehicle was equipped with a first aid kit, a spare tire and jack, and protective rain gear for drivers. Recognizing the importance of vehicle maintenance, vehicles were routinely serviced by staff mechanics from the Upper East RHD. Spare parts were procured and kept in stock at the RHD to ensure timely repair in the event of breakdowns.



**Figure 8.1: Three-wheeled motorcycle**

Three-wheeled motorcycles, known as Motorkings (Figure 8.1) served as emergency transport vehicles in the pilot districts of northern Ghana. Structural modifications were made to enhance patient safety and comfort, including extended review mirrors and a tarpaulin to provide privacy and protection

Geographic information systems (GIS) data were used to estimate the optimal placement of ambulance stations and configuration of catchment areas to ensure community access to an ambulance(Nazzar et al. 1995b). The SERC ambulances were deployed to 9 subdistrict health centers, 12 community health posts, and 3 communities that lacked facilities or community resident nurses. In Ghana, community health posts function as the first point of care, but only half of the planned locations for these facilities are functional. In the 3 locations that lacked health facilities, community leaders were engaged to determine an appropriate location for the community-based ambulance station. In each of these 3 villages, the community chose an assemblyman's or subchief's home as the station due to its centrality, relative security, and social acceptability for this responsibility. The number of Motorkings was based on an appraisal of the

equipment required to effectively cover all communities of the 12 subdistricts. The size of the study area, in turn, was determined by the volume of referrals that would be required to provide statistical power for evaluation.

The community selected 48 volunteers (2 per ambulance), who were trained to serve as drivers. Drivers varied in age, but were typically literate young adult men. A collaboration of the RHD's Transport Unit, the Motorking vendor, the Driver and Vehicle Licensing Authority, and the Ghana Red Cross provided training to all drivers in basic first aid, infection prevention, defensive driving, basic maintenance, transport policies, communications protocols, and recordkeeping.

### **8.3.2 Communication**

Before SERC, no integrated emergency communication system had been established to link patients to emergency care services at the community and subdistrict levels. Therefore, the RHD procured communication equipment: dual-SIM mobile phones were distributed to health facilities, health workers, and volunteer drivers. Emergency phones were assigned to nurses called community health officers who were based at community facilities, in subdistrict health centers, or in district hospitals' outpatient departments. In communities that lacked a resident nurse, a volunteer was provided an emergency phone and cell phone time for calls to emergency numbers. This collaboration with a cell phone vendor ensured that every community had access to a mobile phone for eliciting rapid referral. At the tertiary referral point, the regional hospital designated a phone line in each ward for receiving incoming calls about impending cases.

### **8.3.3 Community Engagement**

Ghanaian cultural groups have well-defined systems of social organization and community consensus building that rely upon *durbars*, which are open forums for discussing matters of collective importance to the community. In concert with these traditions, the SERC program convened *durbars* in all ambulance catchment areas to explain the intended use of the ambulance, introduce the local SERC health workers and volunteers and review their roles, and discuss the importance of seeking care during emergencies. An emergency phone number was provided to each community and placed on posters at the nearby health facilities and community gathering points. Participating health workers also liaised closely with traditional chiefs and elders, whose support was essential.

GEHIP equipped SERC staff and volunteers with emergency phones and trained them in mobile phone use, criteria for ambulance use, protocols, and recordkeeping. GEHIP staff held quarterly refresher training sessions to ensure that knowledge and skills were retained, and trained district-

and subdistrict-level supervisors to oversee SERC activities and provide routine monitoring and supervision. Monthly review meetings were held across worker tiers to discuss challenges that arose and system improvements needed.

Protocols specified various emergency scenarios in the community and facility setting. Key guidelines included verification of emergency by a health worker and alerts to facilities to prepare for incoming patients and minimize delays. Frontline workers at community health posts were trained in basic triage procedures. All patients being transported were to be accompanied by a health worker. Facilities that received an emergency case were required to provide feedback to the referring facility upon discharge to facilitate follow-up scheduling. The program design included routine monitoring of resources and supplies to assess availability of human resources, equipment, medication, and forms.

GHS supported the operating costs of the SERC emergency referral system. Pregnant women and children under 5 years of age were provided free emergency transport. To encourage facility-based delivery, normal labor cases were transported free of charge. Other ambulance users were charged a nominal cost recovery fee (US\$2.50–\$5.00) that was determined by each District Health Management Team. In one district, the district assembly covered maternal and child referral fuel costs.

Health worker feedback was solicited on SERC to continually inform strategies for educating communities about emergencies. Qualitative appraisal methods were used to determine what community members needed to learn regarding emergencies and to identify strategies for developing a culturally appropriate community education program. The aim was to increase capacity in the community to recognize signs and symptoms of emergencies, encourage prompt decision making to seek care, and increase use of SERC. Opinion leaders and community members contributed to the development of educational materials, which were translated into local languages. These materials included educational flip charts (for use by health workers) and informative songs played on local radio stations and on speaker systems in outpatient hospital wards. Dramas depicting emergency scenarios were developed, filmed, and shown at evening durbars, and posters displayed in health facilities and meeting points depicted actions to be taken in emergency situations.<sup>41</sup> Discussions of the possible harm to SERC that could arise if equipment was misused were integrated into community education sessions.

## **8.4 Methods**

An iterative systems development approach was employed to continuously refine the SERC initiative in response to community reactions and administrative realities. GEHIP staff and

consultants conducted implementation research to identify operational challenges and potential solutions. Methods included a quantitative analysis of key process and health indicators over time, a survey of health workers, and continuous qualitative systems appraisal with frontline workers and community members.

#### 8.4.1 Time Series Analysis of Key Indicators

Volunteers, health workers, and district supervisors completed monthly SERC monitoring records and submitted them to GEHIP staff at the RHD, who created visualizations of results to help supervisors assess both referral volume by location and the types of cases associated with referral operations. Monitoring included station-specific information on distances traveled, transit times, adherence to protocols, types of emergency, and patient outcomes. The monitoring used technology designed to integrate SERC monitoring into the routine GHS data system operations known as the District Health Information Management System (DHIMS). Educational aids and training sessions were developed to help regional and district-level managers use the DHIMS database for practical decision making.

DHIMS data are aggregated at the facility level and provide indicators of the monthly care caseload by indicator and by type of facility (e.g., CHPS, subdistrict health center, or hospital). Monthly DHIMS data are routinely available for all primary health care service points in Ghana, including the community health posts and community nurses involved in SERC, and we used these aggregated data to support the program evaluation. For the purpose of this analysis, the 12 SERC-exposed “treatment” subdistricts provided a basis for assessing the effect of the program. District facilities in the Upper West Region and the remaining subdistricts of the Upper East Region served as comparison areas. The dependent variable was monthly case volume of each relevant indicator; exposure versus nonexposure to SERC in the facility catchment area was the key independent variable.

For the SERC evaluation, we compared DHIMS time series data from SERC facilities with data from facilities located in unexposed districts of the Upper East and Upper West regions. The comparison applied generalized linear mixed models with an exchangeable covariance structure to account for repeated observations (Leiva and Roy 2011). This basis for inference ensures simultaneous adjustment for autoregressive error in time series models (McCulloch 1997) and hierarchical adjustment for multilevel clustering (Burgess et al. 2000). For each dependent variable of interest, a model of monthly time series data takes the form:

$$y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 t_{ij} + \beta_3 x_{ij} t_{ij} + u_j + \epsilon_{ij}$$

where

$y_{ij}$  is a DHIMS-reported value of outcome  $y$  from facility  $j$  at time  $i$ ,

$x_{ij}$  is a dummy variable defining whether facility  $j$  is in the SERC area or in a control area,

$t_{ij}$  is a dummy variable defining whether time  $i$  is before or after the start of the SERC intervention,

$u_j$  is a random intercept for facility  $j$ , and

$\epsilon_{ij}$  is a random error term for facility  $j$  at time  $i$ .

The parameters  $\beta_0, \beta_1, \beta_2$ , and  $\beta_3$  are estimated by maximum likelihood, with  $\beta_3$  estimating the difference-in-difference association of SERC exposure with the number of events of interest recorded by 14 hospital facilities over 70 months of observation. This approach to evaluation represents a regression extension of the Heckman procedure for estimating the impact of interventions in nonexperimental designs (Heckman 1974a, Dimick JB and Ryan AM 2014).

The sign of the  $\beta_3$  coefficient in the equation indicates the direction of the net change in expected monthly case volume between treatment and control: A positive sign implies a positive SERC effect on case volume (i.e., an increase in the treatment facility volume relative to the control), and a negative sign implies a negative SERC effect on case volume (i.e., a decrease in the treatment facility volume relative to the control). For example, a value of +6 for  $\beta_3$  in the equation for an analysis of facility-based delivery would indicate that the expected mean number of monthly deliveries in the treatment facilities increased by 6 deliveries relative to the mean volume of deliveries in the comparison area between the pre- and post-intervention periods. Statistical tests for this coefficient assess whether this relative change is significant. We employed a similar difference-in-difference approach to evaluate the effect of SERC on maternal mortality; however, we substituted a generalized linear Poisson model to properly estimate the maternal mortality ratio. Repeated observations within a facility were adjusted by assuming an exchangeable correlation structure (Zeger and Liang 1986, Zeger et al. 1988). Table 8.1 reports robust standard errors obtained via the sandwich operator (Moulton and Dibley 1997). Although the time series models in this analysis have employed conventional adjustments and statistical safeguards, all such models incur an element of instability. Results therefore merit further investigation and validation (Parker 2000).

## **8.4.2 Survey of Health Workers**

A survey was administered to health workers by trained professional interviewers in December 2013 to assess their perspectives on SERC components and challenges. The questionnaire was pretested and then revised based on feedback provided. The sampling frame comprised all staff based at subdistrict- and community-level health facilities that were involved in the SERC program, including staff affiliated with ambulance stations, responsible for referral operations at ambulance stations, or charged with receiving SERC referrals. This yielded a list of 124 health workers and a response rate of 89% (N=110), as 14 potential respondents were on annual leave during the week the survey was administered. During that 1-week period, the 110 respondents completed the survey instruments as self-administered questionnaires. Respondents were encouraged to provide candid feedback, and were provided with de-identified forms and blank envelopes to preserve anonymity. These procedures assured respondents of confidentiality so that they could answer questions without risk that critical comments would incur supervisory concern or reprisal.

## **8.4.3 Qualitative Systems Appraisal**

Trained professional facilitators conducted a qualitative systems appraisal in March 2014 to assess community stakeholder, patient, and volunteer experiences with SERC, employing qualitative research procedures that have been applied to CHPS assessment in the past (NYONATOR et al. 2003). An analysis of focus group discussions (FGDs) and in-depth interviews (IDIs) with community stakeholders assessed the acceptability of the intervention at the community level. IDIs were also used to examine patient experiences with SERC, satisfaction with care, and suggestions for improvement. A total of 16 FGDs were conducted with men, women, drivers, and volunteers from the subdistricts implementing the SERC program. Twenty-three IDIs were conducted with chiefs, emergency referral users, and volunteers equipped with emergency phones. To enhance representativeness, each focus group category (i.e., women, men, community health volunteers) was sampled in a different community, and each FGD was held within the community to promote discussion. Respondents provided written consent; all IDIs and FGDs were conducted in local languages Buili and Guruni; and all interviews were tape-recorded, transcribed, and analyzed using the NVivo 9 software package (Berg 2004).

# **8.5 Results**

## **8.5.1 Findings From the Time Series Analysis of Key Indicators**

From July 2013 through June 2015, 1,290 patients used SERC transport services. The average trip time and distance traveled were 56.6 minutes and 9.92 kilometers, respectively. Most referrals

were to higher levels of care at subdistrict health centers and district hospitals, with a high concentration of care occurring at 2 facilities that are well staffed and equipped to manage emergencies (Figure 8.2). The next most common reasons for referral included malaria, anemia, diarrhea, acute respiratory illnesses, and injury. Most patients (98%) were treated and discharged successfully, while 2% of all emergency referrals resulted in death.

**Table 8.1: Difference-in-Difference Estimates of the Impact of SERC on Hospital-Based Health Measures, Upper East and Upper West Regions, Ghana  
2009 – 2015**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Deliveries	Cesarean Delivery Rate	Referrals In	Referrals out	Pneumonia	Other Upper Respiratory Tract	Septicemia	Accidents	Diarrheal diseases
Treatment area	<b>-52.93*</b> (26.18)	-0.00651 (0.0113)	<b>-12.08**</b> (4.345)	-6.499 (3.735)	-4.537 (8.015)	<b>-100.5**</b> (37.8)	2.555 (25.98)	-15.35 (8.088)	20.96 (36.05)
Time period	<b>32.55***</b> (9.55)	<b>0.0249**</b> (0.00964)	<b>-3.050*</b> (1.435)	<b>-6.804***</b> (1.87)	0.677 (12.75)	35.57 (47.67)	<b>23.64*</b> (11.9)	-3.235 (3.209)	18.12 (19.13)
SERC <sup>b</sup>	-4.884 (12.76)	0.00352 (0.0146)	<b>12.27*</b> (5.184)	1.597 (3.515)	10.99 (12.92)	22.57 (49.82)	35.09 (41.91)	<b>20.52*</b> (9.904)	11.71 (33.54)
Constant	<b>89.73***</b> (23.81)	<b>0.117***</b> (0.0161)	<b>17.45***</b> (4.174)	<b>12.18***</b> (3.041)	<b>46.96***</b> (14.13)	<b>237.4***</b> (58.8)	28.38 (30.88)	<b>28.17***</b> (6.84)	<b>72.04***</b> (14.96)
Observations	861	795	361	500	787	748	237	796	804
Number of hospitals	14	13	13	14	14	14	10	14	14

Abbreviation: SERC, Sustainable Emergency Referral Care

Note: Estimates are from multilevel linear regressions of outcomes from monthly hospital records in the Upper East and Upper West Regions of Ghana. Regressions include random facility intercepts to account for clustering at the facility level. Standard errors are calculated assuming an exchangeable correlation structure and are reported in parentheses.

\*  $P < 0.05$ ; \*\*  $P < 0.01$ ; \*\*\*  $P < 0.001$

<sup>b</sup> The SERC Effect (difference in difference) is given by the interaction of treatment area with time period

The referral profile changed over time as SERC progressed (Figure 8.3). However, regardless of time period, obstetric cases were the predominant type of referral. Consequently, nearly three quarters of patients were women. Although inappropriate use of the referral system could not be monitored directly, care for minor situations that were not emergencies tended to be labeled as “other” types of referrals. As Figure 8.3 shows, the proportion of such referrals declined with time, suggesting that the high initial frequency of inappropriate SERC referrals may have diminished as operations progressed.



**Figure 8.2: Transportation Routes of Patients Using Sustainable Emergency Referral Care (SERC) Services, July 2013 -June 2015**

There was a shift in the location of delivery care within districts where SERC was introduced. In the SERC area, more deliveries occurred at facilities capable of acute care (i.e., district hospitals), displacing delivery care at health centers and clinics where surgical procedures are not performed (Figure 8.4). Hospitals staffed and equipped to provide acute care also received more referrals where SERC was operative than elsewhere (Table 8.1, column 3). This relocation of care was associated with a reduction in facility-based maternal mortality (incidence rate difference, -352; 95% confidence interval, -639 to -65;  $P < .05$ ) (Table 8.2), although there was no significant effect on the cesarean delivery rate (Table 8.1, column 2). There were several specific indicators of volume of acute care episodes, and only the volume of care for accidents and for maternal emergencies appear to have been affected (Table 8.1, columns 3 and 8, respectively). The impact of SERC on acute care for accident victims is important, not only for the evidence shown in Table 1.1 but also because evidence now suggests that modest economic gains in the region have led to dramatic increases in the purchase of motorbikes, with accident-related morbidity and mortality rapidly expanding as a consequence (Bawah et al. 2014). Time series regression results can be

unstable owing to autoregressive error(Parker 2000). Nevertheless, the relationships demonstrated in Table 1.1 suggest that SERC has had effects on mortality.

The information monitored included process indicators such as staff compliance with protocols. Contrary to guidelines, less than half (49%) of the patients transported were accompanied by referring health workers, and receiving facilities were alerted to incoming patients in only 46% of the Table 1.1 presents the association of SERC exposure with facility output indicators. At baseline, before the introduction of SERC services, there were approximately 53 fewer deliveries per month in hospitals in the SERC intervention area. These facilities also received fewer referrals and reported fewer upper respiratory tract infections at baseline than the facilities serving the comparison area. Cesarean delivery rates were no different between facilities in the SERC and comparison areas at baseline. SERC had no statistically significant effect on the number of deliveries; the cesarean delivery rate; the number of referrals “out” from sub-district clinics to dimonitored referral episodes.

### 8.5.2 Findings From the Health Worker Survey

Of the 110 survey respondents, over half were community health officers (56%); the remainder were clinic-based nurses (25%), midwives (13%), or physician assistants (6%). Places of work included community health posts (69%), subdistrict health centers (27%), and hospitals (4%). Nearly three-quarters (74%) of the respondents had personally referred patients using SERC’s transport service since the program launched.

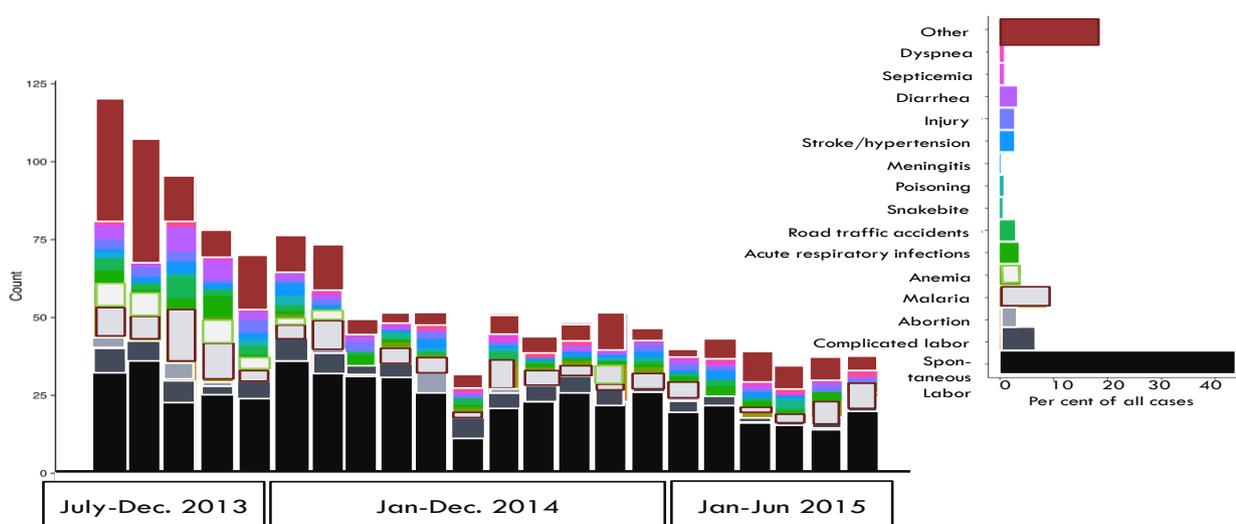


Figure 8.3: Trends in Aggregated Reasons for Referral Reported by 359 Facilities Unexposed and Exposed to SERC System, July 2013- June 2015

### 8.5.2.1 Perceived Effectiveness and Safety of Motorking Ambulances

The majority of health workers (66%) considered SERC to be “very effective” in improving the community- and subdistrict-level emergency referral system, and 33% considered Motorkings to be “somewhat effective.” Most health workers perceived the Motorking to be safe, with 26% categorizing the vehicle as “very safe” and 61% considering it to be “somewhat safe.”

### 8.5.2.2 Driver Dedication and Availability

Respondents generally perceived drivers to be dedicated to their roles (56% reported finding them “very dedicated”; 41% found them “somewhat dedicated,” and only 3% found them “not at all dedicated”). However, there were instances when health workers were unable to promptly contact the volunteer drivers. When asked whether health workers at ambulance stations should be trained to drive Motorkings in such instances, the majority of respondents (75%) said yes.

### 8.5.2.3 Protocol Adherence

Protocol noncompliance was evident for some aspects of care. For instance, referring facilities often failed to call in advance to alert receiving facilities of an incoming patient. Moreover, many patients transferred were unaccompanied by a health worker despite the protocol requiring it. Although surveyed health workers nearly universally affirmed the importance of these procedures, 67% of the referred patients who were interviewed reported that they had been transferred without accompaniment.

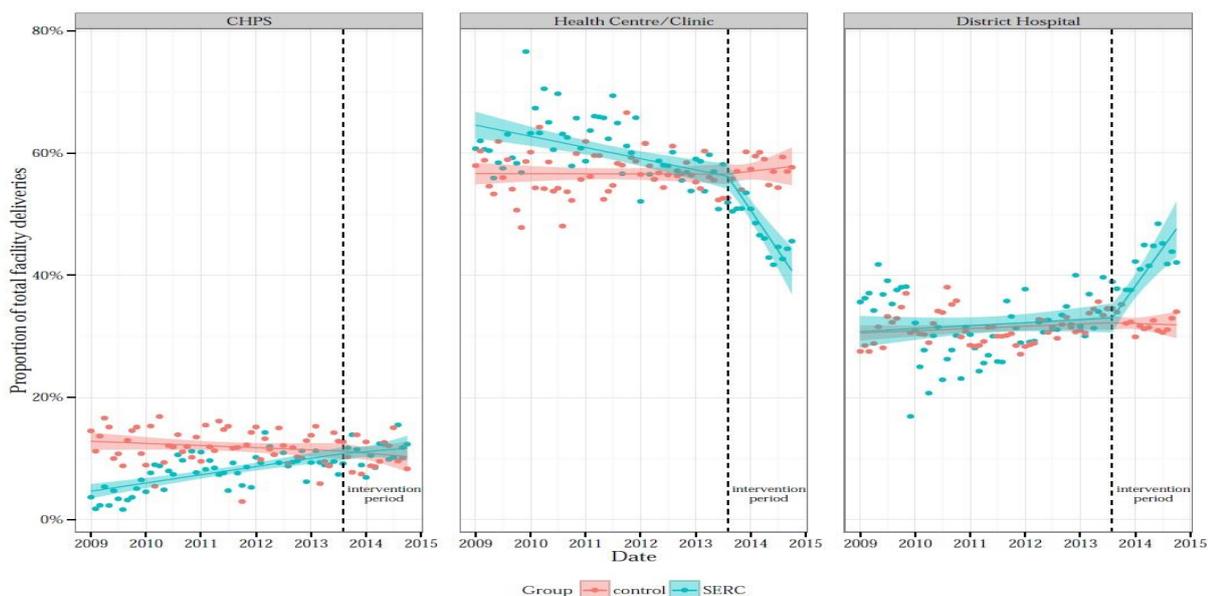


Figure 8.4: Trends in the Location of Facility Deliveries, SERC Intervention Areas vs. Comparison

According to Figure 8.4, difference between the baseline and intervention period were statistically significant at  $P < .001$  for health centers and district hospitals.

**Table 8.2: Difference-in-Difference Estimates of the Impact of SERC on Hospital-Based Maternal Mortality, Upper East and Upper West Regions, Ghana 2009 – 2015**

	MMR (95% CI)		Differences	
	Pre-SERC	Post-SERC	IRD (95% CI)	IRR (95%CI)
Comparison district hospitals (n = 12)	326 (272, 380)	261 (194, 328)	-65 (-140, 10)	0.80† (0.61, 1.05)
Intervention district hospital (n = 2)	618 (392, 844)	201 (22,381)	-417** (-693, -140)	0.33* (0.13, 0.83)
<b>Difference-in-Difference (SERC effect)</b>			<b>-352* (-639, -65)</b>	<b>0.41† (0.15, 1.07)</b>

Abbreviations: CI, confidence interval; IRD, incidence rate difference (deaths per 100,000 live births); IRR, incidence rate ratio; MMR, maternal mortality ratio; SERC, Sustainable Emergency Referral Care

Note: Estimates are from multilevel Poisson regressions of monthly hospital records of births and maternal deaths at 14 facilities in the Upper East and Upper West Regions of Ghana from 2009 to 2015. The hospital MMR is calculated as the number of facility-based deaths per 100 000 live births. The 95% confidence intervals were calculated using robust standard errors accounting for clustering at the facility level.

When workers were asked why they were unable to accompany the patient, the most commonly cited reasons (respondents could choose more than one) were that another health worker accompanied the patient (37%); the respondent was the only staff member at the facility and could not leave the post (35%); or the respondent was attending another patient (32%). Some respondents reported that they did not accompany the patient because they did not feel comfortable riding in the ambulance (16%), while 4% thought the patient would not benefit from riding with a health worker. Protocols also obligate receiving facilities to provide patient outcome feedback to the referring facilities for every case, but this requirement was typically ignored.

#### 8.5.2.4 Frontline Worker Perspectives

Surveyed health workers were asked to identify the primary challenges to effective emergency referral services (the health workers could choose more than one challenge). Poor road conditions (95%) was the most commonly reported challenge, followed by lack of driver motivation (59%); cultural practices that delay care seeking and lack of knowledge of the importance of seeking care (40%); poor communications networks (32%); and adverse weather conditions (29%). Less frequently reported responses included patient inability to take time away from work or family obligations (20%); the cost or unavailability of fuel (19%); poor communication between health facilities (18%); lack of readily available transport options (13%); or lack of Motorking acceptability (12%).

### 8.5.3 Findings From the Qualitative Systems Appraisal

The qualitative systems appraisal shed light on the acceptability of services and on community perspectives on potential areas for improvement. Four main categories of themes emerged during data analysis: community endorsement of SERC; logistical challenges; communication challenges; and interpersonal relationships.

#### 8.5.3.1 Community Endorsement of SERC

Overall, community members strongly endorsed SERC and expressed appreciation for the service. SERC was generally perceived as reliable and reactive, with a committed staff that supported the system. For instance, a woman who had used SERC said this:

*It sent me to the clinic to deliver and I did that safely without any bad thing happening to me. I delivered safely. That is the beauty of it.*

Several users reported that they would recommend SERC services to anyone in need of emergency care. The removal of fees for pregnant women and children under 5 was seen as a key contributor to high SERC uptake. Although some participants preferred 4-wheeled ambulances, respondents generally believed that the 3-wheeled ambulance was better than the available alternatives, such as walking, bicycles, donkey carts, or motorbikes:

*It has been so beneficial to the pregnant women and the children under 5 because they do not pay when the vehicle is transporting them. In the past, we used to transport pregnant women in donkey carts and on bicycles but today there is ready and reliable means of transport for them in emergencies. —Community volunteer participating in an FGD*

Some participants acknowledged that 3-wheeled vehicles such as the Motorking can traverse narrow passages that are inaccessible to 4-wheeled vehicles:

*If not for the Motorking, women, especially pregnant women and children, would have been suffering a lot. ... It is able to go to the interior [of communities] to carry cases like the one I told you about with the woman who was in labor and nearly died if not for the sake of the Motorking ambulance. —Community subchief, in an IDI*

Perceptions of reduced delays and increased numbers of facility-based births as a result of SERC were mentioned by several participants, along with the impression that SERC services were helpful, safe, quick, and lifesaving:

*When a woman is in labor and is not quickly sent to the health facility, she might deliver. She might also lose either the baby or even herself. Kids like this, once they are weak, they can easily pass on. So the impact I see is that the emergency referral saves lives.*  
—SERC driver participating in an FGD

Community and household consensus endorsing SERC was uniformly evident in each FGD and IDI and was a key determinant of the sustainability of the system.

### **8.5.3.2 Logistical Challenges**

While communities were receptive to SERC services, several logistical challenges were identified. Some intervention areas remained inaccessible due to harsh weather and terrain, especially during the rainy season. (These challenges were perceived to affect all vehicle types, not just the Motorkings.) Some communities conveyed interest in overcoming logistical or geographical barriers through collective action or political advocacy. As 2 FGD respondents suggested:

*I am of the view that the community members can contribute something, however little, and seek assistance from the authorities to work on our routes or roads for us.*

*Our youth, if they could help us to repair our roads small, small and when the motors come, they can be running without problems.*

Although concerns about roads did not constrain SERC use, some participants noted that communities that were remote from an ambulance station anticipated delay and often sought alternative means of emergency care. Indeed, this observation is consistent with GIS data analyses showing that communities located far from ambulance stations had lower use rates than proximate communities.

### **8.5.3.3 Communication Challenges**

Communication problems introduced further complications. Poor phone networks, which are common in rural Ghana, exacerbated service delays. Although this did not compromise care seeking resolve, solutions to communication gaps sometimes involved walking great distances to alert a health worker or volunteer.

Patient perspectives on comfort during transport varied: Some patients described the vehicle as being unstable and uncomfortable, while others described feeling very safe, with minimal discomfort. This problem was associated with poor road quality. Any discomfort, however, did not appear to be severe enough to deter people from using SERC in the event of emergencies:

*There are issues like discomfort, safety, and others when you are being transported, but as a sick person you do not have those issues in mind when there is an emergency. Anything that can hurriedly get you to the place on time is what you will be looking for. All vehicles have the tendency of falling when transporting people so it will not be fair relating safety issues to the Motorking alone. —Man participating in an FGD*

*Everyone has his problem, and when the vehicle picked me [up] the driver knew that it was a painful thing being in labor, so they also became careful with the way they were driving and we got there safely. Now I will not be able to speak for another person, but for my experience it was comfortable. —Woman who had used SERC, in an IDI*

Community members also expressed support for improving the work conditions for drivers. There were concerns over drivers being exposed to unfavorable weather and the risk of robbery during late-night service. Although no such incidents were reported, a few drivers worried about driving at night:

*There are beasts at night and also ghosts. From where I come, there are so many spirits that it is not advisable to move out at night. The people sit protected in the vehicle while you are left alone in front. In addition to that you are not supposed to speed the vehicle, and you can imagine how exposed you are if someone intends to harm you. —SERC driver participating in an FGD*

Drivers advised SERC to develop roadside repair protocols for addressing unanticipated mechanical problems. Drivers also noted that personal transportation was a challenge, as many drivers had no means of personal transportation home following late-night referrals. Drivers were provided with 2 bars of soap monthly as a token of appreciation, and this was universally perceived as being insufficient. Cash incentives were preferred by all drivers who were interviewed. Staff participating in FGD who and considered cash payments as being critical to sustaining driver motivation in the future. Some community members recommended that SERC choose drivers from the ranks of existing community health volunteers, given prevailing volunteer commitment to community health.

#### **8.5.3.4 Community Trust and Expectations**

Some participants noted instances of mistrust between health workers and drivers. For example, a driver mentioned an episode where the network was down but a health worker accused him of having turned off his phone. In another example, a man explained during an FGD how at times users might misconstrue basic triage practices as health worker neglect:

*Some of the pregnant women will be complaining that they came and they are thrown away, they don't care about them. Because there is no understanding between the pregnant women and the midwife when she tells them it's not time for them to deliver and they should wait. Because of that, the women say the workers are not serious, but for me, the way I know about the work, I know they are serious.*

Although some patients experienced negative interactions with health workers, many described satisfaction with their performance during emergencies:

*We think that the child was saved by the nurses because of the timeliness of our arrival. We were happy when we got into the hands of the nurses. —Woman who had used SERC, in an IDI*

Drivers expressed concern that the community lacked respect for their contribution. Some community members believed that drivers were paid employees rather than volunteers, and some drivers reported frustration over receiving dismissive and ungrateful comments. Although most community members interviewed indicated gratitude for drivers' services, some complained that drivers operated Motorkings at unsafe speeds.

## **8.6 Discussion**

Mixed-methods implementation research enriched learning about the scalability, acceptability, and potential impact of implementing a community-based emergency referral system in a severely resource-constrained setting. The findings suggest that the strategies used for the emergency referral system can be adapted to the needs of impoverished, remote communities elsewhere in Ghana.

Overall, the SERC system was well received by communities and health workers alike as an effective means of reducing acute care risks. A key lesson learned was the importance of people-centered planning for obtaining and sustaining community endorsement and use of services. Without the engagement of community leaders from the very beginning, acceptance of the program would have been limited. Focused outreach targeting heads of household and familial gatekeepers is also crucial to ensuring continued support and understanding of services. Moreover, the collaborative role of transportation authorities and vehicle manufacturers in the planning, training, and implementation processes proved vital to program success.

While SERC aimed to use process evaluation results to improve system functioning, the pursuit of such improvements was constrained by resource limitations, poor communication network infrastructure, and impassible roads. Nearly all the health workers consulted in this appraisal expressed willingness to use emergency radios to offset poor mobile phone coverage. However, given limited funds for equipment purchases and lack of locally available communication equipment, use of radio devices could not be implemented. Instead, workers were obligated to develop improvised solutions when networks were not functioning.

The Motorking was locally available, affordable, and suitable for traversing rough terrain. Nonetheless, Motorking ambulances received mixed reviews for comfort and safety, indicating a need to explore additional equipment options. A costing analysis that compares 3-wheeled motorcycle ambulances with enhanced Motorkings or higher-quality vehicles is warranted. Similarly, strategies should be investigated for determining an appropriate and sustainable incentive and recruitment system for drivers in order to minimize turnover, improve motivation, and optimize efficiency.

Quite apart from equipment considerations, the quality of emergency care services will be limited by the poor state of infrastructure more generally. Several of the community members who were interviewed expressed concern about the status of the development of primary health care facilities and the slow pace of CHPS implementation, highlighting the fact that effective referral care requires a fully functioning primary health care system.

The SERC experience attests to the value of routine monitoring and evidence-based supervision, in conjunction with refresher training for health workers and volunteers. Lack of accountability mechanisms, supervision, and training can lead to poor adherence to protocols.

Feedback mechanisms are needed to foster timely implementation of systems improvements. For instance, after it was discovered that 30% of the trip report forms were incomplete, the forms were simplified, the format of review meetings was revised, and GIS-based vehicle tracking procedures were instituted to facilitate practical use of data for decision making. Similarly, adhering to a routine vehicle maintenance protocol that ensures prompt repairs was found to be crucial for preventing breakdowns and minimizing service disruptions.

Training for quality assurance is important. Although most patients reported positive experiences with staff involved in facilitating referrals, some patients experienced negative or insensitive comments. While clinical skills are crucial to operations, it is equally essential to foster health workers' patience and understanding of patients' perspectives on the quality of emergency care operations.

Some volunteer drivers perceived community members to be unappreciative of their services. Although FGD participants may have been reluctant to criticize drivers, the general discussion suggests that drivers were, in fact, appreciated, and participants generally agreed that the incentives provided to drivers should be increased. The exchanges among FGD participants nonetheless suggested a need for durbars and other means of community engagement that would promote awareness of the lifesaving service and dedication of volunteers.

Remote communities sometimes preferred to find their own means of transport to offset ambulance delays. This fact attests to the need for implementation research that investigates the mechanisms such communities use for emergency referral and transport. Community-based solutions to referral problems may be relevant to operations more generally.

SERC has made its impact by transporting emergency cases, at considerable cost, to distant hospitals where physicians are available to provide essential acute care. However, bypassing subdistrict clinics and relocating care to hospitals is less sustainable than developing service capability at the subdistrict level. While bypassing for delivery is a logical and common strategy in Ghana (Saleh 2012, Yaffee et al. 2012) and elsewhere in Africa (Kahabuka et al. 2011, Kante et al. 2016), the implication of this finding is clear: There is a need for a new round of implementation research is needed to explore implementing SERC in concert with a program that trains midlevel providers to manage emergencies directly.

## **8.7 Conclusion**

While facility-based emergency health care is important to reducing mortality, facility-focused approaches can fail to achieve their full lifesaving potential in the absence of effective referral. Moreover, if receiving facilities are poorly equipped, inadequately staffed, and unable to respond to clinical emergency needs, effective referral will be little more than a program for relocating mortality. The SERC time series research presented in this article attests to the lifesaving potential of redirecting referral to facilities where emergencies can be competently managed. In the areas where SERC rechanneled acute care to specified facilities, we found decreased facility-based maternal mortality and accident-related deaths relative to comparison facilities. In the future, SERC could expand its intervention regimen with training and capacity building to enable more frontline care providers in smaller facilities to more effectively manage emergencies that arise. This strategy would offset the existing strategies for bypassing substandard care facilities.

Just as SERC's success was dependent on implementation research and evidence, effective scale-up of these results will require effective systems approaches to replication trials in other regions of Ghana, with contrasting social, economic, and ecological conditions. The need for reform of referral systems persists throughout the country, but care should be taken to develop solutions that are informed by SERC, yet tailored to local contexts in the central and southern regions. The transition from pilot to trial clarified training and engagement requirements; replication of SERC elsewhere in Ghana could clarify the practical milestones in establishing a large-scale system of referral care.

The Ghana Health Service has adopted the SERC model and has included it in the national CHPS implementation guidelines. Donors including the Japan International Cooperation Agency, the Korean International Cooperation Agency, and the U.S. Agency for International Development have funded the purchase of Motorkings, which are being used in 4 of Ghana's 10 regions, with plans to use them in 2 additional regions.

**Competing Interests:** None declared.

**Acknowledgments:** The SERC initiative was funded by grants to the University of Ghana School of Public Health and the Ghana Health Service by the British charity Comic Relief and by grants to the Columbia University Mailman School of Public Health by the Doris Duke Charitable Foundation.

## 9 The impact of the Ghana Essential Health Intervention Project on health systems performance in northern Ghana

James F. Phillips<sup>1</sup>, John Koku Awoonor-Williams<sup>2,3,4</sup>, Patrick O. Asuming<sup>5</sup>, Christopher B. Boyer<sup>1</sup>, Sebastian F Achana<sup>6</sup>, Ayaga A Bawah<sup>7</sup>,

<sup>1</sup> Columbia University, Mailman School of Public Health, 60 haven Avenue, NY, NY 10032

<sup>2</sup> Policy Planning Monitoring and Evaluation Division, Ghana Health Service PMB, Accra, Ghana.

<sup>3</sup> Swiss Tropical and Public Health Institute Socinstrasse 57 4002 Basel, Switzerland;

<sup>4</sup> University of Basel, Peterplatz 4003, Basel, Switzerland

<sup>5</sup> Business School, University of Ghana, Legon, Ghana

<sup>6</sup> Navrongo Health Research Centre, P. O. Box 114, Navrongo, Upper East Region, Ghana

<sup>7</sup> Regional Institute of Population Studies, University of Ghana, Legon, Ghana.

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Working paper in preparation for submission to *International Journal of Epidemiology*

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## 9.1 Abstract

Pronouncements that health systems should be strengthened often lack specificity on how the strategies pursued can be evaluated with statistically tractable procedures. This paper presents the results of the analysis of merged cluster data from a baseline and endline survey and linked longitudinal monitoring data, a multi-level systems analysis assesses the net impact of enabling systems strengthening activities on improvements in childhood survival over a five year trial period. Procedures aim to determine if the accelerated pace of implementation of community-based care has saved childhood lives and if manpower and other interventions have had value added, over and above the impact of CHPS expansion. Implications for national scale-up of community-based policy planning are reviewed and discussed.

## 9.2 Introduction

GEHIP aims to test the hypothesis that health systems strengthening at the *district level* will accelerate progress with achieving or surpassing MDGs 4 among *individual children*. Strengthening the health systems, as articulated by GEHIP, is complex, multidimensional, and involves various health sector players –leadership and governance, workforce performance, information generation and utilization, health financing, essential drug supply and overall performance. However, the primary focus of GEHIP has concerned community-based primary health care –the CHPS initiative. While CHPS has been proven to work when it is implemented, the pace of its scale-up is lagging and its implementation has been flawed. To assess the overall impact of GEHIP thus requires a careful, systematic and coherent evaluation and analytical procedures for monitoring the performance of the health systems, with attention to assessing the interaction of GEHIP with CHPS coverage and performance.

Testing the hypothesis that “health systems strengthening” can improve childhood survival requires the elements of the design and procedures for monitoring health and demographic endpoints: dependent variables and data sources. Essentially, three sources of data are required for monitoring and evaluating the performance of GEHIP: i) information on facilities, investments, and capacity that serves the needs of a defined population ii) information on access to such facilities, with distance as a possible proxy, and iii) household level information on exposure to services and outcomes that are posited to be associated with this exposure and other individual level information on parental characteristics of a household survey at baseline and at the end of project.

The GEHIP project is designed to accommodate systems analyses that bring into account the multi-level aspects of the administrative hierarchy of the programme, the research and the health and survival implications of household exposure to services at different levels of the health delivery system. While we aim to assess general impact, we also plan to examine the relationship between health systems inputs and strength, with individual parental health seeking behaviour. This requires instruments for capturing systems changes over time, exposure to the system in the community and in facilities, and implications of these exposures to the health and survival of children. Procedures will permit adjustment for the potentially confounding effects of donor and Ghana Health Service sponsored health system strengthening investments in comparison districts.

Three primary dependent variables are the focus of the analysis: i) Under-five mortality (*5q0*) ii) neonatal mortality and iii) infant mortality. Based on the volume of clinical care reports on maternal deaths among facility-based deliveries, an index of maternal mortality risk will be analyzed, such as the Total Fertility Rate (TFR) and age specific fertility levels.

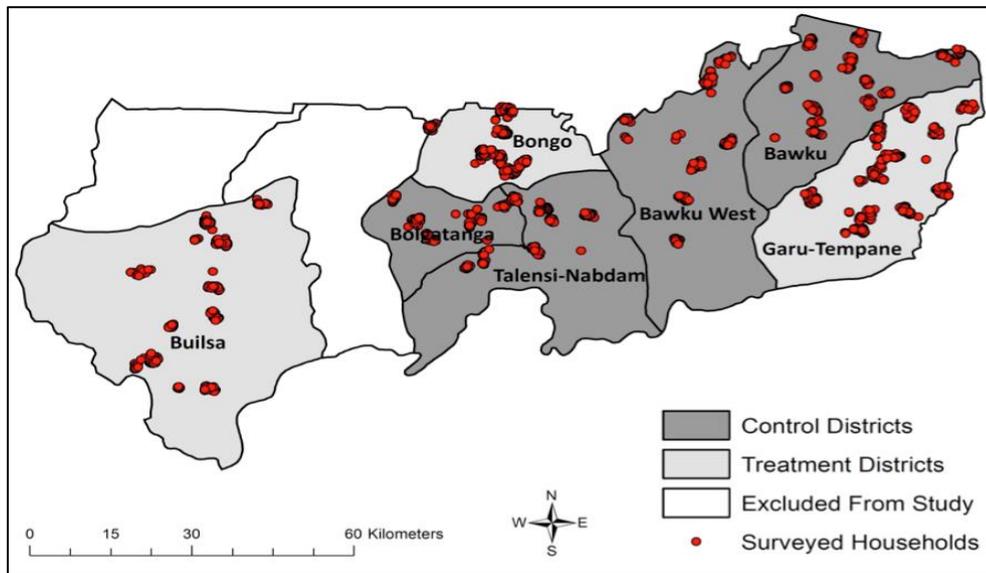
### **9.2.1 The Baseline and Endline Surveys**

Prior to the deployment of GEHIP interventions, a baseline survey was conducted to establish the baseline demographic and health characteristics of the region. The survey, implemented in both the intervention and comparison districts was a random probability survey covering a sample size of 6000 women in a total of 66 clusters in both the intervention and non-intervention (comparison) districts. The Ghana Statistical Service (GSS) provided the sample enumeration areas (EAs) from which participants were drawn. Baseline results portrayed the GEHIP study setting as a typically poor and rural with over 87% of the respondents interviewed living in rural settlements while 13% live in urban settlements. The age structure of the respondents reveals a typical young and potentially fertile childbearing population. More than half (52.5%) of the respondents are younger than 30 years old. Fully 60.8% of the respondents have not had formal education while 66.2% are married. The total fertility in this setting is 5.4 and the infant mortality rate and child mortality rate is 61 and 35 per 1000 respectively.

A total of 5,564 women were interviewed for the baseline household survey. These women reported having given birth to 8,917 children contributing 31,924 person-years under 5 between 2000 and 2011 and recorded 660 deaths (7.4%). This corresponded to average crude and standardized mortality rates of, respectively, 74.0 deaths per 1000 live births and 21.1 deaths per 1000 person-years, which are consistent with national estimates of under-5 mortality from the 2008 DHS survey (88 deaths per 1000 live births). The average infant and child mortality rates were 42.4 and 33.9 deaths per 1000 live births (43.9 deaths per 1000 person-years and 13.4

deaths per 1000 person-years). During the study period, survival increased from 77.3% for children born in 2000 to 86.8% for children born in 2005.

Endline data collection utilized the baseline clusters, an arrangement that enhances the statistical efficiency of difference-in-difference analysis. However, no attempt was made to seek baseline households. Data collection spanned the period from October 2, 2014 to January 31, 2015. The first batch of data collectors were deployed in four districts (Talensi-Nabdam, Bawku West, Bawku Municipal and Garu-Tempane) and data collection lasted for seven weeks in these districts. Subsequently, the second batch of data collectors were deployed in the remaining districts (Bongo, Bolgatanga Municipality, Builsa, Kassena-Nankana West and Kassena Nankana Municipality) on 1<sup>st</sup> December 2014 and lasted for 8 weeks. Data capture utilized the paperless “Open Data Kit” (ODK) technology and tablets, a procedure developed at the University of Washington that permitted instantaneous data editing and correction at the time of interviews (Anokwa et al. 2009). During the survey, close monitoring and supervision of data collection enabled the team to resolve problems encountered by the data collectors and to ensure proper observation of community entry norms, observing informed consent protocols, checking and uploading of data, the issuing of batteries for tablets, etc. Figure 9.1 shows the location of the selected enumeration areas of the Upper East.



**Figure 9.1: Map of the Upper East Region of Ghana highlighting the location of the 66 survey clusters included in the GEHIP study**

Table 9.1 below shows the number of expected interviews, the number actually completed and the percentage successfully interviewed. Overall, 76.3% (5914) of the 7588 women targeted in the 7 study districts were successfully interviewed (2973/3926 in intervention and 2941/3662 in non-intervention districts). Thus, a five percentage difference in the survey response rate if the

two arms of the study are compared. Differences exist across the various districts ranging from 68.3 percent in the Garu-Tempane district to 88.1 percent in the Talensi-Nabdham district.

**Table 9.1: Distribution of Endline Survey Respondents by Intervention and Comparison Districts**

Intervention Districts				Comparison Districts				
Number of interviews....	Bongo	Garu-Tempane	Builsa	Bawku West	Bawku East	Talensi - Nabdam	Bolgatanga	Total
As households	601	1276	928	602	806	721	487	4421
Expected	841	1786	1299	843	1128	1009	682	7588
Attained	698	1220	1055	622	885	889	545	5914
Percentage	83.0	68.3	81.2	73.8	78.4	88.1	79.9	76.3
Excluded districts:								
Kassena-Nankana West & Municipal		No. of Women Sampled		No. Women interviewed			Percentage completed	
		2498		1779			71.2	

## 9.2.2 The Social Context

Using the baseline clusters, the survey was repeated in the endline but with a new sample listing and new household sample. Table 9.2 presents profiles of both survey populations. Since clusters were repeated, to enhance longitudinality, the two sets of survey respondents have similar profiles. Social and demographic features of the survey respondents of interest include age structure, marital status, religious affiliation, education and occupational status of the respondents. These variables are critical in understanding and interpreting the core demographic and health outcomes of interest in this study. Selected baseline survey results are presented in terms of intervention and non-intervention arms of the study for comparison and interpretation.

Table 9.2 present comparisons of children in the intervention and comparison areas at baseline (children born before 2011) and end line (children born since 2011). It is important to point out that the noticeably larger number of children (n) in the baseline compared to the endline is because pre-2011 period captures children born to women interviewed during the baseline survey dating back to 2000. However, those represented in the endline only refers to children born to mothers after 2011 up until the endline survey which was conducted late from 2014 to early 2015.

The data show that both at baseline and the endline surveys there were significantly higher numbers of male children compared to female born to mothers. As expected both at baseline and endline majority of the children born were singletons rather than multiple births (twins or triplets) and this was the case for both intervention and control areas. However, it is noteworthy to point

out that the proportion of multiple births was significantly higher in the control areas than the interventions. There is no such significant difference at the end line. The proportion of children born before nine months was slightly (but statistically significantly) higher in the intervention areas than the control areas at baseline. This is also the case at the end line.

We also present in the same table characteristics of the mothers of the children. The table shows no significant differences in birth spacing between intervention and controls but there has been a change in birth spacing behaviour of mothers since 2011. The fraction of children born less than 24 months after the birth of their mother’s previous children fell by almost more than half between the baseline and endline. This reduction occurred in both intervention and control areas. In both samples (intervention vrs non-intervention) and at both baseline and endline, there were significantly larger multiparous women. In terms of marital union type, there was an increase in the higher proportion of children born to mothers in monogamous marriages at the end line compared to the baseline. In both survey periods, the proportion of children born to mothers in monogamous marriages are higher in the control area than intervention areas. In terms of religious affiliation, majority of children were born to mothers reporting to be Christian, followed by Muslim and then Traditional. However, it is noteworthy reporting that the proportion of children born to women who professed traditional religion declined between the baseline and the end line in both arms of the experiment while those born to women of the Christian faith increased. Finally, in terms of maternal education, there was an increased in the proportion of children born to mothers with some education between the baseline and endline, in both intervention and control areas. As expected, the fraction of children born to mothers with no education is significantly higher than that to mothers with some education. This fraction is also higher in the intervention areas than the controls areas at both baseline and endline.

**Table 9.2: Bivariate comparisons and Chi Square Statistics for intervention and Comparison Districts, Baseline and Endline GEHIP Surveys<sup>a</sup>**

Variable:	Baseline			Endline		
	Comparison (n = 6207)	Intervention (n = 6455)	p-value	Comparison (n = 1416)	Intervention (n = 1489)	p-value
Sex= Male	3114 (50.9%)	3383 (53.0%)	0.023	691 (49.1%)	794 (53.4%)	0.021
Sex=: Female	3000 (49.1%)	3005 (47.0%)		715 (50.9%)	692 (46.6%)	
Birth= Singleton	5945 (95.8%)	6258 (96.9%)	<0.001	1368 (96.6%)	1445 (97.0%)	0.50
Birth=Multiple	262 (4.2%)	197 (3.1%)		48 (3.4%)	44 (3.0%)	
Gestation= 9 months	6139 (98.9%)	6322 (97.9%)	<0.001	1396 (98.6%)	1451 (97.4%)	0.028

Gestation < 9 months	68 (1.1%)	133 (2.1%)		20 (1.4%)	38 (2.6%)	
Birth spacing ≥ 24 months	5426 (87.4%)	5674 (87.9%)	0.41	1325 (93.6%)	1407 (94.5%)	0.30
Birth spacing < 24 months	781 (12.6%)	781 (12.1%)		91 (6.4%)	82 (5.5%)	
Parity=Nulliparous	1162 (18.7%)	1105 (17.1%)	0.004	361 (25.5%)	336 (22.6%)	0.021
Parity=Primipara	1126 (18.1%)	1131 (17.5%)		276 (19.5%)	264 (17.7%)	
Parity=Multipara	2825 (45.5%)	2942 (45.6%)		615 (43.4%)	669 (44.9%)	
Parity=Grandpara	1094 (17.6%)	1277 (19.8%)		164 (11.6%)	220 (14.8%)	
Maternal age= 15-20	751 (12.3%)	745 (11.7%)	0.22	152 (10.7%)	141 (9.5%)	0.026
Maternal age= 20-34	4336 (71.0%)	4510 (70.6%)		1001 (70.7%)	1013 (68.0%)	
Maternal age= 35-49	1022 (16.7%)	1134 (17.7%)		263 (18.6%)	335 (22.5%)	
Unmarried	1483 (24.2%)	1390 (21.6%)	<0.001	136 (9.6%)	142 (9.5%)	0.19
Polygynous	1740 (28.4%)	2102 (32.7%)		375 (26.5%)	439 (29.5%)	
Monogamous	2905 (47.4%)	2933 (45.6%)		904 (63.9%)	908 (61.0%)	
Religion=Traditional	1012 (16.3%)	1077 (16.7%)	<0.001	146 (10.3%)	163 (10.9%)	0.022
Religion=Christianity	2805 (45.2%)	3430 (53.2%)		766 (54.1%)	835 (56.1%)	
Religion=Islam	2128 (34.3%)	1731 (26.8%)		464 (32.8%)	472 (31.7%)	
Religion=other/none	259 (4.2%)	213 (3.3%)		40 (2.8%)	19 (1.3%)	
Maternal education=none	5114 (82.4%)	5068 (78.5%)	<0.001	986 (69.6%)	972 (65.3%)	0.012
Maternal education =some	1091 (17.6%)	1386 (21.5%)		430 (30.4%)	517 (34.7%)	
SES=Poorest (Q1)	1737 (28.0%)	2362 (36.6%)	<0.001	246 (17.4%)	335 (22.5%)	<0.001
SES=Poor (Q2)	692 (11.2%)	629 (9.7%)		248 (17.5%)	315 (21.2%)	
SES=Better (Q3)	1326 (21.4%)	1235 (19.1%)		241 (17.0%)	291 (19.5%)	
SES=Less poor (Q4)	1218 (19.6%)	1355 (21.0%)		325 (23.0%)	320 (21.5%)	
SES=Least poor (Q5)	1231 (19.8%)	874 (13.5%)		356 (25.1%)	228 (15.3%)	
Nearest Health Facility (km)	2.81 (1.72)	4.45 (2.83)	<0.001	2.57 (1.64)	4.18 (2.47)	<0.001

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<sup>a</sup>For categorical variables percentage of total number of birth observations (i.e. column percents) shown in parentheses and p-value is chi-squared test for equivalency of proportions across intervention and comparison groups. For continuous variables the mean and standard deviation are given and the p-value is from two-tailed t-test for equivalent means.

The configuration of data in Table 9.2 and the fact that GEHIP is a plausibility trial rather than an experimental study invites questions about the implications of imbalance for our evaluation strategy. Table 9.2 presents a series of bivariate tests of the hypothesis of statistical balance by testing the significance of differentials in population characteristics in baseline and endline data for GEHIP intervention versus comparison area clusters. Nearly all of the indicators assessed in this appraisal differ significantly by intervention versus comparison area, a finding that is replicated if Table 9.2 is repeated as logistic regressions of net effects of imbalance in the baseline and endline surveys. Such results attest to the need for caution in the interpretation of results and the importance of regression methods for the estimation of adjusted results in our evaluation research.

### **9.2.3 GEHIP Baseline and Endline Endpoint Indicators**

#### **9.2.3.1 Place of Birth**

A high proportion of the respondents in the baseline and endline surveys reported that they had delivered at a health facility (Table 9.3). At baseline 58.8 % of women reported that they delivered at a health facility compared to about 81 percent in the endline survey. The distribution in the two arms of the study are similar, however facility-based delivery increased over time. In both the baseline and endline surveys, series of questions were asked about the last delivery of the women surveyed. Women who were pregnant at the time of the surveys were asked to give information about the delivery they had prior to the current pregnancy. The women were also asked questions about the place of delivery and the people who assisted them during their delivery. To minimize recall bias, these questions were limited to births that occurred in the last three years preceding the surveys. For the baseline survey, the reference years was 2008 and for the endline survey, it was 2011.

**Table 9.3: Selected Health Indicators by Treatment Area**

	Baseline			Endline		
	Treatment	Comparison	Total	Treatment	Comparison	Total
Facility Delivery						
Yes				1,549 (82.4)	2,104 (79.7)	3,653 (80.8)
No				332 (17.6)	536 (20.3)	868 (19.2)
Skilled Delivery						
1 =Skilled Personnel	716(62.2)	640 (57.0)	1356 (59.6)	1527 (81.2)	2036 (77.1)	3563 (78.8)
2=Trained Personnel	37 (3.2)	44 (3.9)	81 (3.6)	_____	_____	_____
3= other personnel	399 (34.6)	438 (39.1)	837 (36.8)	_____	_____	_____
Caesarean Section						
Yes	76 (6.5)	54 (4.6)	130 (5.5)	132 (8.5)	210 (10.0)	342 (9.4)
No	1094 (93.5)	1125 (95.2)	2219 (94.4)	1417 (91.5)	1894 (90.0)	3311 (90.6)
Don't Know	-----	2 (0.2)	2 (0.1)	_____	_____	_____
ANC4+						
Less than 4 times	119 (10.2)	94 (8.3)	213 (9.3)	_____	_____	_____
4 +	989 (85.0)	988 (87.6)	1977 (86.3)	538 (87.6)	732 (84.9)	1270 (86.0)
Don't Know	56 (4.8)	46 (4.1)	102 (4.5)	_____	_____	_____

Table 9.4 presents results of a regression analysis of endline data on skilled attendant delivery. As the results show, skilled delivery is more common among young low parity women than older multiparous women. Other socio-demographic indicators are unassociated with skilled delivery. Somewhat surprisingly, proximity of hospital care is unrelated to skilled delivery while proximity to sub-district health centres is associated with skilled delivery.

### 9.2.3.2 Caesarean Section

A small proportion of women reported delivered by caesarean section in both the baseline and endline surveys. At baseline, the proportion of caesarean section was about 6 percent but this increased slightly to 9 percent in the endline survey. When both arms of the study are compared, there is slightly more increase in caesarean sections in non-intervention districts than in intervention districts. For instance, at baseline, the proportion of caesarean deliveries at baseline was about 7 percent in intervention districts and 5 percent in non-intervention districts respectively. But in the endline survey reported caesarean deliveries increased to 9 percent and 10 percent respectively in the intervention and non-intervention districts respectively. These rates are within the range that WHO has deemed to be acceptable, extending from 5 to 15 percent (World Health Organization 1985).

### 9.2.3.3 Antenatal Care

GEHIP gathered information on antenatal care service women received during their most recent pregnancy. Detailed information was collected on the number of antenatal services received, as well as the health personnel who provided the services and the place of service provision. In this paper, we present women who reported having received at least four antenatal services. To achieve the full life saving potential that ANC promises women and babies, four antenatal care visits that provides essential evidence based interventions called focused antenatal care are required. These essential services include identification and management of obstetric complications, tetanus toxoid immunization, Intermittent Preventive Treatment of malaria during pregnancy (IPTp) and identification and management of infections.

**Table 9.4: Bivariate and multivariate logistic regression analyses of the covariates of delivery by a skilled birth attendant**

Variable	Total (n = 2,385)	Crude			Adjusted		
		OR	95 % CI		OR	95 % CI	
<b>Age</b>							
25-35	629 (26.4)	1	ref		1	Ref	
35 or older	1,099 (46.1)	0.57	0.47	to	0.92	0.72	to
Younger than 25	623 (26.1)	0.46	0.36	to	0.92	0.67	to
			0.58			1.27	
<b>Parity</b>							
Primipara	383 (16.1)	1	ref		1	Ref	
para 2 – 4	1,125 (47.2)	0.44	0.34	to	0.56	0.41	to
para ≥ 5	877 (36.8)	0.3	0.23	to	0.45	0.31	to
			0.39			0.65	
<b>Education</b>							
None	1,711 (71.7)	1	ref		1	Ref	
some education	673 (28.2)	2	1.65	to	1.39	1.12	to
			2.42			1.72	
<b>Marital Status</b>							
Unmarried	90 (3.8)	1	ref		1	Ref	
Married	2,194 (92.0)	1.38	0.91	to	1.33	0.84	to
separated/widowed	97 (4.1)	2.3	1.43	to	1.2	0.71	to
			3.82			2.06	
<b>Polygamy</b>							
No	1,647 (69.1)	1	ref		1	Ref	
Yes	738 (30.9)	0.7	0.59	to	0.85	0.70	to
			0.84			1.03	
<b>Occupation</b>							
Farming	1,143 (47.9)	1	ref		1	Ref	
Non-Farming	1,240 (52.0)	1.84	1.56	to	1.45	1.21	to
			2.17			1.75	
<b>Wealth</b>							
Quintiles 1 – 2	939 (39.4)	1	ref		1	Ref	

Quintiles 3 – 5	1,441 (60.4)	1.82	1.54 2.15	to	1.66	1.38 1.98	to
Distance to nearest clinic							
< 5 km	1,703 (71.4)	1	ref		1	Ref	
> 5 km	640 (26.8)	0.67	0.56 0.80	to	0.65	0.53 0.80	to
Distance to nearest hospital							
< 10 km	1,265 (53.0)	1	ref		1	Ref	
> 10 km	1,078 (45.2)	1	0.85 1.18	to	1	0.83 1.20	to
Clinic readiness score							
Low	758 (31.8)	1	ref		1	Ref	
Med	815 (34.2)	1.41	1.15 1.72	to	1.1	0.87 1.40	to
High	791 (33.2)	1.56	1.28 1.91	to	1.38	1.10 1.73	to
Hospital readiness score							
Low	288 (12.1)	1	ref		1	Ref	
Med	1,183 (49.6)	1.16	0.90 1.51	to	1.29	0.95 1.73	to
High	893 (37.4)	0.91	0.70 1.19	to	1.05	0.77 1.45	to

As Table 9.3 showed, there is nearly complete coverage of antenatal care services in this setting. Overall, there is virtually no difference in the proportion of women who received antenatal care when the two time points of the study are compared. At baseline, the proportion of women who received at least four antenatal care services was 86.3 percent and this decreased slightly to 86 percent in the endline survey. However, differences exist when the two arms of the study are compared. For instance, the proportion of women who received at least four antenatal care services in intervention districts was 85 percent but this increased to 88 percent in the endline survey. In contrast at baseline, the proportion of women received these services in non-intervention districts was 88 percent but decreased slightly to 85 percent in the endline survey.

Table 9.5 examines covariates of complete ANC. Non-farm occupations are associated with completing the ANC regimen. Age is directly related, while parity is unassociated with completing ANC. Clinic readiness is associated with completing ANC, where the readiness index assesses clinical capabilities of a service unit.

**Table 9.5: Bivariate and multivariate logistic regression analyses of the covariates of four or more ANC Attendance during the most recent pregnancy**

Variable	Total (n=5,598 )	Crude		Adjusted	
		OR	95 % CI	OR	95 % CI
<b>Age</b>					
25-35	2,142 (38.3)	1	ref	1	Ref
35 or older	1,589 (28.4)	4.21	3.67 to 4.85	0.77	0.62 to 0.96
Younger than 25	1,769 (31.6)	1.31	1.13 to 1.51	0.22	0.17 to 0.29
<b>Parity</b>					
Primipara	1,966 (35.1)	1	ref	1	Ref
para 2 – 4	1,693 (30.2)	6.36	5.46 to 7.42	2.3	1.82 to 2.90
para ≥ 5	1,937 (34.6)	3.09	2.66 to 3.59	2.24	1.71 to 2.95
<b>Education</b>					
None	3,424 (61.2)	1	ref	1	Ref
some education	2,172 (38.8)	0.5	0.45 to 0.56	1.13	0.96 to 1.33
<b>Marital Status</b>					
Unmarried	1,477 (26.4)	1	ref	1	Ref
Married	3,732 (66.7)	0.27	0.20 to 0.34	0.31	0.23 to 0.41
separated/widowed	381 (6.8)	0.05	0.04 to 0.06	0.05	0.04 to 0.06
<b>Polygamy</b>					
No	4,153 (74.2)	1	ref	1	Ref
Yes	1,445 (25.8)	1.5	1.33 to 1.70	0.84	0.72 to 0.97
<b>Occupation:</b>					
Farming	2,008 (35.9)	1	ref	1	Ref
Non-Farming	3,585 (64.0)	0.43	0.39 to 0.49	0.66	0.57 to 0.76
<b>Wealth</b>					
Quintiles 1 – 2	2,210 (39.5)	1	ref	1	ref
Quintiles 3 – 5	3,378 (60.3)	1.09	0.98 to 1.22	1.21	1.06 to 1.39
<b>Distance to nearest clinic</b>					
< 5 km	3,998 (71.4)	1	ref	1	Ref
> 5 km	1,443 (25.8)	1.03	0.91 to 1.17	0.96	0.82 to 1.13
<b>Distance to nearest hospital</b>					
< 10 km	2,904 (51.9)	1	ref	1	Ref
> 10 km	2,537 (45.3)	0.88	0.79 to 0.99	0.79	0.69 to 0.90
<b>Clinic readiness score</b>					
Low	1,727 (30.9)	1	ref	1	Ref
Med	1,887 (33.7)	0.99	0.87 to 1.14	1.16	0.97 to 1.38
High	1,899 (33.9)	0.93	0.82 to 1.07	0.96	0.81 to 1.14
<b>Hospital readiness score</b>					
Low	743 (13.3)	1	ref	1	ref
Med	2,720 (48.6)	1.22	1.03 to 1.46	1.26	1.01 to 1.57
High	2,050 (36.6)	1.28	1.07 to 1.53	1.29	1.02 to 1.64

#### 9.2.3.4 Malaria in children, household ITN ownership and utilization

Malaria remains a key cause of death especially to children in Ghana. In the Upper East Region of Ghana, malaria accounts for 53.3 percent of all outpatient cases, 41.4 percent of all admissions, and 41.7 percent of all deaths among children less than five years in the region (UER Annual

Report 2010). Successfully reducing ill health and death caused by malaria is thus critical in achieving MDG4 in this setting. In this survey, series of questions were asked to estimate the prevalence and treatment of malaria among children, household ownership of insecticide treated nets (ITNs), usage of ITNs.

Respondents were asked if within the last two weeks prior to the survey, their children had been ill with a fever (malaria) Table 9.6 To minimize recall bias, this question was restricted to women who reported having children born in the last three years preceding the baseline and endline surveys. Overall there is no difference in the proportion of children reported to have had malaria in the baseline and endline surveys. The prevalence of malaria among children in the two time points is about 9 percent. However slight differences exist when the two arms of the study are compared. For instance, at baseline the prevalence of malaria among children in intervention districts was about 10 percent but it decreased to about 6 percent at the end of the study. In contrast, the prevalence in non-intervention districts at baseline was about 9 percent but this increased to 12 percent in the endline survey.

Information about health facility visitation and malaria treatment was not collected in the baseline survey but was included in the endline survey. At the endline a high proportion of children were reported to have been seen at health facility and to have received antimalarial treatment. Overall, as high as 82 percent of children were reported to have been seen at a health facility (about 85 percent in intervention districts and 80 percent in non-intervention districts respectively). Similarly, a total of 79 percent of these children were treated with antimalarial drugs. Majority of children treated with antimalarial drugs (82 percent) were in non-intervention districts compared to (25 percent) in intervention districts. It is not clear if these differences are attributable to the use of different treatment protocols in the various districts.

Household ownership of mosquito net is high and increasing with time (63 percent at baseline and 80 percent in the endline survey) respectively. Although there were slight differences in household ownership of mosquito net in the two arms of the study at baseline, these difference diminished in the endline survey. However, when compared with the baseline results, there was an increase in ownership of nets in both arms of the study. The increase in non-intervention districts is comparatively higher (a 10 percentage difference) than that in the intervention districts.

The type of mosquito net used is important in the successful prevention of malaria. The current WHO policy recommendation focuses on the use of long-lasting treated nets. Thus in the baseline survey, the types of mosquito nets being used in the various households were documented. The types of nets being used were classified into two main categories as long-lasting treated nets, and pre-treated nets. Overall, ownership of long-lasting treated nets was 58% while that of pre-treated

nets was about 20 percent. However, this information was not documented in the endline survey and thus limits comparison of the endline survey results with that of the baseline results.

To achieve protection for both mother and child, the Ghana Health Service encourages both mother and child to sleep under same mosquito net. It appears this strategy is well accepted and patronized by women in this study setting. Overall, close to 80 percent of mothers and their children slept under same mosquito net the night prior to the two surveys. There are no significant differences between the two arms of the study in the distribution of mothers and their children that slept under a net the previous night. It is important to note that revisions to the instrument during the endline led to the collection of additional items which were not previously collected at the baseline as seen in gaps in Table 9.6 such as childhood facility-based antimalarial treatment.

**Table 9.6: Baseline and Endline Prevalence of Malaria, Household Possession and Use of ITNs by Intervention Area**

Indicator	Baseline Results			Endline Results		
	Intervention N (%)	Comparison N (%)	Total	Intervention n N (%)	Comparison N (%)	Total
<b>Malaria in last two wks</b>						
<b>Yes</b>	117 (9.8)	106 (8.8)	233 (9.3)	123(6.4)	212 (11.7)	335 (9.0)
<b>No</b>	1,081 (90.1)	1,101 (90.8)	2,182(90.5)	1786 (93.6)	1602 (88.3)	3388 (91.0)
<b>Don't Know</b>	1 (0.1)	5 (0.4)	6 (0.2)	0	0	0
<b>Child Seen at a Health Facility</b>						
Yes				105(85.4)	168(79.6)	273(81.7)
No				18 (14.6)	43 (20.4)	61 (18.3)
<b>Treated with antimalarial</b>						
Yes				26(25.0)	136(81.9)	214(79.3)
No				78 (75.0)	30 (8.1)	56 (20.7)
<b>Ownership of ITN</b>						
<b>Yes</b>	857 (67.9)	719 (57.8)	1576 (62.9)	1,626(80.1)	1,524(80.3)	3,150(79.8)
<b>No</b>	405 (32.1)	526 (42.2)	931 (37.1)	422 (20.6)	375 (19.8)	797 (20.2)
<b>Type of ITN Used</b>						
<b>Long-lasting treated Nets</b>	624 (72.8)	286 (39.8)	910 (57.7)			
<b>Pre-treated Nets</b>	62 (7.2)	254 (35.3)	316 (20.1)			
<b>Don't Know</b>	117 (20.0)	179 (24.9)	350 (22.2)			
<b>Youngest child slept undernet night before survey</b>						
<b>Yes</b>	660 (80.0)	535 (75.2)	1195 (77.8)	1241 (80.7)	1178 (79.5)	2419 (80.1)
<b>No</b>	161 (19.5)	176 (24.7)	337 (21.9)	296 (19.3)	303 (20.5)	599 (19.9)
<b>Don't Know</b>	4 (0.5)	1 (0.1)	5 (0.3)	0 (0.0)		
<b>Mother slept under net overnight</b>						
<b>Yes</b>	663 (79.6)	538 (75.5)	1201(77.7)	1278 (78.9)	1200 (79.1)	2478 (79.0)
<b>No</b>	170 (20.4)	175 (24.5)	345 (22.3)	341 (21.1)	317 (20.9)	658 (21.0)

### **9.2.3.5 ITPT and Tetanus Injection during Pregnancy**

Equally important in achieving MDG5 is the health status of women as measured by the proportion of women prevented against malaria and tetanus infection during pregnancy. In this study, women who were pregnant at the time of the survey were asked if they had received ITPT (Table 9.7). ITPT in this survey refers to pregnant women who were given SP and ACT during pregnancy. Those who were not pregnant were asked if they had received ITPT during their most recent completed pregnancy (at most three years prior to the baseline and endline survey).

As in the case of ITPT, women who were pregnant at the time of the survey were also asked if they had slept under a mosquito net the night prior to the survey. This indicator was not explored in the baseline survey but was included in the endline survey. The results indicate that about 71 percent of currently pregnant women at the time of the survey slept under a net the night before the survey. Comparatively, more pregnant women in intervention districts (74 percent) than in non-intervention districts (69 percent) slept under a mosquito net the night prior to the survey.

Similarly, women were also asked if they had received an injection in the arm to prevent them and the baby from getting tetanus. The prevalence of tetanus injection among the surveyed women was fairly high (54 percent) at baseline but increased significantly (82 percent) in the end of project survey. Although prevalence increased in both arms of the study, the increase in intervention districts was comparatively more pronounced. The prevalence of tetanus injection increased from about 46 percent in intervention districts at baseline to 86 percent in the end of project survey. In contrast, prevalence of tetanus injection at baseline in non-intervention districts was about 61 percent and increased to 79 percent in the end of study survey. Thus, there was a 22 percentage difference change in the level of increase in the prevalence of tetanus among surveyed women in intervention districts compared to the comparison districts.

**Table 9.7: Maternal Health Seeking Behavior by Intervention Area**

Indicator	Baseline Results			Endline Results		
	Intervention N (%)	Comparison N (%)	Total	Intervention (%)	Comparison N (%)	Total
ITPT during current pregnancy:						
Yes	96(90.6)	97 (82.2)	193(86.2)	1, 800 (91.1)	2,488(87.9)	4,288 (89.2)
No	5 (4.7)	4 (3.4)	9 (4.0)	176 (8.9)	341(12.1)	517 (10.8)
Other	1 (0.9)	2 (11.7)	3 (1.3)			
Don't Know	4 (3.8)	15 (12.7)	19 (8.5)			
Bed net use in Current Pregnancy:						
Yes				1,456 (73.7)	1, 939 (68.5)	3,395 (70.7)
No				520 (26.3)	890 (31.5)	1,410 (29.3)
Tetanus injection during current pregnancy:						
Yes	77 (46.1)	105 (61.4)	182(53.9)	1,698 (85.9)	2,232(78.9)	3, 930 (81.8)
No	90 (53.9)	66 (38.6)	156(46.1)	278 (14.1)	597 (21.1)	875 (18.2)

### 9.2.3.6 Childhood Immunization

Vaccine preventable diseases continue to pose serious risk to children and adults in many developing countries. Immunization is thus critical for improving child health and preventing death and disability to children. According to WHO/UNICEF, all children need to receive BCG vaccination to protect against tuberculosis, three doses of polio vaccine, and a measles vaccination by the age of 12 months. To this end, one of the core indicators of interest in the GEHIP project is improvement on immunization. Mothers were therefore asked about the immunization status of their children and field workers were asked to request mothers to show the immunization cards for their children.

A comparatively higher proportion of the women surveyed at baseline (about 84 percent) were able to produce the immunization cards of their children to the data collectors for inspection, than was the case in the end of study survey (about 62 percent). It is not clear why this was the case and needs further investigation. The proportion of women who reported that they had immunization cards for their children but could not produce the cards for confirmation was fairly same at about 13 percent at the baseline and in the end of study survey and also across the two arms of the study.

Table 9.8 reports results of immunization status of children in intervention and comparison areas. The proportion of children who received their third dose of diphtheria, pertussis (whooping cough), and tetanus toxoid vaccination (DPT3) comprised about 80 percent of the children of the surveyed women at baseline received DPT3. This increased to about 88 percent at the end of the study. There are no differences in the distribution across the arms of the study both at baseline and end of the study. However, there is a 5 percentage difference in the reported proportion of children

who received DPT3 in intervention districts than in the non-intervention districts at the end of the study.

Equally important is the proportion of children protected against hepatitis B3 (HEP B3). According to the 2011 MICS report, in Ghana 89 percent of children were immunized against measles by their first birth day. In this study, the overall proportion of children immunized against hepatitis B at baseline was about 59 percent but this increased to about 80 percent at the end of the study. However, a greater proportion of the increase occurred in the non-intervention districts. For instance, at baseline the proportion of children immunized against hepatitis B increased from 62 percent to 74 percent. In contrast the proportional change in intervention districts was from 55 percent to 86 percent. The difference in change between the two arms of the study over the period is 19 percent. These results are highly unanticipated and merits further investigation.

**Table 9.8: Baseline and Endline Child Immunization Status by Intervention Area**

Indicator	Baseline Results			Endline Results		
	Intervention N (%)	Comparison N (%)	Total	Intervention N (%)	Comparison N (%)	Total
<b>Health Card Possession</b>						
<b>Yes, Seen</b>	1002 (86.2)	932 (81.0)	1934 (83.6)	1285 (62.4)	1202 (62.2)	2487 (62.3)
<b>Yes, Not seen</b>	133 (11.4)	163 (14.2)	296 (12.8)	277 (13.4)	254 (13.2)	531 (13.3)
<b>No Card</b>	28 (2.4)	55 (4.8)	83 (3.6)	499 (24.2)	476 (24.6)	975 (24.4)
<b>DPT3</b>						
<b>Yes</b>	805 (80.3)	743 (79.7)	1548 (80.0)	1165 (90.7)	1015 (84.4)	2180 (87.7)
<b>No</b>	197 (19.7)	189 (20.3)	386 (20.0)	120 (9.3)	187 (15.6)	307 (12.3)
<b>HEP B3</b>						
<b>Yes</b>	620 (61.9)	512 (54.9)	1932 (58.5)	954 (74.2)	1028 (85.5)	1982 (79.7)
<b>No</b>	382 (38.1)	420 (45.1)	802 (41.5)	331 (25.8)	174 (14.5)	505 (20.3)
<b>Yellow Fever</b>						
<b>Yes</b>				984 (76.6)	905 (75.3)	1889 (75.9)
<b>No</b>				301 (23.4)	297 (24.7)	598 (24.1)
<b>Vitamin A Supplementation:</b>						
<b>Yes</b>				2114 (86.0)	1920 (82.5)	4034 (84.3)
<b>No</b>				343 (14.0)	407 (17.5)	750 (15.7)

Another important antigen is the proportion of children immunized against yellow fever. However information on yellow fever vaccination was not collected in the baseline survey. The end of project survey revealed that about 76 percent of the children in this study context had been immunized against yellow fever. There are no difference between the two arms of the study.

Of interest in the end of study survey was also the proportion of children who received Vitamin A supplementation. Vitamin A supplementation coverage in this study context was about 84 percent. Slightly higher proportion of children (86 percent) in intervention districts compared to non-intervention districts (83 percent) received Vitamin A supplementation. Table 9.8 presents the immunization coverage of specific antigens by treatment area of the study. Results show that coverage is generally much higher in the region at the end of GEHIP than in the baseline.

According to the 2008 GDHS Report, the TFR in the Upper East Region was 4.1, lower than what is obtained from this survey, which is probably due to the fact that the urban areas of the region, such as Bolgatanga town and the districts covered by the Navrongo project were excluded. Fertility levels and determinants merit further investigation, however. Regression modelling of parity progression, in analogy with mortality modelling is an anticipated priority for future research.

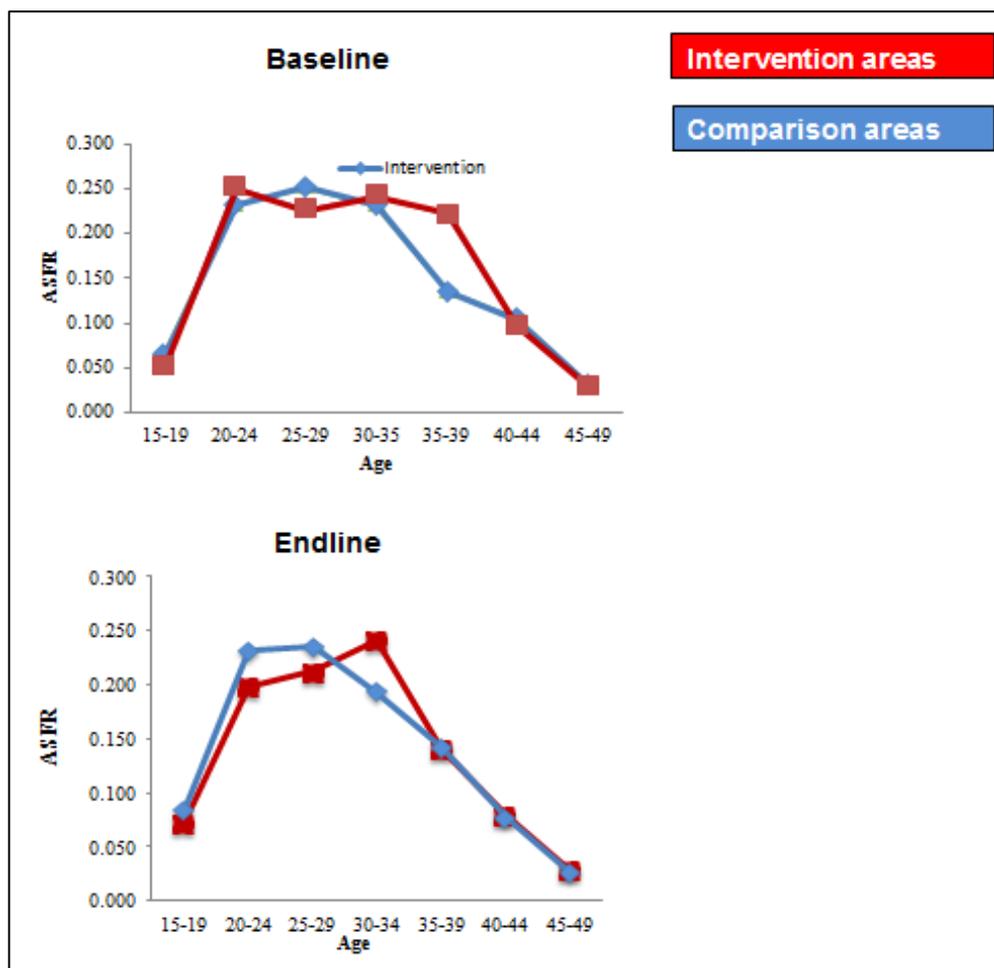
#### **9.2.3.7 Fertility indicators**

All surveyed women were asked to provide information regarding their pregnancy and childbearing experiences. Women were asked to provide information on all live births they have had in their lifetime including the age, sex, and survival status of all live births reported. Based on the birth history data, basic fertility indicators were computed such as the age-specific fertility rates (ASFR) and the total fertility rates using children born within the 12 months prior to interviews (Figure 9.2). The TFR was calculated for all districts combined and separately for the intervention and non-intervention districts. The age-specific fertility rates that are shown in Figure 9.2 suggest that women in the non-intervention districts had higher fertility at older ages than intervention areas. It is not clear why this is the case and thus merits further investigation. The total fertility rate (TFR) was reported to be 5.4 for the entire sample at baseline, slightly higher in the non-intervention area (5.6), relative to the intervention arm (5.3). The figures suggest that intervention area fertility declined relative to comparison area fertility, but that changes were limited to women under 30 years of age.

#### **9.2.3.8 Contraceptive use**

Contraceptive prevalence is an important indicator of health, population and women empowerment. It is often used as a proxy for measuring access to reproductive health services that are essential for achieving many of the Millennium Development Goals; especially child mortality, maternal health, HIV/AIDS, and gender equality. Contraceptive prevalence measures the proportion of women of reproductive age who are using or whose partner is using a contraceptive method at a given point in time. Women were asked to indicate the contraceptive method they and their partner were using to delay or avoid pregnancy. Contraceptive use was

expected to follow patterns that have been repeatedly demonstrated in Ghana and elsewhere. In Ghana, and throughout the region, contraceptive use typically covaries directly with age, parity, educational attainment and economic status. Findings in the terminal survey suggest that the UER is an exception to conventional social correlates of contraceptive use. However, remoteness of households from hospitals and clinics significantly reduces the odds of contraceptive use. Such findings suggest that national policies for improving access to care could significantly impact on contraception.



**Figure 9.2: Baseline Age-Specific Fertility Rates, GEHIP Intervention and Comparison Districts**

At baseline the contraceptive prevalence was found to be generally low (13 percent) for the entire sample; but increased to 17 percent at the end of the project. Although the contraceptive prevalence increased in both arms of the study, the magnitude of change in the intervention districts is slightly higher than that of the non-intervention districts. Contraceptive prevalence increased from 12 percent at baseline in the non-intervention districts to about 15 percent in the endline survey. In contrast, it increased from 14.2 percent at baseline in the intervention districts to 18 percent in the endline survey.

**Table 9.9: Bivariate and multivariate logistic regression analyses of the covariates of modern contraceptive use**

	Total	Crude	Adjusted		
	(n = 5,604)	OR	95 % CI	OR	95 % CI
<b>Age</b>					
25-35	2,143 (38.2)	1	ref	1	ref
35 or older	1,590 (28.4)	2	1.65 to 2.42	1.28	0.98 to 1.66
Younger than 25	1,773 (31.6)	1.3	1.06 to 1.59	0.94	0.68 to 1.30
<b>Parity</b>					
Primipara	1,967 (35.1)	1	ref	1	ref
para 2 – 4	1,694 (30.2)	2.46	2.01 to 3.01	1.85	1.36 to 2.52
para ≥ 5	1,941 (34.6)	1.65	1.35 to 2.04	1.64	1.14 to 2.36
<b>Education</b>					
None	3,430 (61.2)	1	ref	1	ref
some education	2,172 (38.8)	0.99	0.84 to 1.16	1.64	1.34 to 2.01
<b>Marital Status</b>					
Unmarried	1,477 (26.4)	1	ref	1	ref
Married	3,738 (66.7)	0.53	0.36 to 0.75	0.57	0.38 to 0.82
separated/widowed	381 (6.8)	0.4	0.32 to 0.50	0.44	0.32 to 0.60
<b>Polygamy</b>					
No	4,156 (74.2)	1	ref	1	ref
Yes	1,448 (25.8)	0.86	0.71 to 1.03	0.64	0.52 to 0.79
<b>Occupation</b>					
Farming	2,009 (35.8)	1	ref	1	ref
Non-Farming	3,590 (64.1)	0.86	0.73 to 1.01	1.04	0.86 to 1.25
<b>Wealth</b>					
Quintiles 1 – 2	2,213 (39.5)	1	ref	1	ref
Quintiles 3 – 5	3,381 (60.3)	1.12	0.96 to 1.32	1.08	0.91 to 1.29
<b>Distance to nearest clinic</b>					
< 5 km	4,001 (71.4)	1	ref	1	ref
> 5 km	1,444 (25.8)	0.75	0.62 to 0.91	0.75	0.60 to 0.92
<b>Distance to nearest hospital</b>					
< 10 km	2,907 (51.9)	1	ref	1	ref
> 10 km	2,538 (45.3)	0.75	0.64 to 0.88	0.73	0.61 to 0.86
<b>Clinic readiness score</b>					
Low	1,730 (30.9)	1	ref	1	ref
Med	1,887 (33.7)	0.95	0.78 to 1.16	1.11	0.88 to 1.39
High	1,900 (33.9)	1.16	0.96 to 1.41	1.3	1.05 to 1.61
<b>Hospital readiness score</b>					
Low	743 (13.3)	1	ref	1	ref
Med	2,722 (48.6)	1.29	0.98 to 1.71	1.36	1.01 to 1.88
High	2,052 (36.6)	1.84	1.41 to 2.44	2.12	1.55 to 2.95

An important reproductive health indicator closely related to contraceptive prevalence is unmet need for contraception. Unmet need for contraception refers to the proportion of women in their reproductive ages who are fecund and sexually active who desire to terminate or space childbearing but are not currently using any method of contraception. This indicator is useful to family planning programme management and is often employed as a measure of the progress of the programme. At baseline, the unmet need for contraception in this study setting was as high

as 36 percent for spacing and 19 percent for stopping. Unmet need continues to remain high, however, suggesting that GEHIP was not fully effective in addressing demand for contraception.

### 9.2.3.9 Childhood mortality

To measure childhood mortality, the baseline survey collected information on reproduction and child survival. Using information on children born to mothers and those of them who have died, we computed childhood mortality using the UN MORTPAK software (MORTPAK for Windows version 4). Figure 9.3 reports trends in intervention and comparison area childhood mortality that are estimated by arraying terminal survey birth history recall of births and deaths and computing implied rates. We then compared our results with the 2008 GDHS results for the Upper East region. For all areas the infant mortality rate was 61 while the child mortality rate was 35 per 1000. This compares with 50 and 31 respectively obtained from the 2008 GDHS.

Comparing the intervention and non-intervention areas the infant mortality rate in the intervention districts is 60 compared to 61 in the non-intervention districts. Similarly, the child mortality rate in the intervention and non-intervention areas is 35 and 36 respectively; comparatively close to what was obtained in the 2003 GDHS.

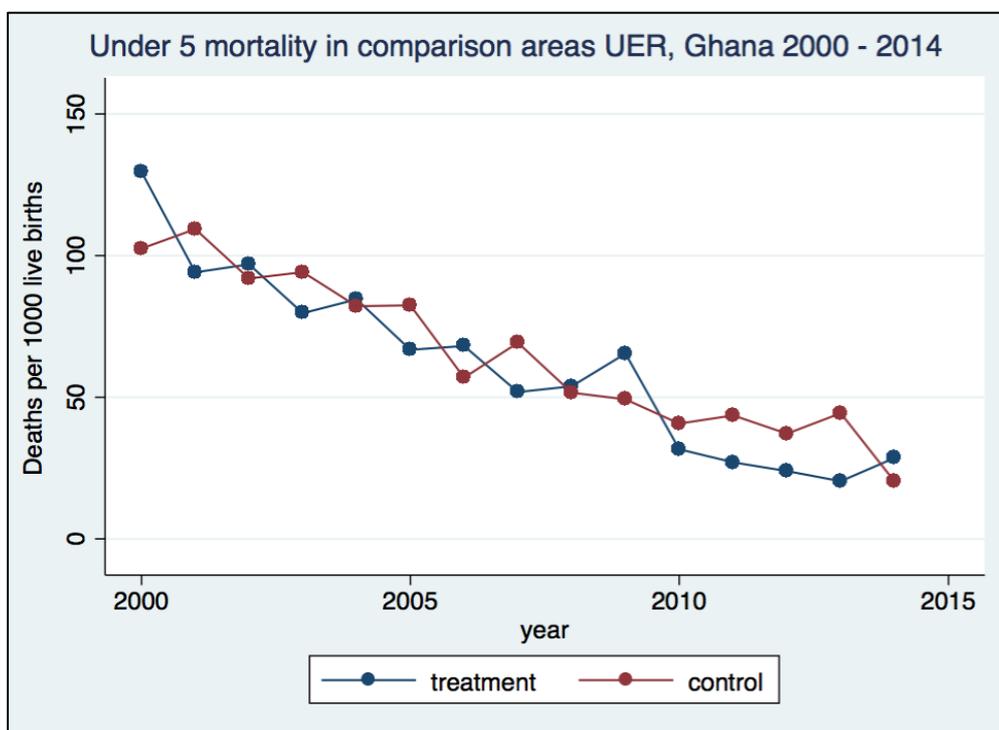


Figure 9.3: Time trends in under five mortality 2000-2014, estimated from the endline survey birth histories

### 9.3 Estimating differences in health outcomes between intervention and comparison groups

Although GEHIP uses conventional sampling procedures to gauge treatment and comparison differences, this process may be affected by omitted variable bias (areas that are exposed to project activities may differ systematically from those which are not due to unobserved characteristics). Accordingly, the project construct an estimator of programme effect that takes into account the time-invariant unobserved heterogeneity between intervention and comparison localities. By using repeated household survey data and estimating “differences-in-differences,” (DD) the project is able to compare outcomes before and after interventions at any point in time following the possible onset of treatment effects (Heckman 1974b). As the study protocol specified, average treatment effects (ATE) is estimated as follows for common indicators:

$$ATE = E(Y_{Mt'} - Y_{Mt}) - E(Y_{Ct'} - Y_{Ct})$$

(1)

In this model, **Y** describes a health outcome such as the under-5 mortality rate, the subscript **t** refers to measurements of health outcomes at baseline, **t'** refers to measurements of health outcomes at the end of the point of observation, **M** indexes GEHIP exposed sample cluster areas and **C** indexes comparison sample cluster areas.

Results for GEHIP “common indicators” are presented in Table 9.9. In general, indicators suggest that exposure to GEHIP improved intervention areas antenatal care (ANC), delivery by skilled attendants (SBA) and contraceptive use relative to comparison area levels and trends. However, several indicators equally improved in both intervention and comparison areas over time, such as indicators of immunization, full coverage of antenatal care (four or more visits).

**Table 9.10: Difference-in-Difference Analysis of GEHIP Common Indicators**

	Baseline			Endline			$\Delta_{\text{GEHIP}}$	$\Delta_{\text{Control}}$	$\Delta^2$
	GEHIP	Control	$\Delta_{\text{GC}}$	GEHIP	Control	$\Delta_{\text{GC}}$			
DDCF Indicator	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ANC 1+	0.99 (0.005)	0.96 (0.009)	0.026*	0.98 (0.004)	0.97 (0.005)	0.011	-0.012	+0.003	-0.015*
ANC 4+	0.38 (0.019)	0.37 (0.016)	0.003	0.88 (0.018)	0.83 (0.019)	0.044	+0.500***	+0.459***	+0.041
DPT3	0.8 (0.019)	0.8 (0.015)	-0.001	0.91 (0.008)	0.84 (0.019)	0.062*	+0.104**	+0.041	+0.063*
IPTp	0.95 (0.011)	0.92 (0.008)	0.028	0.94 (0.009)	0.91 (0.011)	0.037	-0.008	-0.016	+0.009
ITN	0.81 (0.02)	0.75 (0.031)	0.055	0.81 (0.021)	0.79 (0.02)	0.013	+0.002	+0.045	-0.042
ORS	0.47 (0.04)	0.65 (0.045)	-0.178	0.54 (0.044)	0.63 (0.04)	-0.087	+0.068*	-0.024	+0.091
Skilled Birth Att	0.59 (0.02)	0.51 (0.036)	0.082	0.85 (0.021)	0.79 (0.02)	0.055	+0.252**	+0.278**	-0.027
Antimalarial	0.89 (0.034)	0.88 (0.031)	0.007	0.79 (0.039)	0.76 (0.034)	0.029	-0.1*	-0.122*	+0.022
c-section	0.07 (0.014)	0.04 (0.01)	0.02	0.09 (0.012)	0.11 (0.014)	-0.02	+0.027	+0.067**	-0.04*
Contraception	0.12 (0.011)	0.14 (0.012)	-0.02	0.18 (0.011)	0.15 (0.011)	0.027	+0.055*	+0.008	+0.047*
Measles	0.66 (0.013)	0.67 (0.022)	-0.012	0.77 (0.015)	0.75 (0.013)	0.017	+0.114**	+0.085**	+0.029
vitamin A	0.12 (0.01)	0.08 (0.012)	0.039	0.2 (0.014)	0.18 (0.01)	0.028	+0.085**	+0.096**	-0.011

**Note:** All estimates calculated from logistic difference-in-difference models with standard errors clustered by enumeration area.

\*  $p < 0.05$  \*\*  $p < 0.01$  \*\*\*  $p < 0.001$

## **9.4 The Regression Analysis of Childhood Survival**

GEHIP is a plausibility trial, incurring statistical and analytical challenges associated with this type of study. However, the necessity of multi-level comparison complicates inference in this instance. GEHIP is therefore evaluated with regression methods that build on the difference-in-difference concept using methods of econometrics that are used for non-experimental inference.

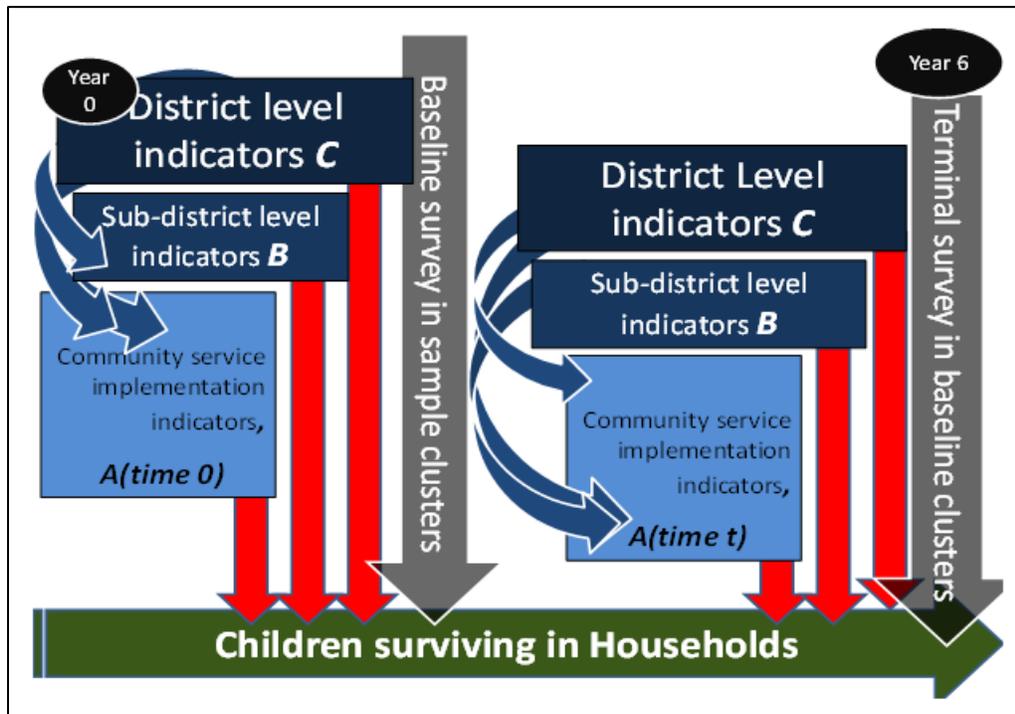
### **9.4.1 Methodological Challenges**

#### **9.4.1.1 The multi-level problem**

As the term “strengthening” connotes, evaluating a systems development programme must be monitored longitudinally to provide insights into organizational change and concomitant behavioural, morbidity, or mortality outcomes. Longitudinal research involves the capture and management of linked data over time. Systems research, in turn, involves programmatic functioning that is complex to observe. Information must be compile that is comprised of levels, components, and interactions that are important to understand, but statistically intractable to interpret at any isolated level of a system. Conventional statistical linear models for the observation of individuals and interpretation of health determinants are based on the measurement of individual-level variance and co-variance, employing assumptions that are grounded in sampling distribution theory. But, such conventions do not directly apply to multi-level systems research, which requires adjustment for error terms to account for data clustering at each system level.

In the absence of conventional theory to guide inference, research is intrinsically challenging to design, implement, and interpret. Figure 9.4 and Figure 9.5 illustrates elements of the challenges involved. This example, taken from the Ghana Essential Health Interventions Project, has a system of care that is posited to explain individual child survival as the outcome of influences of household characteristics and parental behaviour at the base of the diagramme. Survival is also influenced by household exposure to the service environment at the community, clinical, and hospital levels, termed “A”, “B” and “C” in the diagram, respectively. In this example, cluster sampling is employed so that clusters are exposed differentially to the climate of care at levels A, B, and C, and the survey is designed to repeat the use of baseline clusters at the endline, providing the machinery for the study of “strengthening” of service operations. GEHIP creates a treatment by purposeful assignment of four districts and all sample households into a unit of

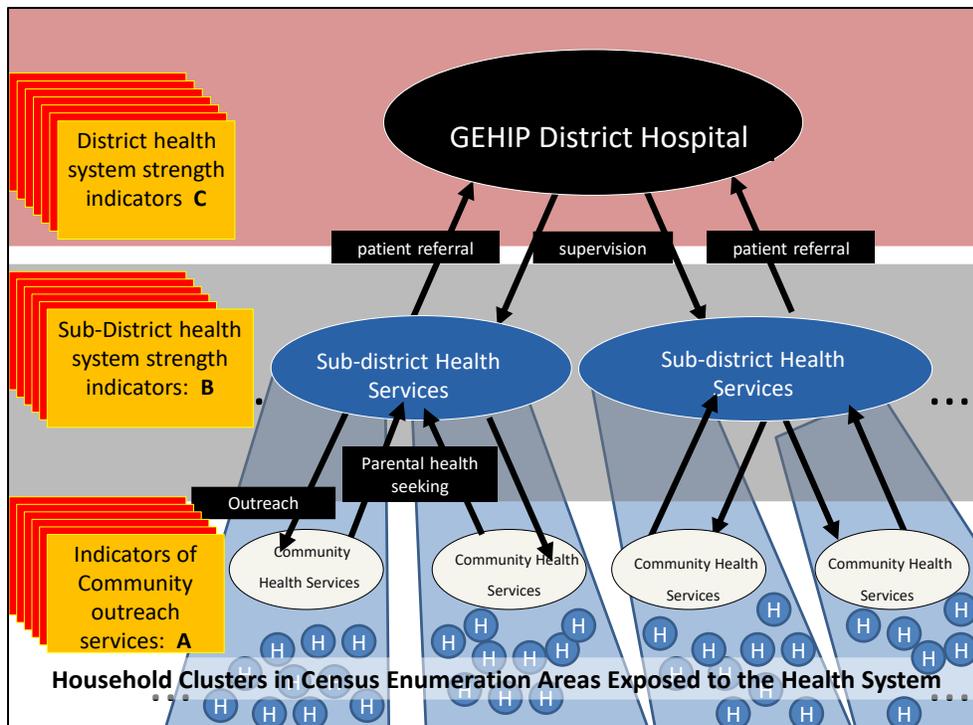
observation comprising four Level C care systems and corresponding levels B and A operations, with the counterfactual provided by care systems in seven contiguous districts. Consider the implicit challenges that arise from this design:



**Figure 9.4: Systems levels contributing to GEHIP Impact**

Individuals under longitudinal observation provide data that are “censored,” in that individuals can be lost to observation over time or observed to a point in time that is truncated by the data collection process. Analysts must resort to life table methods or “hazard models” that deal with this problem.

For systems to be the focus of analysis, information on the implementation of care at each level must be linked to individual children who are exposed to the climate of level A, B, and C care, each level of which is influenced by causal pathways or referral systems that link levels and define service circumstances. Since children are aging, and the impact of care affects ages differently, the aging process must be factored into the analysis, as well as ways in which the system at each level may be changing as age for each child progresses.



**Figure 9.5: Sources of systems data in the GEHIP Impact Analysis**

A further complication concerns the design of the four treatment versus seven district trial design, a number of units of observation at Level C that is statistically meaningless. Only rarely are resources available that permit Figure 9.5 observation on statistically meaningful sample sizes for units of observation corresponding to Levels A, B, and C. To be meaningful to policy makers, however, systems research requires units of observation that conform to units of programme organization, such as the district or sub-district, where workers are assigned as teams to provide health care as identifiable organizational units. In the absence of adequate statistical power at levels B and C, systems studies must be interpreted as “plausibility designs” that address the need for statistical methods to substitute for a theoretically rigorous counterfactual condition (Campbell and Stanley 1966, Habicht et al. 1999, Victora et al. 2004). Economists confront this challenge in the simplest form as “difference in difference” calculations that balance baseline and endline differences with subtraction, and test change in aggregate indicators of interest as a series of bivariate calculations.

#### **9.4.1.2 Limitations of unadjusted difference in difference evaluation.**

While the Heckman formula is widely applied, it has limitations for health systems research that require multivariate extension (Heckman and Hotz 1989). Variation in Y at various levels of the

system are potentially confounding and are not addressed. Moreover, utilization of results for interpreting systems effects requires a systems approach to the Heckman procedures (Bertrand et al. 2004, Meyer 2012). Thus, a regression extension of the Heckman procedure is used by GEHIP for the analysis of the three priority core indicators of childhood mortality.

#### **9.4.1.3 Multilevel analysis of the impact of Health System Strengthening on Survival**

GEHIP has used “multi-level discrete time hazard model survival analysis” for estimating the role of health systems as factors that affect health behaviour and survival. By controlling for baseline and endline conditions that are unrelated to interventions, multivariate models can execute the difference in difference formulation of (1) with multi-level adjustment for confounders. We embrace multilevel modelling because it allows us to exploit the natural hierarchy in our datasets and thus to identify or event to measure potential health system effects. The analysis in this study is restricted to three levels: Households, women and children (level 1) nested within census enumeration areas (level 2) which in turn is nested in a third level represented by the nearest fixed service facility (either CHPS zone or Sub-district Health Centers, level 3). Owing to the small number of districts available for the analysis, district was not employed in our models.

Census enumeration areas are used for defining areal units of exposure to GEHIP and CHPS services in the statistical analysis. Basic personal characteristics registered in the baseline and endline household surveys such as age, educational attainment, occupation, marital status, religion, and parity. These represent covariates at level 1. While these variables are important correlates of dependent variables, they collectively represent “nuisance” variables for multivariate analyses.

#### **9.4.1.4 Limitations of our regression models**

Although challenges associated with plausibility trials can be mitigated, fundamental limitations will remain:

- *Study duration and censoring.* GEHIP observed children who were ever under 60 months of age from the onset of interventions in 2011 to the time of the endline survey in December, 2014. Very few children are observed through childhood, limiting statistical power to gauge effects of interventions that affect late childhood. Children are “left censored” in the sense that all children observed in late childhood have survived infancy

before GEHIP began. Such children may not be fully representative of cohorts that would be observed if GEHIP had a longer period of observation.

- *Recall bias.* The retrospective assessment of child survival (birth and death dates) may be subject to recall bias. This would bias our results if there were differential rates of misreporting by exposure level. The trauma or stigma of losing a child may also lead mothers to not report some deaths. Or, children who die in early infancy and well into the past, may be forgotten or omitted as recalled births and deaths. Again, this could bias our results if it were differential by exposure level. Some evidence also suggests that women may under-report neonatal deaths or may misreport them as stillbirths, especially among deaths in the first 24 hours. In addition, by sampling living women of reproductive age, we miss the survival experience of children with deceased mothers. Given significant evidence of poor survival rates among this population, lead to an underestimate of childhood mortality.
- *Timing of GEHIP.* We have assumed that GEHIP was launched in all study areas on January 1, 2011. In fact, the initiative was phased in with a series of health systems interventions that accumulated with time and with varying intensity by study districts. The uniform start date assumption leads to error in the intervention term of regressions, artificially elevating standard errors and diminishing statistical efficiency. The simplifying assumption of a uniform start date will be replaced with an index of GEHIP exposure in future refinements of the models.
- *Missing data, power and instability.* If a case has an omitted variable or class of an indicator, it is excluded from the analysis, an approach that we term “complete case analysis.” This is tantamount to assuming that all such errors occur at random. In fact, omissions are associated with covariates and the omission process may bias results. Moreover, slight reductions that occur in sample sizes diminish statistical power and elevate standard errors. The alternative is to abandon the balancing contribution of socio-economic covariates, while estimating treatment effects with data on treatment exposure that are known to be complete. We term this “complete case analysis” which is a more conservative approach, with resulting estimation that produces slightly larger confidence intervals on all regression parameters.
- *Conditional hazard models.* The CHPS initiative is known to benefit older children more than infants through the beneficial effects of IMCI on acute respiratory infections. Regression procedures that deal with censoring assume that the functional form for risk,

term the “hazard function” is increased or decreased proportionally as a result of covariate effects. We test for a nonzero slope in regressing the scaled Schoenfeld residuals on functions of analysis time to evaluate the appropriateness of the proportional hazards assumption and the results confirm the hypothesis of age-GEHP conditionality.

## 9.5 The Estimation of GEHIP Results

To model child survival determinants with provision for multilevel effect, we accounted for the exact timing of interventions relative to the exact age of each individual child who may be exposed to GEHIP activities. Since health systems inputs may occur in comparison areas, models should adjust for their confounding effects. To address the complexities implicit in this problem, we appeal to a class of statistical models known as “multi-level discrete time hazard models (Barber et al. 2000).

Utilizing this procedure, GEHIP demonstrates the application of regression analysis to the refinement of the Heckman procedure, using merged baseline and endline data to estimate the net effect of CHPS exposure, adjusting for other health systems inputs in the Upper East Region over the past decade. By arraying survival data from baseline birth histories, and linking these histories with regional health administration records of the timing, location, and content of health systems investment, we demonstrate GEHIP exposure net effects and convert these effects into estimated month of age specific survival probabilities.

To estimate the impact of CHPS and GEHIP on under-five mortality ( $5q0$ ), we pursued three regression simplification models. Baseline and endline data were merged with the variable  $T=1$  for the endline and zero in the baseline. First, we estimate a spline model of  $5q0$  that is conditional on exact months of age of each child. This model has parameters that adjust for the fact that functional form for the odds of mortality differ for neonates, post neonates, and post infants, but these “hazards ratios” are linear in logit metric within these age segments. This produced a function with three corresponding age segments that we term  $A$  for exact age of child. Then, we assign a dummy variable to data source to indicate the timing of the interview, with  $T=1$  for endline data and  $T=0$  for baseline data. To capture the confounding effects of area and time, as in Heckman’s gross estimation as a net regression result, we estimate the net effect of a cluster that is in GEHIP areas, denoted  $G=1$  versus data from clusters that are in comparison areas,  $G=0$  for

the estimation of the main effects of G, controlling for baseline differences (T) and trends unrelated to GEHIP (the interaction of G and T). Since GEHIP may result in impact that is age conditional, we allow for this interaction. Household characteristics comprise a vector of baseline and endline variables that are collectively nuisance parameters. The general discrete time multi-level age conditional hazard model is thereby:

$$\text{Logit}(q) = f\{A, T, G, AG, TG, H\}$$

(2)

By implication, the net effect of GEHIP is gauged by assessing the effect of G and T independently and jointly. CHPS exposure is both a confounder, in the sense that we want to know if GEHIP has an impact over and above CHPS as well as a substantive variable that is an outcome of GEHIP exposure. G in model (2) includes direct effects of GEHIP as well as the effect that GEHIP has had on CHPS coverage. To gauge this net effect of GEHIP activities, independent of its impact on CHPS coverage, we first estimate model (2) and then supplement it by adding a function defining household exposure to CHPS, C. Estimated separately, again using spline modeling, we determined that households within 4 kilometers of a CHPS facility have equivalent patterns of childhood survival, but logit linear diminishing survival as household distances increase. In our model, we refer to this CHPS exposure function as C and estimate net effects as Model (3):

$$\text{Logit}(q) = f\{A, T, G, AG, TG, C, TC, GC, TCG, H\}$$

(3)

Model (3) estimates the direct effects of CHPS with parameters for over 4 kilometer effects as the direct effect, and under 4 kilometers as an omitted class in the regression estimation. To simplify the interpretation of results we extract the average treatment effects of G we use the parameters of (2) and (3) together with mean values of variable in the models to show the overall “Average treatment combined effects” of G, C, and T as a linear combination of effects of interest (G, TG, C, TC, GC, and TCG) that define the plausibility that GEHIP has saved lives.

## 9.6 Results: The impact of GEHIP on survival

### 9.6.1 Infant mortality

Table 9.11 presents the difference-in-difference multilevel regression analysis of infant mortality comparing the pre-2011 period with the post-2011. Model 1 is the crude model where no covariates are included in the model. The model 1 simply compares the baseline mortality differences between the treatment and control arms and differences between the pre-2011 and post-2011. Results show that while there were no statistically significant differences in infant mortality between treatment and control districts at baseline, reductions in infant mortality were observed in both arms of the trial post-2011 compared with the pre-2011 period. However, the treatment districts recorded a much higher reduction in infant mortality between the pre-2011 and post-2011 periods over and above the reduction in the control districts by about 51 percent (HR=49). However, this reduction is statistically significant as a *one tailed* test.

Model 2 introduced various controls, except the distance to nearest CHPS variable, as observed from the table. Introduction of the controls which are expected to purge the mortality effect of the confounding effects of those variables saw a slight marginal reduction in the difference-in-differences estimate (HR=0.56). However, effect of the confounding variables did not change the direction of the results. Model 3 added the distance to CHPS variable but the story basically remained the same. However, it is important to point out that infants who are located less than 4 kilometres to a CHPS compound are better protected compared to those located 4 kilometres or more from the nearest CHPS compound (the HR 0.84 but not statistically significant).

Other factors that affect infant mortality include birth outcome type, period of gestation, parity and household socioeconomic status (SES). Children born out of pregnancies that result in multiple births (twins or otherwise) are significantly at higher risk of mortality relative to those born as singletons, controlling for all founding variables (Models 2 & 3). Also, children whose gestation period was less than 9 months have a significantly much higher risk of mortality compared to those whose gestation was 9 months, controlling for all confounding factors.

**Table 9.11: Difference-In-Difference Multilevel regression results of Infant mortality during the period prior to, and after 2011**

Covariate	Infant mortality					
	Model 1		Model 2		Model 3	
	HR	95% CI	HR	95% CI	HR	95% CI
Control districts	1	Ref	1	Ref	1	Ref
Treatment districts pre 2011	1.22	(0.89, 1.67)	1.06	(0.75, 1.49)	1.05	(1.06, 1.05)
Treatment districts post 2011	0.99	(0.67, 1.48)	0.85	(0.56, 1.31)	0.92	(0.85, 0.92)
Treatment X post 2011	0.49	(0.23, 1.05)	0.56	(0.25, 1.26)	0.57	(0.26, 1.28)
Nearest CHPS ≥ 4 km					1	Ref
Nearest CHPS < 4 km					0.84	(0.65, 1.07)
Sex= Male			1	Ref	1	Ref
Sex: Female =1, zero otherwise			0.82	(0.63, 1.07)	0.82	(0.63, 1.07)
Birth= Singleton			1	Ref	1	Ref
Birth=Multiple			3.36***	(2.17, 5.18)	3.37***	(2.19, 5.20)
Gestation= 9 months			1	ref	1	Ref
Gestation< 9 months			3.85***	(2.06, 7.20)	3.90***	(2.10, 7.25)
Birth spacing ≥ 24 months			1	ref	1	Ref
Birth spacing < 24 months			1.49	(0.98, 2.25)	1.48	(0.98, 2.25)
Maternal age= 15-20			1	ref	1	Ref
Maternal age= 20-34			1.02	(0.64, 1.63)	1.03	(0.64, 1.65)
Maternal age= 35-49			1.69	(0.96, 2.96)	1.73	(0.98, 3.04)
Parity=Nulliparous			1	ref	1	Ref
Parity=Primipara			0.94	(0.58, 1.52)	0.94	(0.58, 1.51)
Parity=Multipara			0.77	(0.50, 1.18)	0.77	(0.50, 1.18)
Parity=grand multipara			0.59	(0.34, 1.00)	0.58*	(0.34, 1.00)
Unmarried			1	ref	1	Ref
Polygynous			0.93	(0.63, 1.37)	0.93	(0.63, 1.38)
Monogamous			0.85	(0.59, 1.24)	0.86	(0.59, 1.25)
Religion=Traditional			1	ref	1	Ref
Religion=Christianity			1.30	(0.76, 2.21)	1.30	(0.76, 2.22)
Religion=Islam			0.71	(0.41, 1.25)	0.70	(0.40, 1.22)
Religion=other/none			1.96	(0.88, 4.34)	1.94	(0.87, 4.30)
Maternal education=none			1	ref	1	Ref

Maternal education =some		1.32	(0.95, 1.83)	1.34	(0.96, 1.86)
SES=Poorest (Q1)		1	ref	1	Ref
SES=Poor (Q2)		0.71	(0.41, 1.24)	0.72	(0.42, 1.26)
SES=Better (Q3)		0.66*	(0.44, 0.98)	0.66*	(0.44, 0.98)
SES=Less poor (Q4)		0.91	(0.62, 1.34)	0.91	(0.62, 1.33)
SES=Least poor (Q5)		0.65	(0.39, 1.08)	0.65	(0.39, 1.09)
Nearest Health Facility (km)		1.03	(0.98, 1.08)	1.03	(0.97, 1.08)
Person-months	172146	164383		164383	
	-	-		-	
Log-Likelihood	1809.40	1650.66		1649.95	
Chi-squared ( $\chi^2$ )	53.62	326.73		344.15	

\* p < 0.05 \*\* p < 0.01 \*\*\* p < 0.001

a Time-varying covariate; distances tabulated for each household to nearest CHPS facility for every month from 2000 – 2014

b Self-reported length of pregnancy

c Spacing measured as months since previous birth (nulliparous births coded as greater than 24 months).

## 9.6.2 Neonatal mortality

Table 9.12 reports results of the analysis of neonatal mortality. Odds ratios of logistic regression analyses are presented for a “crude” model with intervention and post-intervention effect only along with a separate regression with a full range of covariates. Results of the interaction term are not significant. The time effect shows that neonatal mortality declined, but the result is significant as a one-tailed test only owing to the very substantial standard error associated with this effect. We believe that the aggressive scaling up of GEHIP in comparison areas may have diluted estimation of project effects. However, this merits further investigation. From the results reported in Table 9.12, there is no statistical basis for concluding that GEHIP has had a population level impact on neonatal survival.

**Table 9.12: Multiple logistic regression analyses of Neonatal mortality**

		Crude		Adjusted	
		HR	95% CI	HR	95% CI
Intervention	Comparison	1	Ref	1	Ref
	Intervention	1.08	(0.67, 1.75)	1.03	(0.60, 1.77)
Pre-2011	Baseline	1	Ref	1	Ref

	Endline	1.16	(0.75, 1.79)	0.43	(0.17, 1.06)
	intervention * endline	0.59	(0.30, 1.18)	0.80	(0.38, 1.67)
Sex	Male			1	Ref (0.33, 0.74)
	Female			0.50***	
Multiple	Singleton			1	Ref (0.60, 1.64)
	Multiple			0.99	(0.20, 0.66)
Parity	Nulliparous			0.37***	(0.17, 0.65)
	Primipara			0.33**	
	Multipara			1	Ref (4.12, 35.2)
Marital Status (maternal)	grand multipara			22.32***	
	Unmarried			1	Ref (0.59, 2.17)
	other wives			1.13	(0.42, 1.11)
Religion (maternal)	Monogamous			0.68	
	Traditional			1	Ref (0.61, 2.39)
	Christianity			1.21	(0.57, 2.68)
	Islam			1.23	(0.61, 5.25)
Education (maternal)	other/none			1.79	
	no education			1	Ref (0.64, 1.47)
Wealth (maternal)	some education			0.97	
	Poorest (Q1)			1	Ref (0.59, 2.37)
	Poor (Q2)			1.19	(0.72, 2.64)
	Better (Q3)			1.38	(0.43, 1.84)
	Less poor (Q4)			0.88	(0.79, 3.32)
	Least poor (Q5)			1.62	(0.98, 1.17)
Nearest Health Facility (km)				1.07	(0.99, 1.02)
Time (months)				1.01	
Observations		6819		6519	
Log-Likelihood		692.53		-493.92	
Chi-squared ( $\chi^2$ )		3.01		326.13	

**Note:** Logistic regression models of probability of death before 1 month adjusted for clustering within enumeration areas using robust standard errors and the sandwich operator.  
\* p < 0.05 \*\* p < 0.01 \*\*\* p < 0.001

### 9.6.3 Under Age Five Child mortality

As is the case with infant mortality, Table 9.13 reports results of the Difference-In-Differences multilevel regression analysis for under age 5 childhood mortality ( $_{0q5}$ ).

The model (1) analysis showed that there was no difference in child mortality between the treatment and control areas at the baseline. However, there was a statistically significant reduction in child mortality between the pre-2011 period and post-2011, in both intervention and control areas. The difference-in-differences estimate shows that the reduction in child mortality was much higher in the treatment areas compared with the control areas (HR=0.633). This additional reduction is statistically significant, indicating that GEHIP had a gross effect that was approximately 37 percent greater than the decline in all areas combined.

In Model 2, we added all the controls just as we did for infant mortality above, except the distance to nearest CHPS variable. The results are essentially similar to Model 1, except for slight increases in the hazard ratios suggesting that the control variables attenuated the effects slightly. Significant covariates in the model include birth spacing, maternal age, and marital status. Children whose birth were spaced less than 24 months from a previous birth had an enhanced risk of child mortality (HR=1.44), relative to those whose birth spacing were greater than 24 months. Children whose mothers are in monogamous marriage are significantly less at risk of mortality relative to those whose mothers are in polygamous marriages.

Model 3 adds distance to the nearest CHPS compound in addition to all the variables controlled for in Model 2. This changes the fundamental storyline i.e. the change in child mortality during the post 2011 period is no longer a net effect. Rather, decline is associated with CHPS in both the intervention and comparison areas. The treatment effect is an interaction of GEHIP with CHPS, showing that GEHIP has no independent effect. The direct effect of CHPS proximity is quite substantial (HR=0.75). Health facility proximity in general benefits child survival, as shown by the positive hazard ratio indicating an inverse relationship between distance from household to facility and mortality risk. (HR=1.05).

Table 9.13 thus shows that GEHIP had a substantial effect, but this impact is wholly a consequence of the impact of GEHIP on CHPS coverage. By improving the proximity of functional CHPS to households, survival odds were markedly enhanced.

**Table 9.13: Difference-In-Difference Multilevel regression results of Childhood mortality during the period prior to, and after 2011**

Variable		(1) Model 1		(2) Model 2		(3) Model 3	
		HR	95% CI	HR	95% CI	HR	95% CI
Intervention	Comparison	1	ref	1	ref	1	ref
Period	Intervention	1.051	1.293)	0.949	1.188)	0.931	1.219)
	pre 2011	1	ref	1	ref	1	ref
GEHIP (DiD)	post 2011	0.706***	0.918)	0.742**	0.980)	0.805	1.224)
		1	ref	1	ref	1	ref
Nearest CHPS <sup>a</sup>	≥ 4 km	0.633*	1.021)	0.662*	1.082)	0.678	1.155)
						1	ref
Intervention × CHPS	< 4 km					0.747**	0.962)
Period × CHPS						1.018	1.402)
GEHIP × CHPS (DiDiD)						1.036	1.831)
Sex	Male			1	ref	1	ref
Multiple	Female			0.814***	0.936)	0.812***	0.935)
	Singleton			1	ref	1	ref
Gestation <sup>b</sup>	Multiple			4.034***	5.295)	4.064***	5.321)
	9 months			1	ref	1	ref
Birth spacing <sup>c</sup>	< 9 months			4.833***	7.147)	4.892***	7.195)
	≥ 24 months			1	ref	1	ref
Maternal Age	< 24 months			1.455***	1.767)	1.438***	1.748)
	15-20			1	ref	1	ref
Parity	20-34			1.020	1.347)	1.038	1.367)
	35-49			1.084	1.564)	1.135	1.644)
Nulliparous				1	ref	1	ref
	Primipara			1.046	1.325)	1.044	1.321)
Multipara grand multipara				0.779*	1.016)	0.785*	1.021)
				0.705**	0.972)	0.698**	0.962)
Marital (maternal) Status	Unmarried			1	ref	1	ref
	other wives			0.896	1.136)	0.894	1.133)
Education (maternal)	Monogamous			0.748***	0.933)	0.759**	0.948)
	no education			1	ref	1	ref
Wealth (maternal)	some education			0.974	1.198)	1.007	1.237)
	Poorest (Q1)			1	ref	1	ref

	Poor (Q2)	0.826	(0.608 1.122) (0.754	-	0.839	(0.615 1.145) (0.747	-
	Better (Q3)	0.925	1.136) (0.761	-	0.921	1.135) (0.743	-
	Less poor (Q4)	1.002	1.319) (0.745	-	0.981	1.294) (0.739	-
	Least poor (Q5)	0.945	1.198) (1.015	-	0.937	1.187) (1.014	-
Nearest Health Fac. (km)		1.052***	1.090)	-	1.053***	1.093)	-
Observations	631,197	631,197			631,197		
No. Subjects	14809	14809			14809		
No. Clusters	66	66			66		

## 9.7 Conclusion

The statistical evaluation of GEHIP has proceeded with a logic that is directed to overcoming the challenges of plausibility inference. First, we examined bivariate differentials and established that the treatment and comparison areas differ markedly, and that these contextual differences could confound inference. Simple procedures for addressing confounding were imposed on the data, the commonly used Heckman “difference in differences” method for comparing treatment and unexposed areas over time.

Results showed that core and common indicators changed in the study period, in all likelihood because leadership and implementation capacities of GEHIP applied to a significant degree to comparison areas, as well. Once proven and life-saving neonatal survival interventions were launched, they were spread to comparison areas, quite possibly contributing to mortality reductions that are observed in treatment and comparison districts alike. Indeed, crude tabulations are spuriously suggestive of null effects (Table 9.14):

**Table 9.14: Baseline and endline raw data for the probabilities of childhood mortality in Intervention and comparison districts of the GEHIP project.**

	Baseline	End line
All districts	65 deaths per 1000 livebirths	46 deaths per 1000 livebirths
Intervention districts	64 deaths per 1000 livebirths	45 deaths per 1000 livebirths
Comparison districts	68.6 deaths per 1000 livebirths	48 deaths per 1000 livebirths

Our regression refined difference in differences analysis showed that the increase in the “Average Treatment Effect” of GEHIP on delivery by trained professionals was associated with improvement and that antenatal care continuity and immunization continuity improved with GEHIP exposure. Contraceptive use increased, but nearly all of this effect was limited to women under age 30 and all fertility decline that is GEHIP related was registered among young women under age 30. While reproductive change effects of GEHIP merit further investigation, results are modest rather than transformative, indicating a need for strategic development of CHPS as a family planning programme.

To pursue the plausibility of impact, we examined the impact of SERC on the climate of clinical care. Results show that referral care shifted the location of emergency services to points of care where intervention could be competently provided. This impacted on maternal and neonatal survival among facility based clientele. However, statistical investigation of the population impact of this strategy are unconvincing, largely because neonatal mortality declines in the region are substantial, and the incremental impact of GEHIP is masked by “strategic contamination.” Once strategies were operationally functioning, the Regional Health Administration with support from UNICEF and core GHS resources, pursued relentless policies of scale-up.

Yet, despite the challenge of operational contamination, we have concluded that GEHIP saves childhood lives. As the results showed, GEHIP fostered the implementation of “functional CHPS.” In this approach, service delivery and community-based care has been the focus of implementation rather than the construction of costly health posts or investment in expensive equipment. Such investments are needed to ultimately sustain CHPS as a programme of care, but the need for these investments should not pose a barrier to getting CHPS started. Statistical evaluation shows that household proximity to CHPS is associated with mortality reduction. And, community exposure to GEHIP is associated with accelerated CHPS implementation. While we have no evidence that GEHIP has had an impact that is independent of CHPS, results show that the impact of GEHIP on the coverage of CHPS has saved lives. Models that we have estimated are conservative, not as yet allowing for the age conditionality of GEHIP or areal variance in the timing of start-up activities, but results are significant and merit policy review.

**Part III:**

**GENERAL DISCUSSIONS, CONCLUSIONS AND  
RECOMMENDATIONS**

## **10 General Discussions**

The detailed discussions of the main findings of the various components of this dissertation as it relates to the Ghana Essential Health Intervention Project are found in each of the respective chapters. This section summarises some key issues, discusses how they were addressed, lessons learnt and implications for health development in Ghana and beyond.

### **10.1 Community-based Health Planning and Services**

A number of events lead to the implementation of the GEHIP in Ghana's Upper East region. The adoption of Ghana's Community-based Health Planning and Services (CHPS) in 1999 was aimed at improving access, equity, efficacy, quality and sustainability of primary health care and the achievement of universal health coverage. Although CHPS became the country's official strategy for providing essential primary health care and reproductive health services to communities, there were major bottlenecks that prevented CHPS from achieving its potential countrywide. CHPS scale up as a national programme was extremely slow and constrained by a variety of factors namely service delivery, manpower, communication, logistics, resource management, and leadership bottlenecks. Planning CHPS activities at the district level lacked appropriate tools for enabling managers to implement strategies that for example, respond to actual need, while a number of proven interventions were never introduced into the programme. GEHIP became the response to these implementation bottlenecks. It provided a set of systems development agenda and the operational design which was launched in the Upper East Region of Ghana in 2010 and aimed at addressing the CHPS implementation and scale-up challenges. Figure 10.1 recaps a synopsis of the history of this evidence-driven programme development.

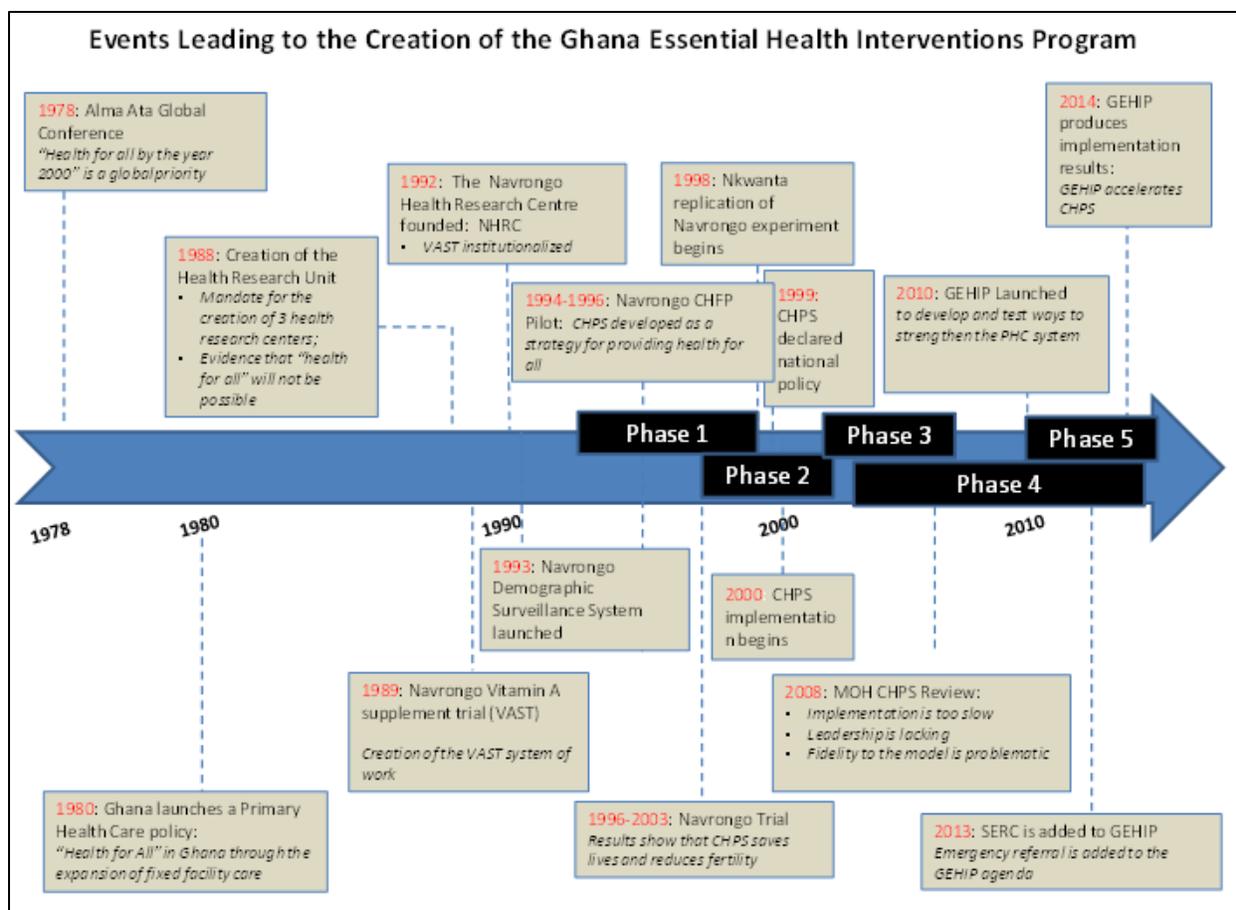


Figure 10.1: Events leading to the creation of the Ghana Essential Health Interventions Project

## 10.2 The Ghana Essential Health Intervention Project

GEHIP interventions were focused on priority activities that spanned all six WHO building blocks of health systems strengthening (World Health Organization 2007) and focused on developing district leadership, planning, and implementation capabilities. The key interventions were in six critical areas:

- i) Expanding the range of community-based services to improve newborn care and introduce emergency referral systems,
- ii) Retraining frontline workers, with particular focus on expanding the range of volunteer-provided care,

- iii) Simplifying the collection of health information and introducing data utilization procedures,
- iv) Ensuring worker access to essential equipment and supplies,
- v) Developing mechanisms for improved budgeting and financial management and
- vi) Augmenting flexible financing with \$0.85 per capita for three years in conjunction with training district leaders in multi-sectoral approaches to CHPS implementation leadership.

GEHIP intervention model was developed not only with a theoretical perspective on how systems reform can improve survival, but also with a framework for knowledge management with strategy for translating outcomes into national programming. The model was built upon the framework proposed by WHO for defining the essential and interlocking elements of any fully functioning health system (WHO 2007, DeSavigny and Adam 2009) The fact that the system in Ghana requires “strengthening” was not a matter of debate. As already indicated, Ghana has a comprehensive primary healthcare programme that provides a wide range of essential preventive and curative services. However, the sub-systems of this programme have gaps in the services they provide and flaws in their operational structures that are preventing them from achieving their full potential.

### **10.3 What did GEHIP do?**

GEHIP was grounded in the challenge of solving practical problems of CHPS, assessing the impact of doing so, and positioning results to impact on policy. With a knowledge management design in mind, the study acknowledge the fact that dissemination alone will not change the way that the programme works at scale and therefore developed capacity for ensuring community and grassroots political engagement for expanding resources for health. It also created a multi-faceted programme of knowledge sharing, ownership assurance as well as exchange and participatory learning. Core GEHIP intervention strategies (discussed in detail in previous chapters) lead to successful outcome of the project.

A number of things were done. The project applied integrated package of strategies for leadership capacity buildings to community and political engagement, training capabilities of district teams,

evidence-based budgeting, evidence-based decision-making and catalytic funding for CHPS strengthening. It also provided strategies for improvement in essential health services, information for decision making, emergency transportation and referral innovations. One innovation was the provision to each participating intervention districts supplemental funding over a three year period. This fund enabled district team appropriately focused on CHPS start-up and community engagement activities.

Classroom in-service training sessions for health staff for example were minimized and instead systems strengthening activities including peer-exchanges that demonstrated teamwork, mentorship and coaching were launched. These in conjunction with community-engaged frontline worker training demonstrated practical learning and task planning. Emergency referral capacity was instituted with an approach that links health worker training to community volunteer mobilization and information support. The outcome was an approach that integrated services and expanded the coverage and quality of health services and responsiveness to emergency care needs.

Popularity of health services development was demonstrated in ways that built political commitment to leveraged financing of health sector investment in CHPS by linking grassroots politicians to communities. The result of this was a politically inspired development investment and sustained diplomatic support for health system development that transformed CHPS implementation.

In strengthening essential community-based services provided by Community Health Officer (integrated management of childhood illnesses, ante-natal and post-natal care, family planning services etc.), frontline workers were equipped and trained in triage and emergency management to prevent neonatal mortality and save newborn lives. Significant attention was devoted to developing service quality by launching health and mortality audit within the study areas. Health care workers were trained in risk identification, newborn resuscitation, community-engaged kangaroo mother care while skills of community volunteer were upgraded in the management of childhood illnesses.

To address complex paper registers that lacked the provision for feedback, information for decision making was reformed during the study by simplifying information tools for frontline workers, improving data utilization procedures, and supporting supervisory decision-making. In

addition, a knowledge management for decision-makers was established which compiles and disseminates lessons learned to managers at all levels of the health care system.

To improve budgeting for health sector financing and build district capacity for budgeting and planning, a tool was developed (DiHPART) for the allocation of resources according to actual need so that budgeting is linked to the relative burden of disease. The benefit associated with this tool was the strengthening of community and district leadership involvement in CHPS financing.

As a means of strengthening leadership, governance, and accountability, the study employed leadership demonstration strategies for engaging teams of political, traditional and health system leadership into a system of collaborative observation, participatory problem solving and peer learning. This allowed for the expansion of development sector investment in CHPS scale-up.

## **10.4 GEHIP Results and Lessons learned**

GEHIP was aimed at testing the hypothesis that health systems strengthening at the district level will accelerate progress with achieving or surpassing MDG 4 among individual children. Strengthening the health systems as designed by GEHIP, is complex, multidimensional, and involves various health sector players – leadership and governance, workforce performance, information generation and utilization, health financing, essential drug supply and overall performance. To assess the overall impact of GEHIP thus requires a careful, systematic and coherent evaluation and analytical procedures for monitoring the performance of the health systems.

Testing the hypothesis that “health systems strengthening” can improve childhood survival requires the elements of the design and procedures for monitoring health and demographic endpoints. Essentially, three sources of data were required for monitoring and evaluating the performance of GEHIP: i) information on facilities, investments, and capacity that serves the needs of a defined population ii) information on access to such facilities, with distance as a possible proxy, iii) household level information on exposure to services and outcomes posited to be associated with this exposure and other individual level information on parental characteristics of a household survey at baseline and at the end of project.

GEHIP was designed to accommodate systems analyses that bring into account the multi-level aspects of the administrative hierarchy of the project, the research and the health and survival implications of household exposure to services at different levels of the health delivery system. While we aimed at assessing general impact, we also examined the relationship between health systems inputs and strength, with individual parental health seeking behaviour (Chapter 9). This required instruments for capturing systems changes over time, exposure to the system in the community and in facilities, and implications of these exposures to the health and survival of children.

Both qualitative and quantitative survey research methods were employed in assessing GEHIP impact. The result is the analysis of merged cluster data from a baseline and endline survey and linked longitudinal monitoring data. A multi-level systems analysis assessed the net impact of enabling systems strengthening activities on improvements in childhood survival over the five year period. Procedures aimed to determine if the accelerated pace of implementation of community-based care has saved childhood lives and if manpower and other interventions have had value added, over and above the impact of CHPS expansion.

Prior to the deployment of the GEHIP interventions, a baseline survey was conducted to establish the baseline demographic and health characteristics of the study area in the Upper East Region. The survey was implemented in both the intervention and comparison districts (Chapter 3). This survey was a random probability survey covering a sample size of 6000 women in a total of 66 clusters in both the intervention and comparison districts (Chapter 9).

In summary, the results of the baseline survey portrayed the study setting as a typical poor and rural African setting with 87 percent of respondents living in rural settlements while 13 percent live in urban settlements. The survey revealed that the majority of respondents are engaged in peasant agriculture (35.5 percent) while, as high as 60.8 percent of the respondents did not have formal education. This low level of formal education has profound implications on female empowerment and health development. Social and demographic features of the survey respondents of interest include age structure (more than half (52.5%) of the respondents are younger than 30 years old), marital status (66.2% are married), religious affiliation, education and occupational status. The total fertility in the study setting is 5.4 and the infant mortality rate and child mortality rate is 61 and 35 per 1000 respectively. These variables were critical in understanding and interpreting the core demographic and health outcomes of interest in the study.

In conjunction with economic monitoring, GEHIP compiled health systems indicators that define the management, resource, and leadership context of care. Programme records used include an M&E tracking system, programme records for emergency referral system and the District Health Information Management System (DHIMS) which is the national Ministry of Health mandated platform for managing facility data. For analyses requiring service statistics data, DHIMS data were extracted, organized and examined to detect trends in facility-level outputs vis-à-vis exposure to connect inputs at the community level. Overall, the results of this study offered important lessons for health development in Ghana and beyond.

Community-based primary care programmes are becoming a priority in global health interventions. However, little is known about the potential implementation barriers within these programmes and what can be done to improve programmatic effectiveness and scale-up. Using in-depth interviews the study identified barriers to the successful implementation and scale-up of CHPS and strategies adopted to confront those barriers. Major constraints to CHPS scale up were identified to include inadequate human resources, lack of transportation and logistics, poor and inadequate infrastructure, inadequate funding and unpredictable funding bottlenecks. Results also identified strategies employed by staff in confronting these barriers (Chapter 4) --leadership, facilitative supervision, engaging communities for support, and leveraging local political support.

An important lesson from the results of the study was that in addressing health system challenges, there cannot be a single solution. Implementation of community-based primary care programmes must continuously take into account the complex nature of health systems and in ensuring effective health system development, emphasis must be placed on engaging communities in the implementation process with increased collaboration with local political bodies. Doing so expands grassroots political support for CHPS that can generate catalytic development sector investment in start-up costs.

By providing catalytic revenue of \$0.85 per capita per year to intervention district managers for three years, and in conjunction with implementation of strategies for comprehensive leadership development, community partnership and monitoring systems, results showed that GEHIP successfully accelerated CHPS implementation, starting from a low level coverage when the project started in 2010. GEHIP achieved 82% coverage of the total population with community service activities in intervention areas and corresponding to 100 percent of the targeted rural population reached by routine CHPS services in its four intervention districts within four years (Chapter 5).

The study results showed that GEHIP strategies have improved the range and quality of primary health care services, maternal and newborn care and the development of sustainable referral services. Critical emergency referral services are now widely available, and the scope of care provided by frontline workers broadened to include a range of life-saving skills for mothers and newborns. Strategies adopted have added elements that have been missing from CHPS in the past. The catalytic financing combined with strategies for community-engaged celebration of CHPS implementation milestones and the engagement of traditional leaders and grassroots politicians in programme implementation activities resulted in prestige and community recognition for their commitment and leadership. Taken as a package of activities and capabilities, GEHIP has accelerated CHPS coverage and achieved universal healthcare (UHC) in the challenging context of the Upper East. This success therefore represents the initial stage of a national programme for strengthening community health systems in Ghana.

Projects often end with a dissemination activity and an end to funding arrangements that dissipates teamwork and dilutes prospects that the project will impact on the way that large scale programmes actually work. To avoid this pitfall, GEHIP was designed, with terms of reference to the policy establishment, to anticipate scale-up, ownership and strategic integration. It was a study for reforming CHPS rather than proving that community-based care can impact on health, thus has successfully tested ways to improve the utilization of research. The results will guide the national CHPS reform having been successful in identifying strategies for solving the CHPS scaling-up problem.

Allocation of scarce resources available to district-level health managers often proceeds without consideration of the priority needs represented by the burden of disease (BoD). The introduction of the District Health Planning Analysis and Reporting Tool (DiHPART) was to address service delivery gaps and reduce maternal and under-five mortality. The tool provided district managers with a planning tool for allocating healthcare resources according to prevailing BoD and fostered evidence-based healthcare planning and decision making. It facilitated informed resource allocation and prioritisation of budgets and assisted and equipped district managers with limited planning skills with evidence-based indicators of the quality of resource allocation goals.

Despite the technical shortcomings with DiHPART, study results provided evidence for an improved budgetary decision-making tools to enhance the efficiency and effectiveness of health systems, especially in low-income settings. Such tools have great potential to improve district level health operations, and ultimately the health of the population they target to serve. The study

results lend support to the notion that evidence-based budgeting merits development and implementation in Ghana.

The Sustainable Emergency Referral Care (SERC) as part of the study tested the hypothesis that context-specific, community and sub-district level interventions designed to strengthen emergency referral systems will improve access to emergency care in rural, impoverished communities in Ghana. Using mixed methods implementation research, the study allowed for enriched learning around SERC, its scalability, acceptability and potential impact. Results showed that the strategy is highly regarded and appreciated by the communities and saves lives (see Chapter 8). SERC has demonstrated that successful implementation in severely resource-constrained settings depends upon systematic investigation of the appropriate equipment for the context, clarification of the appropriate strategies for social engagement in the sustainable deployment of equipment, and trial of all manner of procedural detail in rolling out an effective transportation system of care.

## **10.5 Limitations and Challenges**

Overall, there are certainly several limitations to this work that made it not possible to make reliable conclusions on some aspect of GEHIP, admitting fully that systems research is complex.

First and foremost is the complications to the design that provide challenges. Different GEHIP interventions started at different periods in different non-randomized localities. For example CHPS expansion started before SERC in most intervention districts while IMCI start dates were different from SERC start dates; volunteer IMCI was extended to comparison areas upon completion of intervention area training.

Second is the “plausibility problem”. GEHIP is not a “true experiment” and this confronts the project with various statistical challenges. The project was confronted with a multilevel problem as GEHIP was embedded in different levels of the health care system namely the community, the sub-district and the district while survey research was within household clusters in census enumeration areas as unit of analysis at the community level that are exposed to the health care system. There was also the timing problem as GEHIP activities are being phased in over time in both intervention and comparison areas. In this regard, children at various ages are exposed to

the implementation of activities as they are born or age and this have to be factored into the analysis.

# 11 General Conclusions and Recommendations

## 11.1 General Conclusions

The Ghana Essential Health Intervention Project (GEHIP) represents a successful Ghana Health Service demonstration of strategies for reforming the Upper East Regional health service system that are potentially relevant to national primary health care programming. The process employed represents a paradigm for researchers, policy makers and managers to collaborate in the design, conduct, and interpretation of a successful experiment for strengthening Ghana's Community-based Health Planning and Services (CHPS) initiative. This strengthening of the health system was achieved through an inspired programme of applied learning, team problem solving, peer-mentoring, incentivizing financing for improving basic equipment requirements, and technical training that strengthens the health system at all levels. While the paradigm is complex to describe, it represents an approach that can be facile to demonstrate and feasible to replicate.

CHPS was launched in 2000, amid well-founded policy commitment to putting Navrongo findings to work. While it remains as a signature achievement of the GHS, Ghana has struggled to bring primary health services to all who need them, largely because practical strategies for developing leadership and support systems at the regional, district, and sub-district levels have been neglected or isolated from the ideational leadership of academic and national champions of the CHPS concept. As a result, conceptual leadership at each level of the system has lacked coherence, and scale-up of the approach has been unacceptably slow, with the consequence that the provision of health services from the district and sub-district level through to the community level has remained fragile, and health outcomes remained needlessly poor. In particular, district-level leadership gaps have had consequences that cascade to the community level. The lack of a strategic understanding of the CHPS implementation process among district managers hampered the expansion of facilities. Likewise, implementation of new technologies and improved competencies has tended to depend on formal training, often without adequate attention to practical challenges to implementing essential tasks or coordinating innovations. Organizing effective teamwork, which is vital to systems implementation was neglected. Of the major shortcomings of the national rollout of CHPS was a lack of a link between leadership and professional training programmes and the organizational support that national leaders provide for the support, deployment, and supervision of community health workers. Limitations of this counter-systemic approach to CHPS leadership training were abundantly evident. Over time,

critical components of CHPS implementation were neglected because many national, regional and district managers and implementation leadership teams either lacked the basic understanding of the critical components of CHPS support systems as originally designed or lacked systems thinking and key elements of systems support. Yet, according to policy, CHPS is fundamental to achieving the longstanding national goal of “Universal Health Coverage” (UHC).

So despite compelling evidence that CHPS can save lives and impressive investment of Government of Ghana resources in manpower expansion, equipment, and community facilities, the pace of the CHPS programme implementation was unacceptably slow. Community-engagement has been neglected, with programmes for facility development relying more on contractors than on community commitment to make services work. Rather than incentivizing community action by targeting construction on communities that implement the programme, construction has become a substitute for community-engaged launching of interim facilities for functional CHPS care. Long waits for construction resources translate into a major barrier to making functional CHPS happen. As a consequence, manpower for community services has been expanding faster than the availability of facilities where workers can be posted. The core problem therefore constraining effective scale-up of CHPS concerns fidelity of implementation to key operational innovations of the Navrongo Project that were grounded in community engagement.

GEHIP was organized in a way to prevent the fidelity problem with a sustainable programme of basic innovations, and pursued a health systems strengthening innovations with capacity building and knowledge management capabilities that ensure long term implementation needs. GEHIP indeed has demonstrated practical means of solving these problems. The main conclusions drawn from the GEHIP project were:

*CHPS expansion:* At low cost, with “catalytic financing” of \$0.85 per capita per year for three years, CHPS coverage accelerated leading to 82% of the expected 80% CHPS coverage in GEHIP intervention areas.

*Leadership and Governance:* There was a strong and visible regional and district leadership for programme management together with effective political and social engagement. In addition, efficient management of the catalytic financing and health financial resources and budgeting using DiHPART tool accounted for the successful CHPS expansion in intervention districts.

1. *CCHPS impact in childhood survival*: CHPS coverage accelerated improvement in childhood survival, thereby providing evidence that GEHIP was successful and merits national scale-up. GEHIP had a significant impact on under-five mortality resulting in a 30% reduction in under-five mortality in intervention areas relative to levels in non-intervention districts.
2. *Saving newborn lives*: Neonatal and infant mortality declined very substantially. This decline may have been related to newborn interventions that GEHIP accelerated in both intervention and non-intervention areas.
3. *Sustainable Emergency Referral Care*: CHPS alone does not reduce maternal mortality. But adding “Sustainable Emergency Referral Care” saves maternal lives signifying that referral service development has had its intended impact.
4. *Family planning*: Contraceptive prevalence rate increased in both intervention and non-intervention areas but significantly higher increase of 35% in intervention areas
5. *Total Fertility Rate*: Total fertility rate reduced slightly in both GEHIP and non-GEHIP districts but more in GEHIP intervention districts. However, while we observed this fertility effect, the level is still high among women over the age of 30 years
6. *Systems learning and thinking*: Systems learning, thinking and action was essential to the CHPS result. CHPS was developed as a community-focused approach. Policies, manpower training and deployment investment and action has ignored district leadership and community engagement as essential components. GEHIP addressed this challenge with impressive results.

## **11.2 Recommendations and the Future: Beyond GEHIP**

GEHIP has been a successful “proof of concept” plausibility trial. The big question is what does one do with success? Proving a concept does not prove that it can impact on national programming; nor does a trial clarify the operational requirements of scale-up. There is a need to redirect investment into low cost and effective alternative strategies for expanding CHPS operations that have been demonstrated by the GEHIP project in the Upper East Region, but will remain confined to that region unless scaling up strategies are developed and tested. After six years of implementation, monitoring and evaluation results have demonstrated that GEHIP is

feasible and an effective means of accelerating the expansion of CHPS coverage in the intervention districts compared to comparison districts resulting in 30 percent reduction in under-five mortality in intervention areas relative to levels in comparison (non-intervention) districts.

Based on this success, a new Ghana Health Service initiative is envisioned that will be an implementation research project that develops and tests GEHIP's strategy for scaling up community-based primary health care in Ghana. This new programme will be named CHPS+ to connote an enhanced approach to CHPS implementation and will draw upon lessons from GEHIP that could enable the Ghana Health Service to accelerate CHPS scale-up. CHPS+ will not only emphasize its link with existing national CHPS policy, but an added value as a programme with new system strengthening components. As such, GEHIP will function as a strategic template, providing guidance on how to achieve total CHPS coverage with minimal delay in Ghana. This new programme will be informed by the phased implementation of processes and guided by a rigorous system of monitoring and evaluation.

It is expected that the new programme "CHPS+" will fill an information gap in primary health care development in the rest of Ghana. It will test a means of accelerating CHPS expansion that is based on GEHIP success, but implemented with an approach that aims to demonstrate large scale action with lifesaving outcomes. Taken as a system of interventions, training, and programme development, CHPS+ will demonstrate a practical approach to evidence-based health systems development in Africa.

Already approved by the Ghana Health Service and with funding guaranteed by the Doris Duke Charitable Foundation (DDCF), CHPS+ is set to utilize the existing GEHIP districts as a platform for catalyzing scale-up while testing the hypothesis that a strategy for replication and scale-up will work. CHPS+ will infuse regional and district management operations with the attributes of "Resilient Health Systems" (RHS) (Kruk et al. 2015). GEHIP thus is providing a platform for CHPS+ development, not merely as a template for rigid replication, but more in the manner of demonstrating the tools of flexibility and adaptation that has enabled the team to achieve complex system development objectives in a challenging environment with constrained resources. Creating capacities for resilient leadership, on the GEHIP model, will therefore be a core operational objective of CHPS+.

To advance RHS in Ghana, CHPS+ will embrace four specific aims that underlie its programme plan and guide its implementation and contribute to overall systems strengthening goals:

1. Develop and utilize learning platforms to foster systems thinking, resilient health systems development, and sustainable scale-up by combining catalytic financing, peer learning exchanges and the use of information for decision-making as a process for capacity building. The “cascade model” pursued will utilize a “guided diffusion” theory of change;
2. Develop links between the learning platform and learning processes with routine national policy development and programming functions, to involve creating a national knowledge management system and a national coordinating unit for monitoring process and communicating results to key stakeholders;
3. Integrate data capture, analysis, and use into peer learning operations so that project activities build evidence-based programming capabilities that are decentralized, decision-oriented, and focused on resilient systems planning; and
4. Develop, test, and disseminate simple, low cost and rapid turnaround tools for impact monitoring that can inform policy and guide practical decision-making at all levels of the GHS system.

While GEHIP has been implemented in the Upper East Region of Ghana, CHPS+ will assume a national dimension with the goal of setting the stage for scale up by defining models and means for accelerating the spread of GEHIP lessons learned. CHPS+ activities will therefore be pursued from the national level and in concert with development policies of the Ministry of Health and the implementing mandate of the Ghana Health Service Policy, Planning, Monitoring and Evaluation (PPME) Division. This will translate in a coordinated leadership with the creation of demonstration districts, national implementation of CHPS monitoring and evaluation, and coordinated utilization of lessons learned through national knowledge management activities.

Sustainability of CHPS+ will be ensured not only through leadership and partnership with central authorities of the GHS, but also through a coordinated programme of capacity building and training in health systems development in partnership with academic institutions in northern Ghana the University for Development Studies (UDS) and in southern Ghana with the University of Health and Allied Sciences (UHAS) as well as international collaboration with the faculty and staff of Mailman School of Public Health, Columbia University and the Swiss TPH.

CHPS+ learning will be grounded in a programme of advanced systems research, using methods developed by GEHIP, but with refinements to demonstrate the science of evidence-based scale-up of health systems strengthening and building capacities in quantitative research, qualitative

systems appraisal, knowledge management, system thinking, team building approaches as well as process and peer learning.

We envisioned that CHPS+ will draw on important health systems innovations and successes of GEHIP to achieve equitable improvements in health status, building upon GEHIP and experience gained from projects such as the Navrongo Experiment and other programmes. In that regard, CHPS+ will extract lessons from on-going projects which have aimed to improve responses to various public health issues; civil registration and vital statistics (CRVS), data management for decision making, malaria, nutritional adversity and other related health issues. CHPS+ will utilize the successful GEHIP implementation districts as learning localities for transferring capacity to develop CHPS to regions and districts elsewhere in Ghana.

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# CURRICULUM VITAE

## Personal Data

Name: John Koku Awoonor-Williams  
Date of Birth: 31 August, 1960  
Nationality: Ghanaian  
Marital status: Married

## Educational Background

1972 – 1974 Dzodze Local Authority Middle School, Ghana  
1974 – 1979 Keta Secondary School, Ghana (GCE 'O' Level)  
1979 – 1981 University Practice Secondary School, Cape Coast, Ghana (GCE 'A' Level)  
1981 – 1988 Minsk State Medical Institute, Minsk, Belarus (MD)  
1993 Institute of Management and Public Administration, Accra, Ghana  
(Certificate in Health Administration and Management)  
1994 – 1995 University of Leeds, Leeds, UK (MPH)  
2000 Liverpool School of Tropical Medicine, Liverpool, UK (Certificate in Gender,  
Health & Communicable Diseases)  
2001 John Hopkins University, Baltimore, USA (Certificate in Strategic  
Leadership and Management for Population and Reproductive Health)  
2004 Johns Hopkins University School of Public Health, Baltimore, USA  
(Certificate in Research Methods in Reproductive Health)  
2006 - 2008 Institute of Management & Public Administration, Accra, Ghana (MPA)  
2013 – 2016 Swiss Tropical and Public Health Institute, University of Basel (PhD in  
Public Health & Epidemiology)

## Professional Experience

1988 - 1989 House Officer, Korle Bu Teaching Hospital, Accra, Ghana  
1989 - 1990 Medical Officer, Korle-Bu Teaching Hospital, Department of Surgery &  
Orthopedics  
1990 – 1994 Medical Officer, Mary Theresa Hospital, Dodi Papase, Ghana  
1992 Locum Medical Officer, Ghana Bauxite Company Hospital, Awaso, Ghana

1995 – 2008 District Director of Health Services, Nkwanta District, Ghana (also doubled as Medical Superintendent of Nkwanta District Hospital with general clinical and surgical duties)

1996 – 2004 Senior Medical Officer (PH), Northern Sector of Volta Region, Ghana

1999 - 2013 Public Health Specialist, Ghana Health Service, Specialist, Public Health

2005 – 2008 National CHPS Coordinator

2008 – 2015 Regional Director of Health Services, Upper East Region, Ghana

2009 Fellow, Ghana College of Physicians and Surgeons (Faculty of Public Health)

2013 - Consultant Public Health

2015 - Director, Policy, Planning, Monitoring and Evaluation, Ghana Health Service

### **Additional Professional Experience**

1999 – 2001: National Chairman of District Directors of Health Services in Ghana

2001 – 2008: Executive Director, Nkwanta Health Development Centre, Ghana

2008 - 2014 Health Education and Advocacy Committee Ghana Medical Association

2008 2015 Part-time Lecturer, University of Development Studies, School of Medicine and Health Sciences, Tamale, Ghana

2008 – 2015 Governing Board Member, University of Development Studies, School of Medicine and Health Sciences, Tamale, Ghana

2008 – 2015 Chair, Navrongo Health Research Centre Institutional Review Board (IRB)

2008 –2015 Field Supervisor, Masters Residency Internship Programme for University of Michigan College of Human Medicine & Family Practice, Columbia University Mailman School of Public Health, New York, University of Ghana School of Public Health, College of Allied Health Sciences, University of Development Studies, Tamale and Kwame Nkrumah University of Science and Technology Kumasi.

2009 – Date Governing Board Member Global Doctors for Choice, New York USA

2009 – Date Ghana Health Service Council Sub-Committee on Appointments and Promotions

2009 – 2015 Senior Lecturer, Columbia University, Mailman School of Public Health, New York, USA

2009 – 2015 Co-Principal Investigator, Ghana Essential Health Interventions Project

2010	Representative on the WHO Executive Committee on Roll Back Malaria (RBM), Ghana in Geneva
2010 – 2013	Co-Principal Investigator, Mobile Technology for Community Health Project, Upper East region, Ghana.
2011 – 2014	External Advisory Board and Faculty Member, Institute for Health Care Improvement (IHI) Cambridge, MA, USA

### **Membership in Professional Organizations and Societies**

- Ghana Medical Association [GMA]
- Ghana Medical and Dental Council [GMDC]
- Ghana College of Physicians and Surgeons [GCPS]
- American Public Health Association [APHA]
- Population Association of America [PAA]
- Global Doctors for Choice [GDC]
- Public Health Physician Association of Ghana (PHPAG)

### **Honours, Awards and Recognition**

1997:	Award for Best Medical and Public Health Service (for dedicated, exemplary and innovative health services delivery and combining both medical and public health services to a deprived population of the Volta Region by VRCC)
1997	State Grand Medal [GM] Civil Division for meritorious medical and public health service in rural and deprived district of Ghana.
1999	Best award for effective and efficient hospital drugs and cash and carry management practices by Volta Region Health Directorate
2005	World Medical Association (WMA) 'Caring Physicians of the World International Award'
2006	Grand Medal Order of the Republic for distinguishing in Health
2007	Presidential Excellence Awards for Public Health Service Delivery in Ghana: Gold in the category of Innovative Partnerships in Service Delivery with Communities & Silver in the category of Innovative Service Delivery Improvements in Communities
2013	Honorary Fellow at Institute for Global Health, Peking University
2015	Health Legendary Award – Health Personality of the Year Award (Public)

## Publications

1. **Awoonor-Williams, J.** “Study on Malnutrition and Immunization Status of Children under 5 years in Nkwanta District of the Volta Region of Ghana”. *Volta Health News* 3rd Edition 1997.
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### Conference Papers and Presentations

**John Koku Awoonor-Williams**, “The Ghana Community-based Health Planning and Services Initiative: Fostering Evidence-based Organizational Change and Development in Resource Constrained Setting”. A Paper presented at Annual Conference of the Global Health Council, Washington DC May 29-31, 2002

**John Koku Awoonor-Williams**, “Setting the Stage for Scaling up a Successful Experiment: The Nkwanta Initiative in Rural Ghana”: Paper presented at the 131st Annual Meeting of the American Public Health Association, San Francisco, California November 15-19, 2003

Nyonator, Frank K., **Awoonor-Williams, J**, James F. Phillips, Tanya C. Jones, Robert A. Miller, 2003 “The Ghana Community-based Health Planning and Services Initiative for Scaling up Innovation in a Resource-constrained Setting,” Paper prepared for the Rockefeller Foundation Bellagio Conference Centre Seminar: “From Pilot Projects to Policies and Programmes,” March 31- April 5, 2003.

**Awoonor-Williams, John Koku** Ellie S. Feinglass, Rachel Tobey, Maya N. Vaughan-Smith. “From Experiment to Policy: Scaling-up the CHPS Initiative in Rural Ghana”: Paper presented at the Population Association of America Annual Meeting, Boston, Massachusetts April 1-3, 2004

Nyonator Frank, James F. Phillips; **John Koku Awoonor-Williams**; John Williams; Adams Kasanga: May 2005; The Impact of Decentralized District Partnering on Scaling-up Community-based Health Sector Reform in Ghana. Paper Presented at the Global Health Council Annual Conference Washington, DC. 30th May – 4th June 2005

**Awoonor-Williams John Koku**, Feinglass E, Phillips J, Vaughan-Smith M. ‘Chasing children’ in rural Ghana: do community-based health planning and services improve the chances of complete and correct child immunization?” Presented at: 133rd Annual Meeting of the American Public Health Association; 2005 Dec 10-14; Philadelphia, PA. Abstract available from: [https://apha.confex.com/apha/133am/techprogram/paper\\_102497.htm](https://apha.confex.com/apha/133am/techprogram/paper_102497.htm)

**Awoonor-Williams J**, Maya Vaughan-Smith, James F. Phillips, Ellie Feinglass, “Does Community-based Health Planning and Services improve access to Family Planning Services? A case Study of Nkwanta District of Ghana” Paper presented at American Public Health Association December 10-14, 2005 Philadelphia, PA

**Awoonor-Williams J**, Maya Vaughan-Smith, James F. Phillips Frank Nyonator: “Chasing Children: The impact of rural community-based health services on childhood immunization in Nkwanta District, Ghana” Paper presented at Population Association of America Annual Conference March 28-31 March 2007 New York, NY

Francis Yeji, Jemima A. Frimpong, Stephane Helleringer, James F. Phillips, **Awoonor-Williams, J**. “Assessing the knowledge and skills of community health workers in a high mortality region of northern Ghana”: Paper Presented at the Annual Conference of the American Public Health Association, Denver, Colorado November, 2010

**John Koku Awoonor-Williams**, Colin Baynes, “Scaling Up Field-Trial Success to National Policy Initiative in Ghana: Reviewing a Decade of the Community-based Health Planning and Services Program”, Paper Presented at the Annual Conference of the American Public Health Association, Denver, Colorado November, 2010

**Awoonor-Williams J**, Stone Allison, James F. Phillips Frank Nyonator: “Mobile Technology for Community Health (MoTeCH) in Ghana”. Paper presented at mHealth Summit December 4-8, 2011 Washington DC

Patience Afulani, **John Koku Awoonor-Williams**, Ernest Opoku: “Implementing Community-Based Health Promotion projects: A case study of the Nutrition and Malaria Control for Child Survival Project (NMCCSP) Ghana”. Paper presented at the Annual Conference of the American Public Health Association, Washington, DC, October 30 - November 3, 2011

Nyonator FK, **Awoonor-Williams JK**, Phillips JF. “Scaling down to scale up: accelerating the expansion of coverage of community-based health services in Ghana”. Presented at 2011 International Conference on Family Planning; 2011 Nov 29-Dec 2; Dakar, Senegal.

**John Koku Awoonor-Williams**, James F. Phillips, Allison Stone, Stephane Hellinger, Bruce MacLeod, Ernest Opoku, Jemima Frimpong, Maggie Schmitt “The Mobile Technology for Community Health (MoTeCH) Initiative: An m-Health System Pilot in a Rural District of Northern Ghana” Paper presented at the Annual Conference of the American Public Health Association, Washington, DC, October 30-November 3, 2011

Ayaga Bawah, James F. Phillips, **John Koku Awoonor-Williams**, et al "Is contraceptive use in Northern Ghana related to stopping or spacing behavior?" Paper to be presented at the Annual Conference of Population Association of America PAA, San Francisco, May, 2012

Ayaga A. Bawah, Paul Welaga, Sebastian F. Achana, Margaret Schmitt, **John Koku Awoonor-Williams** and James F. Phillips “Reproductive preferences and contraceptive use among women of childbearing age in seven rural districts of northern Ghana” Paper presented at the Annual Conference of the Population Association of America, San Francisco, California, USA May 2-4, 2012.

**Awoonor-Williams J**, Sory Elias, Phillips James, Nyonator Frank “A case study in successful health system development in a challenging environment: Rapid progress with the scale-up of

community-based primary health care in an impoverished region of northern Ghana” paper for the 140th APHA Annual Meeting (October 27 - October 31, 2012) held in San Francisco, CA.

**John Koku Awoonor-Williams**, Stone Allison “Mobile Technology for Community Health (MoTeCH) in Ghana. Lessons learned so far” paper presented at eHealth conference in Nairobi, Kenya April 18-19, 2012 “Integrating mHealth into eHealth strategy implementation”.

Patience Afulani, **John Koku Awoonor-Williams**, Ernest Opoku: “Using community health workers to meet the health workforce needs of developing countries: A case study of the Nutrition and Malaria Control for Child Survival Project, Ghana,” presented at the Congress organized by the World Federation of Public Health Associations (WFPHA), in collaboration with the Ethiopian Public Health Association in Addis Ababa, Ethiopia, 23 April - 27 April 2012.

Francis Yeji, **John Koku Awoonor-Williams**, Peter Baffoe, Ernest Opoku, Afua Williams, Emmanuel Ayire: Absence of Key Staff in Health Facilities: a major cause of increase emergency obstetrics referrals in Northern Ghana (Paper presented at the Global Maternal Health Conference Arusha January, 2013).

Elma K. Yabang, Cecilia Samata Azabu, Solomon Atinbire, Isaac Amenga-Etego, Nana A. Twum Danso, **John Koku Awoonor-Williams**, Improving the coverage and quality of first trimester antenatal care in Northern Ghana “Paper presented for the British Medical Journal Group (BMJ) for the Quality and Safety in Health Care forum in Paris April, 2012 & at ISQUA Conference in Accra February, 2013.

**John Koku Awoonor-Williams**, Elias Kavinah Sory, James F. Phillips, Frank K. Nyonator, Successful Health System Development in a Challenging Environment: A Study of the Scale-up of Community-based Primary Health Care in Northern Ghana. (ISSER, University of Ghana Press Publication in press) 2013.

**John Koku Awoonor-Williams**, Rofina Asuru, Sneha Patel, James Phillips: Lessons learned from a community-engaged pilot for developing and testing emergency referral systems in an impoverished and remote district of northern Ghana (paper presented at the Global Maternal Health Conference Arusha, Tanzania, January 2013).

## Working Papers

1. **Awoonor-Williams John Koku**, Baynes CD. “Qualitative assessment of maternal & newborn care-seeking knowledge, attitudes and behaviors in six communities in the Upper East region of Ghana”
2. **Awoonor-Williams John Koku**, Hanes CD. “Examining current practices for emergency obstetric care referral within the Ghana CHPS system: A case study”.
3. **John Koku Awoonor-Williams**, James F. Phillips, Allison Stone, Stephane Helleringer, Bruce MacLeod, Jemima Frimpong, Maggie Schmitt “The Mobile Technology for Community Health (MoTeCH) Initiative: An m-Health System Pilot in a Rural District of Northern Ghana” (submitted to *International Journal of Health Planning and Management*).
4. Solomon Atinbire Abotiba, Henry Kunkyen, Elma Yabang, Isaac Amenga-etego, Linda Azumah, **John K. Awoonor-Williams**, Sodzi Sodzi Tettey: Improving data quality in the routine health information system in resource poor setting of northern Ghana: A case of the Garu-Tempene district of the Upper East region, (Manuscript in preparation).
5. Martin Nyaaba Adokiya, Thomas Abachie, **John Koku Awoonor-Williams**: Ebola virus disease in northern Ghana: Challenges to screening of travelers at the points of entry/exit, *Global Health Action* (in review).
6. Lauren Archer, **John Koku Awoonor-Williams**, Robert Alirigia, Rofina Asuru, Mallory C. Sheff, James F. Phillips: A qualitative systems appraisal of constraints to scaling up a community-based primary health care initiative in rural Ghana: Paper (submitted to *Global Health Science and Practice*).
7. **John Koku Awoonor-Williams**, James F. Phillips, Mallory C. Sheff, Christopher B. Boyer, Ayaga A. Bawah: Researching the utilization of research: A health systems experiment on accelerating the scale-up of community-based primary health care in Ghana: paper (submitted to *Social Science and Medicine*).
8. Yawson AE, Bonsu G, Senaya LK, Eleeza JB, **Awoonor-Williams JK**, Banskota HK and Agongo EEA: Scaling up Expanded Programme on Immunisation Services in Ghana: The Bottleneck Analysis Approach (*Working paper to be submitted to Health Policy and Planning*)

9. Moses Aikins, Edmund W. Kanmiki, James F. Phillips, Ayaga A Bawah, **John Koku Awoonor-Williams**, Abraham R. Oduro, James Akazili: What is the Cost of Primary Health Care Delivery in Ghana? Evidence from Seven Rural Districts of Northern Ghana (working paper).
10. James F. Phillips, **John Koku Awoonor-Williams**, Patrick O. Asuming, Christopher B. Boyer, Sebastian F Achana, Ayaga A Bawah, The impact of the Ghana Essential Health Intervention Program on health systems performance in northern Ghana: Working paper (to be submitted to *International Journal of Epidemiology*).
11. Ayaga A Bawah, **John Koku Awoonor-Williams**, Patrick O. Asuming, Elizabeth F. Jackson, Christopher B. Boyer, Sebastian F Achana, James Akazili, James F. Phillips: The child survival impact of the Ghana Essential Health Interventions Program: A health systems strengthening initiative in a rural region of northern Ghana (*Working paper to be submitted to Health Policy and Planning*).
12. **John Koku Awoonor-Williams**, James F. Phillips, Ayaga A. Bawah: The Application of Embedded Implementation Science to Developing Community-based Primary Health Care in Ghana (*Working paper to be submitted to Wiley journal on "learning systems"*).