REGIONAL INSTITUTE FOR POPULATION STUDIES AT THE UNIVERSITY OF GHANA

ASSESSING PRIMARY HEALTH CARE PROGRESS AND READINESS TOWARDS THE ATTAINMENT OF UNIVERSAL HEALTH COVERAGE: THE CASE OF THE VOLTA AND OTI REGIONS OF GHANA

BY

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DECLARATION

I, STEPHEN APANGA, hereby declare that except for references to other people's work, which have been duly acknowledged, this is the result of my own research and it has neither in part nor in whole been presented for another degree.

09/12/2022

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DEDICATION

I dedicate this work to my wife Olivia Kaburise and children: Awentime, Awenbisa, Awen-Nallem and Aweneba Apanga for their care and support. I also dedicate this work to my parents Mr and Mrs Apanga for their support and encouragements.

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LIST OF ABBREVIATIONS

ACT	Artemisinin-based Combination Therapy
ANC	Antenatal Care
BEmONC	Basic Emergency Obstetric and Neonatal Care
BP	Blood Pressure
CHC	Child Health Care
CHNs	Community Health Nurses
CHOs	Community Health Officers
CHPS	Community-based Health Planning and Services
DHS	Demographic and Health Survey
DMPA	Depo-Provera
DPT	Diphtheria Pertussis Tetanus vaccine
EA	Enumeration Area
EC	Effective Coverage
FP	Family Planning
FRP	Financial Risk Protection
GEHIP	Ghana Essential Health Intervention Programme
GHS	Ghana Health Service
GLSS	Ghana Living Standard Survey
GPS	Global Positioning System
HDI	Human Development Index
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HRI	Health Readiness Index
IMCI	Integrated Management of Childhood Illness
ITN	Insecticide-Treated Bed Nets
IUCD	Intra-Uterine Contraceptive Device
KMO	Kaiser–Meyer–Olkin
LGA	Local Government Area
LMICs	Lower and Middle-Income Countries
MCA	Multiple Correspondence Analyses
MCH	Maternal and Child Health
MDGs	Millennium Development Goals
MoH	Ministry of Health
NCDs	Non-Communiable Diseases
NHIL	National Health Insurance Levy
NHIS	National Health Insurance Scheme
ODK	Open Data Kit
OOP	Out-of-Pocket Payment
OR	Odds Ratio
ORS	Oral Rehydration Solution
PC	Principal Component
PCA	Principal Component Analysis
PHC	Primary Health Care
PHCPI	Primary Health Care Performance Initiative
PNC	Post Natal Care

PPME	Policy Planning Monitoring and Evaluation Division
RDT	Rapid Diagnosis Test
SARA	Service Availability and Readiness Assessment
SC	Service Coverage
SDGs	Sustainable Development Goals
SLDs	System Learning Districts
SPA	Service Provision Assessment
SRI	Service Readiness Index
SSNIT	Social Security and National Insurance Trust
TB	Tuberculosis
ToC	Theory of Change
TSPA	Tanzania Service Provision Assessment
UHA	Universal Health Access
UHC	Universal Health Coverage
UHCI	Universal Health Coverage Index
UN	United Nations
WASH	Water Hygiene and Sanitation
WB	World Bank
WHO	World Health Organization

ABSTRACT

Universal Health Coverage (UHC) involves the provision of quality health services without the need for out-of the pocket payments. Implementation of the **Community-based Health Planning and Services** and the **national health insurance scheme (NHIS)** which provides health service coverage and financial risk protection respectively to Ghanaians caters for the two critical of dimensions UHC. However there are inadequate metrics for measuring progress of UHC that combines its two dimensions simultaneously and primary health care system (PHC) readiness towards attaining UHC in Ghana hence the need for this study.

Repeated cross-sectional surveys of household reproductive aged women and a survey of health facilities were carried out in the Oti and Volta regions of Ghana. Principal Component Analysis was used to develop composite indices for measuring progress of UHC and service readiness towards attaining UHC. Binary logistic regression models were run to assess the effect of the health system readiness on UHC at the population level.

The composite for measuring progress of UHC comprised of quality of care, access to health care and active membership of NHIS as its components whilst the composite for measuring the system readiness towards attaining UHC had monitoring of health services; functioning basic equipment; essential medicine; and availability of trained health personnel as its components. There was some progress made towards attaining UHC over a period of time with the lower level of the health care delivery system found to be least ready towards attaining UHC. Readiness of the health system was a significant (AOR=1.06, 95%CI: 1.003-1.142, p=0.04) predictor of active NHIS membership.

For Ghana to accelerate its progress and get its PHC system more ready towards attaining UHC, it needs to invest more in the various components of the two composites for measuring progress of UHC and health system readiness.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Attaining the goal of universal health coverage (UHC) is becoming more relevant now than ever and is being pursued as a major developmental activity at both national and global levels (Prinja et al., 2017). According to the World Health Organization (WHO), the goal of UHC requires that all people obtain the health services they need without facing any form of financial hardship resulting from out-of pocket payments. UHC also requires that people have access to a wide range of quality health care services, which include health promotion and prevention, treatment, rehabilitation and palliative care whilst enjoying a form of financial risk protection (Boerma, Eozenou, et al., 2014; Ng et al., 2014).

In 2010, the WHO advocated for a concerted effort to achieve UHC with the goal of reducing health inequalities whilst promoting avenues for attaining quality health care and reducing financial risk. Since the transitional phase of the Millennium Development Goals (MDGs) to the recently adopted Sustainable Development Goals (SDGs)- Goal three which involve the inclusion of UHC-, there has been a change in global health systems from service-specific oriented targets to a more holistic health system goals with countries committed to attaining UHC's goal in 2030 (Ferri, 2010; Leslie, Malata, et al., 2017; UN Economic Commission, 2015). The pathway to UHC focuses on achieving at least 80% essential health service coverage for everyone (primary health care) and 100% financial risk protection from out-of-pocket (OOP) payments when accessing health care irrespective of their socioeconomic status (World Health Organization & The World Bank, 2015; Zhang et al., 2019).

The general lack of global consensus on measuring UHC, including its progress and non-availability of standardized data across countries limits global estimates of UHC and its comparison at national or sub-national levels. However few studies from Lower and Middle-Income Countries using data from the world bank and the WHO suggest that countries from Latin America and South Africa appear to be performing well than countries in sub-Saharan Africa after ranking them based on constructed UHC index scores for either service coverage or a combination of service coverage and financial protection (Leegwater et al., 2015b; Wagstaff et al., 2016).

Globally, it has been acknowledged that Primary Health Care (PHC) serves as an essential driving force for advancing the pathway to UHC and will play an important role in the 2030 Agenda for Sustainable Development (Dugani et al., 2018). It has also been postulated that when PHC is supported by strong public health policies, as well as efforts that cut across social, economic and political spheres, it can play a critical role in attaining sustainable development (Onokerhoraye, 2016; Rao & Pilot, 2014). Therefore the past ten years has not only seen calls for more emphasis to be placed on the role of PHC as a strategy towards the achievement of UHC but has also witnessed a revitalisation of support for the PHC agenda as envisaged in the Declaration of Alma-Ata and its importance in achieving the health-related SDGs (Rao & Pilot, 2014; Stenberg et al., 2019).

In the last two decades, Ghana in its effort towards achieving UHC has adopted several strategies to make health care more accessible and affordable to Ghanaians. Among the current strategies are the expansion and scaling up of a national community-level health delivery system and the implementation of a social health insurance scheme called the National Health Insurance Scheme (NHIS) which is funded mostly through tax. Through these two interventions Ghana is addressing the two critical dimensions of UHC by providing

service coverage and financial risk coverage for the population who are accessing health care services.

Community-level health delivery is being implemented through the **Community-based Health Planning and Services** (CHPS) as part of a national strategy adopted in 1999 to reduce geographical barriers to accessing health services particularly in remote communities. CHPS employs a close-to-client service approach which ensures that the physical gaps in access is closed leading to the enhancement of the community health landscape. Augmenting the CHPS concept is a decentralised District Health System that has been structured within the health sector to plan and provide public health services, supervision and support to the lower levels (sub-district and community) through a PHC approach which is in accordance with the Ouagadougou Declaration on PHC in 2008 (Nyonator et al., 2014; WHO African Region, 2015).

Ghana's Ministry of Health (MoH) in 2019 showed further commitment towards achieving UHC through the development of the National UHC Roadmap which is a health sector plan focused on strengthening PHC delivery in health facilities across the country and intended to localize global UHC efforts in Ghana's policies and systems and also guide the development of operational plans to deliver health services for the next decade (Health & Roadmap, 2019). Therefore recognizing the critical role that the health system plays through health facilities in strengthening PHC delivery in Ghana, there is a compelling need to measure the capacity of health facilities (especially at the PHC level) to provide essential services in order to help guide the implementation of the country's UHC policies.

Despite the need for monitoring access to services and service delivery on a regular bases, UHC is often seen as the weakest link of both country and global performance as well as progress monitoring (O'Neill et al., 2013). Whereas more countries remain committed to

achieving UHC they are constrained as to how to adequately measure and track their progress towards achieving its main goals in terms of both health service coverage and financial risk protection. The absence of a worldwide consensus on an ideal measurement metric for monitoring and tracking the progress UHC has led to its exclusion as one of the major health system performance goal in the post-2015 era. The WHO and the World Bank have since identified measuring progress of UHC as a major research priority at all levels (Maclennan et al., 2013; Prinja et al., 2017) resulting in the development of a framework for measuring UHC (Boerma, Eozenou, et al., 2014).

In Ghana as in most countries, a comprehensive framework for tracking the progress of UHC is lacking. Monitoring progress of UHC in Ghana is often conducted as part of a regular health sector progress and performance review activity that uses health system inputs, health status and service delivery indicators (Nyonator et al., 2014).

If Ghana is to be successful in the development and implementation of its National UHC Roadmap, it will be important to communicate the results on UHC progress through the PHC system in a way that is scientifically meaningful, replicable and can be easily communicated to policy makers. A strategy for achieving this is to use a summary measure or composite index that will summarize complex or multi-dimensional issues of relevance to UHC with the hope of supporting policy-makers as well as acting as a communication instrument for the entire public. In view of the fact that successfully computed indices often provide a broader perspective of issues, they are easier to interpret than trying to find trends in many separate indicators (Boerma, Eozenou, et al., 2014; Metge et al., 2009) as is the case of Ghana (Nyonator et al., 2014). At the population level, indices have also been found to aid in strategic planning and reporting. Composite indices in addition can also offer opportunities

for identifying areas that require interventions (Boerma, Eozenou, et al., 2014; Metge et al., 2009).

Measuring the progress of UHC in the context of the PHC system and the system's readiness towards the attainment of UHC in Ghana will require adequate and reliable data from both the population and health facility levels. However because such data seldom exist at the national level, the choice of the Volta and Oti regions (formerly part of the Volta region)- which are part of a National Program which aims to strength the implementation of the CHPS initiative (CHPS+ project) in some selected regions (Volta, Oti, North East, Savannah and Northern) of the country offers a good opportunity to be able to carry out this study. As part of the project, data was collected at both the population and health facility levels in these two regions to facilitate a scientific evaluation of the project's impact. This data was used for this dissertation.

1.2 Statement of Problem

As more countries make commitments towards attaining UHC over the past decade there is the need to measure and track its progress. However most countries face the challenge of a clear framework and a general lack of consensus on how to measure its progress leading to individual countries developing their own metrics of measuring UHC (Boerma, Eozenou, et al., 2014; Prinja et al., 2017; Wagstaff et al., 2016). Although the WHO and World Bank have developed and recommended a framework for monitoring UHC using both dimensions of health service coverage and financial risk protection, except for a few (Wagstaff et al., 2015, 2016; Wagstaff & Neelsen, 2020) most studies to date have only examined one dimension of UHC in isolation which have widely been acknowledged (Hogan et al., 2018; Wagstaff, Flores, Hsu, et al., 2018; Wagstaff, Flores, Smitz, et al., 2018).

In view of the fact that many governments in Africa have adopted PHC as a framework for developing and improving their health systems (Onokerhoraye, 2016), key frameworks for monitoring and tracking the implementation of PHC initiatives especially those targeted at achieving UHC are lacking.

Even though people have tried to measure the strength of Ghana's health system (Boyer et al., 2015; Phillips et al., 2018), these measurements are often not done in the context of attaining the UHC drive embarked by the government especially at the PHC level. The few studies that have attempted to measure the progress of UHC in Ghana have either done so through a desk review of the progress and performance of the entire health sector using mainly indicators related to health coverage and health status (Nyonator et al., 2014) or measured the two dimensions of UHC separately (Amporfu, 2013; Sheff et al., 2020).

By far there has only been one study that has tried to offer a glimpse into Ghana's progress towards achieving UHC using both dimensions of UHC were significant improvements were seen in both health service coverage (childhood immunizations increasing from below 70% to about 90%) and financial risk protection (financial catastrophe due to healthcare spending decreased by almost eight-fold and impoverishment by a four-fold decrease) from 1995 to 2015 but with some inequalities across wealth quintiles and regions (Zhang et al., 2019). Although the study used data from both the demographic and health survey (DHS) and the Ghana living standard survey (GLSS) which are nationally representative household surveys, it fell short of measuring the progress or performance of UHC at the PHC level considering the crucial role that PHC plays towards the attainment of UHC in the health system. Another short fall of the study by Zhang et al. (2019) was that, it measured progress towards achieving UHC by calculating only a composite coverage index for the service coverage dimension and calculating the incidence of catasthrophic health expenditure and impoverishment due to

OOP health payments for the financial risk protection dimension separately too rather than calculating a single index of UHC using both dimensions. Zhang and colleaques did not also take the quality aspect of the service coverage dimension into consideration whilst measuring Ghana's progress towards achieving UHC. Furthermore, (Zhang et al., 2019) computed a composite coverage index that was calculated from both a composite prevention index and a composite treatment index while assigning equal weights to all service coverage indicators rather than using a robust statistical approach to account for weighting challenges.

This study therefore bridges these gaps identified in the literature by developing a composite index for measuring progress of UHC using both dimensions (health services and financial risk protection) as recommended by the WHO. Additionally a robust statistical approach was used that accounted for weighting challenges and measures progress of UHC at the PHC level with the aim of assisting in the policy direction of attaining UHC.

The importance of strengthening PHC delivery at the facility level and its role towards the attainment of UHC cannot be over emphasised. It is for this reason that Ghana has developed a national UHC roadmap which focuses on strengthening PHC delivery in health facilities across the country (Health & Roadmap, 2019). However what remains undetermined is how ready or prepared the PHC system is towards attaining UHC through the implementation of this roadmap.

Several studies have been conducted to measure the readiness of PHC across Asia and sub-Saharan Africa by way of developing composite indices using Service Provision Assessment (SPA) surveys (Boyer et al., 2015; Jackson et al., 2015; Leslie et al., 2017). These studies have however not measured PHC systems readiness in the context of achieving UHC. Additionally these studies are limited in their ability to determine how changes in a measured index score that are input-focused affects health service coverage or population health in

general. This limitation is sometimes due to lack of data that links household surveys to facility surveys. For example whereas Boyer et al. (2015) developed an index of health system readiness from SPA data using principal component analysis that could in practice be used to monitor progress towards stronger health systems, they could not determine how an increase in index score which is input-focused affects population health (Boyer et al., 2015). Similarly, Leslie and colleagues also developed composite indices of key clinical importance for maternal and child health care services from existing guidelines by linking SPA data to household data to examine effective coverage. Their study linked utilisation metrics to quality at the sub-national level, which prevented them from measuring variations in access and quality at the lower level of the health system which is most relevant to PHC services (Leslie et al., 2017).

This study therefore sought to fill this additional knowledge gap of developing measuring metrics for general health system readiness by developing a composite index of the PHC system in the context of attaining UHC. The study also sought to determine how a measured index score affects certain essential health services or population health by linking data sets from both household and health facilities surveys.

1.3 Research Questions

This study assessed the PHC progress and readiness towards attaining UHC by asking the following key research questions for selected districts in the Oti and Volta districts of Ghana:

1. How do we develop a scientifically appealing measure that realistically captures the progress and health system readiness for attaining UHC?
2. How is the progress of the PHC system towards the attainment of UHC?
3. How ready is the PHC system towards attaining of UHC?

4. How has the readiness of the PHC system affected UHC at the population level?

1.4 Objectives

The main objective of this study was to assess PHC progress and readiness towards attaining UHC within the context of implementing a health system strengthening program in seven rural districts in the Volta and Oti regions of Ghana, after the implementation of the CHPS concept and the NHIS by the government.

The specific objectives include:

1. To develop a composite measure of progress and health system readiness for attaining UHC
2. To assess the progress of the PHC towards the attainment of UHC
3. To assess the readiness of the PHC system towards attaining UHC
4. To assess the effect of the PHC system readiness on UHC at the population level

1.5 Hypotheses

This study hypothesises that:

1. The implementation of CHPS and NHIS has had no effect on progress towards UHC.
2. The PHC system readiness does not improve population health outcomes.

1.6 Rationale

This study assessed PHC progress and the readiness of the PHC system towards attaining UHC in Ghana. The area of measuring of PHC systems strength in the context of attaining UHC is generally lacking in the literature.

The study used principal component analysis (PCA) to construct a universal health coverage index (UHCI) and a system readiness index (SRI) as measuring metrics for PHC progress and system's readiness. By linking health facility survey data to household survey data, the study addressed the gap in the literature of how changes in a measured SRI score which is input-focused affects health service coverage or population health.

Considering the commitments and efforts that successive governments in Ghana have made through PHC systems strengthening (Awoonor-Williams et al., 2013; Ghana Health Service, 2002; Nyonator et al., 2014) and the subsequent introduction of the NHIS- all aimed at attaining UHC-, measuring the progress and performance of PHC towards attaining UHC still remains a challenge especially in regions where most performance indicators are poor. This study therefore addressed this knowledge gap of measuring UHC at the PHC level.

Since summary measures or composite indices have numerous advantages especially in terms of supporting policy-makers and communicating data to the public (Boerma, Eozenou, et al., 2014; Metge et al., 2009), this study does not only fill the gaps in previous studies (Boyer et al., 2015; Nyonator et al., 2014; Phillips et al., 2018; Zhang et al., 2019) in respect of measuring the PHC system strength in the context of attaining UHC but has also served as a useful guide for decision makers and stakeholders involved in Ghana's drive towards attaining UHC.

The WHO advocates for an investment in reliable data of selected tracer indicators for monitoring the progress of UHC through both household and facility surveys. However considering the fact that such data sources rarely exist simultaneously and even tend to have content challenges if they do exist (Wagstaff et al., 2016), this study further provides an opportunity for measuring the progress of UHC by providing reliable and adequate data at both the household and facility levels.

There is currently a paradigm shift from measuring crude health coverage as a dimension of UHC to measuring effective coverage in order to address concerns of quality health care. Effective coverage measures the fraction of potential health gain that is actually delivered to the population through the health system given its capacity. In addition to need, effective coverage also considers the importance of use and quality of care delivered (Ng et al., 2014; Willey et al., 2018). Household level surveys are required to estimate access to care at the population level, however, data from them are often lacking on measures of quality of care as respondents do not report on quality issues, specifically those related to clinical care (Footman et al., 2015). SPA on the other hand provides better data on quality by providing measures of readiness on quality of care but however fail to provide data on population level denominators (Willey et al., 2018). It has therefore been suggested that linking data from both household and SPA surveys will serve as a good opportunity for measuring effective coverage considering the growing interest in integrating population and quality measurements (Do et al., 2016).

Therefore this study is further justified because it enables the linking of two data streams of household and SPA surveys as a way of addressing the challenges associated with quality of health care in measuring UHC. This study appears to be one of its kinds in Ghana to measure UHC at the PHC level using a composite index and thereby adding to the literature and knowledge gap of this growing field of health systems strengthening.

1.7 Chapter Outline

This study comprises of five chapters. Chapter one covers the background of the study, statement of the problem, research questions, objectives, rationale, hypotheses and the outline of the study chapters. Chapter two reviews the literature and includes overview of universal health coverage, universal health coverage and primary health care, universal health coverage

in Ghana, measuring universal health coverage, measuring primary health care system readiness, linking health facility surveys to household surveys, theoretical and conceptual frameworks adopted for the study. Chapter three presents the research methodology which includes the profile of the study and the analytical framework. Chapter four is dedicated to reporting and discussing the results after analysis. Finally chapter five presents the summary, conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

Chapter two reviews the literature of the study on universal health coverage, health systems readiness and linking of health facility to household surveys. The overview of universal health coverage, universal health coverage and primary health care, and universal health coverage in Ghana was presented first. This was followed by a review of measuring universal health coverage, metrics of measuring universal health coverage according to its dimensions and composite indices for universal health coverage. Furthermore, was reviewed on the measurement of primary health system readiness and linking of health facility surveys to household surveys. This chapter was concluded by presenting the theoretical and conceptual frameworks.

2.2 Overview of Universal Health Coverage

Universal health coverage is now seen as a key global health priority and is being recognized by many as a major developmental goal following its inclusion as one of the health SDGs (SDG target 3.8) during the transition from the MDGs to the recently adopted SDG (Barasa et al., 2018; Prinja et al., 2017).

The World Health Report of 2010 describes UHC as the goal where all people have access to the needed health services and do not suffer financial hardship paying for those services (Haas et al., 2012). Therefore the goal of UHC requires that everyone obtains the quality health care they need without facing any financial hardship as a result of OOP payments.

According to the WHO, UHC involves the provision of quality health care of all types (prevention, promotion, curative, palliative care and rehabilitation) and at all levels (primary, secondary and tertiary), without facing any financial hardship resulting from OOP spending at the time of receiving health care (Haas et al., 2012; Prinja et al., 2017).

The WHO recommends that a UHC framework operates progressively in several dimensions so as to ensure universal coverage under health care systems. The framework presents three dimensions comprising of population coverage, service coverage and financial risk protection coverage. For countries to progress in UHC they require a benefit package that is not only comprehensive in nature, but ensure that priority populations are selected as well as subsidize the cost of seeking health care as much as possible. Attaining UHC requires the provision of a service package that covers over 80% of the entire population and an increased share of pooled funds representing the main source of funding for health care resulting in a reduction in co-payments by those accessing health care (Boateng & Yawson, 2019; Haas et al., 2012; Kutzin, 2013; *WHO | Health Systems Financing: The Path to Universal Coverage*, n.d.).

The pathway to UHC which has been described by some as the "third global health and epic transitions" after the demographic and epidemiological transitions (Frenk & De Ferranti, 2012; Rodin & De Ferranti, 2012) is now being viewed by many national governments as the guiding principle for developing their human resource and health systems (Maclennan et al., 2013). After the United Nations Sustainable Development Summit in 2015, many countries worldwide have declared and shown commitments towards achieving UHC by introducing pragmatic and strategic policies (Fore & Gurría, 2019; Leegwater et al., 2015a). Furthermore, several countries have already enacted legislation on UHC with many developing countries introducing policy frameworks to commit their resources to expanding health care services.

It is the expectation of the World Bank (WB) and WHO that by 2030, a minimum of 80% essential health service coverage for all people regardless of their socioeconomic status and a 100% financial risk protection (FRP) from OOP payments for health care will be achieved (World Health Organization & The World Bank, 2015; Zhang et al., 2019). However despite this ambitious expectation and the efforts made by many countries globally to achieve it, the rate of progress of UHC has declined since 2010. Therefore considering current trends if progress is not accelerated, UHC will probably not be attained by 2030 thereby leaving those of poor nations behind (Fore & Gurría, 2019). Accelerating progress will require considerable efforts that strengthen national health systems so as to be able provide UHC in low income settings in particular. Such measures could also be aimed at addressing the slow gains related to non-communicable disease services (Fore & Gurría, 2019).

In order to achieve UHC, there is the need to measure the gains in health service coverage as well as understanding the barriers to access and the associated large gaps that remain. When countries have such information, it will go a long way in ensuring that local and global decision-makers effectively target their scarce resources and tailor their policies towards the advancement of UHC. Progress towards UHC also means lowering barriers to seeking and receiving needed care such as distance, OOP payments, poorly equipped facilities and poorly trained health workers. Achieving UHC also means that those seeking health care should be able to do so without limiting their ability to afford food and other basic necessities in life including putting their families at risk of poverty (Fore & Gurría, 2019; Nguhiu et al., 2017).

2.3 Universal Health Coverage and Primary Health Care

Globally, it has been acknowledged that PHC serves as an essential driving force for advancing the pathway to UHC and will play an important role in the 2030 agenda for Sustainable Development (Dugani et al., 2018). Evidence has shown that when supported by

strong public health policies and aligned with efforts across social, economic, and political domains, PHC can play a central role in achieving sustainable development (Onokerhoraye, 2016; Rao & Pilot, 2014).

The WHO Alma Ata agreement in 1978 acknowledged health as a fundamental human right with PHC playing a vital role in delivering health care to all by 2000. PHC represents a continuing health care process that bridges the gap between community members and the health care system, enabling community members directly receive health care where they live and work (Rao & Pilot, 2014). Since then, it has been well established and documented that PHC leads to better health outcomes, lower costs and greater equity in health. An important part of a country's development should therefore be the strengthening of PHC services. When this is done, the health care provided will be comprehensive and people-centred as well as for all ages and stages of life. This also involves the incorporation and coordination of health promotion, prevention, acute and chronic care management activities in other to deliver equitable access and safe high-quality health care (Goodyear-Smith & van Weel, 2017).

Primary health care core's features such client-centeredness, comprehensiveness, integration and continuity of care have been reported to be associated with better health outcomes, cost-effectiveness and higher user satisfaction (O'Malley et al., 2015). For example, a study of 102 lower and middle-income countries (LMICs) showed that a broader coverage of primary care services was linked to increased life expectancy, lower infant mortality and lower under-five mortality (Hsieh et al., 2015; Tsimtsiou, 2017). Amongst some of the benefits that a strong primary health system offers include increased accessibility to deprived populations, provision of long term patient-centred care, emphasis on prevention and reduction of unnecessary medical care. These benefits have resulted in narrowing the gap between socially deprived and advantaged populations (Stigler et al., 2016). A PHC approach according to the

2018 Global Conference on PHC includes multi-sectorial policies and actions that engage people and communities aimed at integrating services with essential public health activities. Although there are variations in the specific set of PHC interventions across countries, its most basic form involves the provision of public health interventions and outpatient care for all (Fore & Gurría, 2019).

Strengthening of PHC systems, coupled with financial risk protection for universal coverage appears to be the surest pathway to achieving health for all and hence necessitating the need for PHC to serve as the vehicle to achieving UHC (Rao & Pilot, 2014; Tsimtsiou, 2017). The international community advocates for every nation to invest in building robust PHC systems as this is a critical driver for achieving UHC and the agenda of the SDGs in an efficient, effective and equitable manner (Dugani et al., 2018; Pettigrew et al., 2015; Veillard et al., 2017).

There are several gaps in the global data related UHC and PHC. It is the goal of UHC that all people, including the most vulnerable and marginalized, have access to good quality health services without them experiencing financial hardship. To be able to monitor health system performance especially those related to delivering quality health service and progress towards UHC, assessing the coverage of health interventions alone is not sufficient. For countries to make any progress towards the health-related SDGs targets, they need to invest in methods of assessing quality including the integration of PHC. The PHC that will be required to drive the needed progress in UHC will include the ability to offer a comprehensive people centred services by qualified health providers with the needed competencies whilst adhering to safe and good clinical guidelines and responding to people's needs and preferences as well (Fore & Gurría, 2019).

PHC services in Ghana are delivered through a range of health facilities comprising of CHPS zones, Maternity Homes, Health Centres, Polyclinics and District Hospitals. District hospitals are the highest level of health care serving as referral points to lower level health facilities and responsible for delivering comprehensive health care services. They also collaborate with the district health management teams and the district assemblies to enhance delivery of health services. The CHPS zones work mainly at the communities by providing health promotion, prevention and treatment of illnesses through facility and household care (Macarayan et al., 2019).

2.4 Universal Health Coverage in Ghana

Over the last two decades successive governments in Ghana have made efforts towards achieving UHC by adopting a number of strategies to make health care more accessible and affordable to Ghanaians. Among the current strategies are the expansion and scaling up of a national community-level health delivery system and the implementation of a social health insurance scheme funded solely through tax.

By prioritizing universal provision of PHC in accordance to the Ouagadougou Declaration on PHC and health systems in Africa (WHO/AFRO, 2008), Ghana started scaling up the CHPS concept at the national level after initially piloting it at Navrongo in the Upper East Region and replicating same at Nkwanta in the Volta region (now Oti region) (Awoonor-williams et al., 2013; Maly et al., 2019; Nyonator et al., 2005). Community-level health delivery is being implemented through the CHPS, a national strategy adopted in 1999 to reduce geographical barriers to accessing health care services particularly in remote communities. CHPS employs a close-to-client service approach which ensures that the physical gaps in access is closed leading to the enhancement of the community health landscape. Augmenting the CHPS concept is a decentralised District Health System that has been structured within the health

sector to plan and provide public health services, supervision and support to the lower levels (sub-district and community) through a PHC approach which is in accordance with the Ouagadougou Declaration on PHC in 2008 (Nyonator et al., 2014; WHO/AFRO, 2008). Therefore, CHPS through its community-based strategies, home visits and outreaches, has evolved to become one of the most successful and cost effective programmes implemented in Ghana (Zhang et al., 2019).

The Ministry of Health (MoH) of Ghana in April 2019, showed further commitment towards achieving UHC through the development of the National UHC Roadmap which is a health sector plan focused on strengthening PHC delivery in health facilities across the country. This roadmap is intended to situate UHC efforts in Ghana's policies and systems and also to guide the development of operational plans to deliver health services for the next decade (Health & Roadmap, 2019).

One of the main strategies Ghana has instituted towards the realization of UHC has been the implementation of the NHIS in 2003. This was meant to lessen financial bottlenecks, protect Ghanaians from adverse health expenditure and increase access to health care for everyone. NHIS is mainly funded through the National Health Insurance Levy (NHIL) which is a 2.5% tax on selected goods and services, the Social Security and National Insurance Trust (SSNIT) which is a 2.5% contribution paid by those in the formal sectors and a premium set at an annual flat rate. The NHIL accounts for 70% of the funding of the NHIS whilst SSNIT and premium payments account for 17.4% and 4.5% of funding respectively (Akazili et al., 2012; Alhassan et al., 2016; Mills et al., 2012). Several studies have suggested a financial protective effect of the NHIS particularly amongst the poor since its implementation (Alatinga & Williams, 2015; Kusi et al., 2015; Nguyen et al., 2011). For instance the NHIS was shown to have provided a financial protective mechanism against financial shocks resulting in 67%

reduction in OOP payments and reduced the likelihood of foregoing other subsistent needs for health care in two rural districts of Ghana (Nguyen et al., 2011).

By implementing these two interventions of CHPS and NHIS, Ghana is addressing the two main dimensions of UHC by providing health service coverage and financial risk protection for its population when accessing health care services. The expansion and implementation of the insurance coverage to improve quality care within the current PHC system context will not only ensure that poor people are not excluded from accessing quality health care but is also key to achieving the goal of UHC (Nyonator et al., 2014). Zhang et al. (2019) opined that, through the implementation of the CHPS concept targeting primary health care and the decentralization of the health system coupled with the introduction of NHIS might have contributed significantly to the improvement in coverage of certain maternal and child health services in Ghana (Zhang et al., 2019).

Progress towards UHC in Ghana has been associated with declining under five mortality rates by almost a third since 1990 (82 deaths per 1,000 live births for 2007–2011 compared to 155 per 1,000 in 1988), marginal (5%) reduction in neonatal mortality rates since 2003 and a widening gap between the richest and poorest in recent times. While mortality trends alone cannot be said to be a good indicator of progress towards UHC because several other determinants contribute to coverage, they nonetheless provide measures of assessing progress in reducing certain challenges. Although increases have not been that significant, there has also been a consistent increase in the coverage of MDG-related interventions (Nyonator et al., 2014). However progress towards UHC in terms of NHIS coverage often determined by either enrolment into the scheme or active membership still continues to remain low therefore falling short of the target (100%) of the scheme. For instance as at 2012, enrolment into the scheme was only 34% of the population (Nyonator et al., 2014) and at the end of 2018

enrolment had only increased marginally to around 36% of the population according to reports from the national health insurance authority (Nsiah-Boateng et al., 2019; Wang et al., n.d.).

2.5 Measuring Universal Health Coverage

The introduction of UHC as a developmental goal calls for regular measurement and tracking of its progress (Barasa et al., 2018; Boerma, AbouZahr, et al., 2014; Boerma, Eozenou, et al., 2014; Chan, 2016). However one limitation to its inclusion as a major health system performance goal in the period post-2015 is because globally there is no consensus on an appropriate measurement metric. As a result the WHO has identified measuring the progress of UHC as a major research priority at both the country and sub-national levels (Prinja et al., 2017; *WHO | World Health Report 2013: Research for Universal Health Coverage*, n.d.).

Due to the significance of UHC globally, it is important that its assessment becomes part and parcel of the health sector monitoring agenda of every country. Since every country also has its own pre-determined benefit package based on some inherent priority setting activities, it is important each country begins the measurement of its progress towards UHC by assessing the extent to which it has been able to provide its benefit package without financial hardship. It is equally important for the other determinants of health such as social and environmental factors to be considered when monitoring and measuring progress of UHC as they impact on health. Therefore there is the need for the inclusion of additional indicators by countries that reflect country specific priorities and their local needs rather than limiting themselves to a few set of internationally agreed indicators. Most countries already working towards UHC are relying on indigenous and routinely collected service statistics to measure their health system performance. Because countries have varied circumstances due to differences in their health systems, epidemiology, health financing, socioeconomic status, population needs and

priorities amongst others, the expectant measurable indicators may vary from to place to place and also with time, thereby affecting how progress of UHC is measured (Alebachew et al., 2014; Boerma et al., 2014; Prinja et al., 2017).

In order to achieve UHC and address the SDGs, there is the need for governments and other stakeholders to be proactive in measuring progress towards delivery of PHC services. The measurement and monitoring of UHC should therefore include the use of indicators that can capture the principles of PHC such as equity; community participation; prevention; appropriate technology; and inter-sectorial collaboration as outlined in the Alma-Ata declaration. Health financing indicators also need to track government expenditure in this area and provide information on the economic accessibility of primary care services (Pettigrew et al., 2015).

2.6 Metric of Measuring Universal Health Coverage

As the measurement of health systems performance still continue to be a major cause of concern due to a general lack of consensus of measuring metrics, the use of indices to summarise information about underlying health related events is becoming increasingly common in the global health literature with a deriving motivation from the Human Development Index (HDI). For example, indices have been developed for global assessments such as maternal and child health (MCH) interventions (Wehrmeister et al., 2016) and in the health related SDGs (Barasa et al., 2018; Hogan et al., 2018). Similarly, indices are currently being used extensively in the assessments of progress towards UHC (Leegwater et al., 2015a; Wagstaff et al., 2015).

Most countries till date do not have a well-defined approach for tracking progress of UHC and therefore monitoring and tracking its progress by most countries has either been through

measuring the performance of the health sector using certain service coverage and health status indicators (Alebachew et al., 2014; Boerma, AbouZahr, et al., 2014; Nyonator et al., 2014) or measuring the dimensions of UHC separately through the use of tracer indicators (Amporfu, 2013; Hogan et al., 2018; Ng et al., 2014; Sheff et al., 2020; Wagstaff, Flores, Smitz, et al., 2018). Measuring progress this way however does not give a holistic perspective of the multifaceted nature of UHC. In view of this short-fall, the WHO and WB advocates for a more holistic approach for monitoring progress mainly through summary indices so as to comprehensively represent the wide range of health services under UHC which are multifaceted in nature. The monitoring framework therefore proposed by these two bodies is for countries to measure both dimensions simultaneously (Giedion et al., n.d.; *WHO | World Health Report 2013: Research for Universal Health Coverage*, n.d.).

It is also important that findings on progress of UHC are meaningfully communicated to the populace and also be attractive to decision makers. There are a number of ways of achieving this. First is to focus on a few set of tracer indicators. Second is the use a summary measure or a composite index measure progress of UHC. The last option is the combination of both tracer indicators and a composite index. Although summary measures presents issues about weights of the varying components, they nonetheless play useful roles in communicating progress of UHC and hence their increasing use (Boerma, Eozenou, et al., 2014; Metge et al., 2009; Wagstaff et al., 2016) as compared to using only tracer indicators.

Composite indices are a mathematical combination of individual indicators or measures that represent different aspects of a single but larger phenomenon. Composite indices have several uses such as using them to reduce complicated phenomenon with the intention of supporting policy and communicating findings to the general public. Successfully computed indices can provide an overview of activities thereby making interpretation simpler as opposed to finding

patterns from several indicators. Composite indices are also useful for strategic planning and reporting at the population or system-wide level. Furthermore, composite indices could also provide opportunities for identifying areas that need interventions. An additional possible use of composite indices that requires further or future work is exploring its use in quantifying the impacts of reforms on UHC especially if there is enough evidence on the impact of a reform or programme on some UHC indicators. However despite these numerous uses, a major setback of composite indices is that, they hardly portray the true rates of the indicators used (Metge et al., 2009).

2.6.1 Measuring Service Coverage Dimension

In measuring service coverage (SC), there is the need to carefully and systematically select indicators by attaching relative weights to them. Traditionally the measurement of SC as a dimension of UHC has been done based on disease states and their treatment. However because of the myriad of diseases and other health related events, attention is shifting to the generation composite indices as measuring metrics. The MDG Countdown Research Group has been at the forefront of this effort by constructing composite indices through the compilation of a set of selected service coverage indicators that represent strengths or areas of intervention under MCH service delivery. This is based on data availability, accuracy and consistency of measurement, relevance to health system strength and potential health gains from achieving high levels of coverage. Areas covered fall mainly under maternal and child care. Indicators under each area are first weighted followed by an equal weighting of each area and finally an averaged coverage gap index computed. However, the limitations to this approach have been identified to be its over reliance on only MCH services and also by apportioning the same, arbitrary, and equal weight to each indicator (Barros et al., 2012; Boerma et al., 2008; Haas et al., 2012; Leegwater et al., 2015b).

After the MDG Countdown Research Group's work on using composite indices, only few other studies in the literature have measured SC through this approach by using the most widely used MHC service delivery indicators (Leslie, Malata, et al., 2017; Ng et al., 2014; Nguhiu et al., 2017).

In measuring SC, the concept of effective coverage (EC) has been well acknowledged. As opposed to the crude coverage that focuses mainly on the use or access to interventions, EC measures interventions based on need, use and quality. The comprehensive nature of this measure makes it more appropriate for tracking the progress of UHC as opposed to the crude coverage (Knaul et al., 2012; Ng et al., 2014). EC is often defined as the fraction of potential health gain that is actually delivered to the population through the health system, given its capacity. It has three components which include need, use and quality. Need refers to the individual or population in need of a particular service; use refers to the use of services; and quality refers to the actual health benefit experienced from the service. Measuring EC can therefore be seen as a major improvement over the conventional approach of measuring crude coverage, which measures only access based on conditional need. EC can also be estimated for some sub-populations of interest and therefore useful in estimating socio-economic and geographic inequalities. It is important that a metric for measuring health performance covers both coverage and quality of the service being provided, considering the fact that use of service alone is not indicative of the complete benefit package of health services provided (Barros & Victora, 2013; Ng et al., 2014; Nguhiu et al., 2017). The WHO and WB have since identified measuring and improving EC as critical to achieving universal health coverage (Leslie, Malata, et al., 2017; World Health Organization & The World Bank, 2015). Nguhiu et al. (2017) for example found an increasing (from 26.7% in 2003 to 50.9% in 2014) aggregate EC in Kenya after determining the average of EC for maternal and child health services in Kenya, weighted by population need for the service using both DHS and SPA

surveys (Nguhiu et al., 2017). Similarly in a study to measure EC (quality-corrected coverage) of primary care services from eight low-income and middle-income high mortality countries to monitor progress towards the SDG for health combining facility and household surveys, an average EC of- 28% for ANC, 26% for FP and 21% for sick-child care was found across all eight countries (Leslie, Malata, et al., 2017).

The measurement of EC just like crude coverage focuses more on the use of three essential services within a PHC system. These include ANC, FP and care for sick children under five (Heredia-Pi et al., 2016; Hodgins & D'Agostino, 2014; Marchant et al., 2015; Ng et al., 2014; Nguhiu et al., 2017; Serván-Mori et al., 2017). Measuring EC through the use of ANC has been the most researched area with some studies in Latin America countries like Mexico showing 80% of women with appropriate ANC (Heredia-Pi et al., 2016) whilst Colombia and Peru showed 87% and 88% respectively (Hodgins & D'Agostino, 2014). Other studies in several low-income countries have shown less than 15% of women receiving a minimum set of essential services during pregnancy (Hodgins & D'Agostino, 2014). These studies have often measured EC by measuring blood pressure or testing blood during ANC services as a form of rendering essential services (Hodgins & D'Agostino, 2014; Marchant et al., 2015; Sharma et al., 2017). The use of FP and sick-child care for measuring EC however has not been extensively researched into. The focus on this area has largely been on structural measures such as facility readiness (Jackson et al., 2015; Leslie, Spiegelman, et al., 2017; Nguhiu et al., 2017).

Another important categorization of indicators used for measuring SC through intervention coverage is what is known as the promotion and prevention coverage indicators mostly covering maternal and immunization interventions. This categorization also requires the coverage of interventions on behavioural risk factors. Even though indicators on safe water

and sanitation are generally not the primary responsibility of the health sector, they should also be included in this category because improvement of health maybe considered a primary purpose of these interventions (Boerma, AbouZahr, et al., 2014) since majority of patients develop illnesses related to water and poor sanitation such as diarrhoea, cholera and typhoid, which are among the leading cause of deaths (Boateng & Yawson, 2019).

A number of the MDG or SDG indicators for reproductive and adolescent health, maternal and child health and infectious diseases often used to measure SC tend to over represent it including existing composite indices. However a study by Leegwater et al. (2015) has been the one of its kind to use indicators that takes into account human resources for health and health infrastructure to provide a comprehensive perspective of service coverage through the use of PCA. Their study was an advancement of many other existing composite indices of coverage by relying on weights computed from the data itself and not on fixed or arbitrary weights as frequently used (Leegwater et al., 2015b).

Notwithstanding the challenges associated with developing composite indices as a way of measuring SC and the general lack of data, it is a process worth embarking on considering its role in policy formulation. In view of this, the Primary Health Care Performance Initiative (PHCPI) which is an international partnership established to champion the course of PHC is increasingly recognizing the need to develop an index that closely align its PHC indicators and methodology with the WHO index of service coverage. However a major challenge confronting the PHCPI in terms of monitoring PHC progress toward UHC is the general lack of available and validated data for measuring PHC's core functions (Veillard et al., 2017).

2.6.2 Measuring Financial Risk Protection Dimension

The financial risk protection dimension of UHC is the ability of a health system to protect households or individuals from OOP catastrophic health expenditure that exceed a certain

threshold of the annual household expenditure (Akinkugbe et al., 2012; Boateng & Yawson, 2019; Prinja et al., 2017; Xu, Evans, et al., 2003; Xu, Jan, et al., 2003). Therefore most indicators for determining financial risk protection are targeted at measuring catastrophic payments with two measures frequently used in the literature.

The first is whether total household OOP spending on health exceeds a certain threshold or percentage of the household's budget. Although the choice of thresholds are often arbitrary, the most widely used thresholds which were proposed by Ranson (2002) and Wagstaff and van Doorslaer (2003) are ten percent (41% of studies) of the household's total consumption (Ranson, 2002; Wagstaff, Flores, Hsu, et al., 2018; Wagstaff & van Doorslaer, 2003) and forty percent of household's consumption net of expenditures on basic necessities (Kawabata et al., 2002; Wagstaff & van Doorslaer, 2003). The rationale for these thresholds is that they represent an approximate threshold at which the household is forced to sacrifice other basic needs, sell productive assets, incur debt or be impoverished (Akinkugbe et al., 2012; Russel, 2004). Basic necessities or needs as defined in the literature varies and ranges from the median food expenditures in the country to the household's own reported food consumption expenditures (Haas et al., 2012). The share of households whose OOP health expenditures exceed these thresholds is then reported as an aggregate indicator of catastrophic payments (Haas et al., 2012).

The second measure of catastrophic spending is whether OOP spending pushes households into poverty or impoverishment. The threshold is not a percentage of household consumption but rather a poverty line which is either established by the state due to different levels of economic development by countries (World Health Organization & The World Bank, 2015) or an international poverty line such as $1.25, $1.90, $2.0 and $3.10 per person per day (Haas et al., 2012; Wagstaff, Flores, Smitz, et al., 2018; Wagstaff & van Doorslaer, 2003; World

Health Organization & The World Bank, 2015). This indicator is measured by calculating both pre-payment and post-payment values each household (Haas et al., 2012; Wagstaff & van Doorslaer, 2003). A household is impoverished by catastrophic health payments when its pre-payment total consumption exceeds the poverty line but health expenditures pushed its post-payment consumption below that line. The aggregate indicator reported is then taken as the share of households who are estimated to be impoverished by OOP health expenditures (Ghosh, 2011; Haas et al., 2012).

Since findings from empirical studies suggest that enrolments into pooled financial schemes grants universal health access (UHA) and FRP to residents which in turn impacts positively on the attainment of UHC (Moreno-serra & Smith, 2012; Nsiah-Boateng et al., n.d.; Savedoff et al., 2012), it will be useful to include pooled financial schemes when measuring UHC in settings that have implemented it. The WHO intimates that in countries where insurance or other risk pooling mechanisms exist and functioning, measures of nominal affiliation such as enrolment have been helpful in measuring FRP (Haas et al., 2012). To this effect, Ghana has used enrolment into the NHIS as one of its measurement metric in measuring progress towards UHC though often done at the national level (Nyonator et al., 2014).

2.6.3 Measuring Population Coverage Dimension

The measurement of population coverage mostly revolves around the measurement of equity in coverage across population groups rather than the magnitude of coverage in majority of studies in the literature. The indicators used in measuring this dimension focuses more on comparing service and financial coverage amongst sub-population groups. The most used approach in measuring this dimension is the disaggregation and analysis of indicators by quintiles of socioeconomic status (wealth, consumption and income), area of residence (urban or rural) or by region. Other sub-populations of interest include age groups, gender and ethnic

or religious groups (Boateng & Yawson, 2019; Haas et al., 2012; Nsiah-Boateng et al., n.d.; Zhang et al., 2019). The WHO and World Bank (WB) global framework on UHC proposes three elements for disaggregation which include socioeconomic status of households, location and gender aimed at ensuring the comparability of measurements across countries (Boerma, AbouZahr, et al., 2014).

Hosseinpoor et al. (2014) have written extensively on global equity-oriented monitoring of UHC and provide suggestions on measuring health inequalities in the era of UHC. This includes using a minimum of two measures to complement each other, gap or gradient analytical approach and absolute or relative inequality to estimate the extend of inequality gaps (Boerma, Eozenou, et al., 2014; Hosseinpoor et al., 2014).

2.6.4 Composite Universal Health Coverage Index

Considering the critical role summary measures play in decision making amongst others, the WHO together with the WB and Wagstaff et al. (2015) suggested a framework for integrating the dimensions of UHC into a single measuring metric with the aim of making it useful in estimating progress of UHC of countries and serving as an avenue for comparison across countries. The framework also suggests that composite indices be computed from indicators of health prevention/promotion and treatment. Although their framework provides a guide list of SC indicators to select from, they advocate for a more practical process to be employed in the selection of indicators guided by relevance, quality and data availability. Furthermore, because equity is critical in UHC, the framework advocates for tracking to be incorporated in analysing equity. The FRP composite index uses indicators from two domains: the incidence of catastrophic healthcare spending and the proportion of the population that is impoverished by OOP healthcare spending. Following this, an attempt was made at generating a composite UHC index where Wagstaff et al. (2015) used SC and FRP indicators which were clubbed

into a summary index using geometric average approach as used in the United Nation's HDI. The SC and FRP were weighted for the extent of inequality. Their summary index however had limitations as they assumed arbitrary weights for computing the SC indicator rather than applying robust statistical methods. The authors also did not account for 'quality' in the computation of SC (Barasa et al., 2018; Boerma, AbouZahr, et al., 2014; Boerma, Eozenou, et al., 2014; Chan, 2016; World Health Organization & The World Bank, 2015).

So far following the combined approach of the WHO, WB and Wagstaff et al. (2015) in computing composite indices, there have been relatively few studies in the literature that have adapted a composite index approach of using both dimensions of SC and FRP for measuring UHC considering its advantages. One of such studies has been that by Barasa et al. (2018) in Kenya who measured the overall progress towards UHC by using DHS and household survey data. They computed a UHC index of 56.55% (95% CI 51.29% to 51.82%) which they considered to be low. In this study arbitrary weights where chosen as well as not accounting for quality in the computation of their UHC index (Barasa et al., 2018).

Few of the other studies that tracked progress towards UHC using a composite index of both dimensions adapting the WHO and WB framework have done so either at the global or regional level with the aim of comparing country performance towards achieving UHC. However these studies have often been limited by either incomplete data especially regarding the extend of service coverage or poor quality data from national representative surveys (Wagstaff et al., 2015, 2016; Wagstaff & Neelsen, 2020).

The study by Prinja et al. (2017) in Haryana state in India appears to be the only study identified in the literature that has attempted to measure the PHC system's performance towards achieving UHC using a composite index as proposed by the WHO and WB framework at the subnational or district level. Although their study can be considered to be a

methodological one because they employed multiple methodologies such as the HDI, PCA and regression weighting in computing their composite index, they nonetheless demonstrated how a composite index or indicator can play such a crucial role in decision making at the local health system level towards attaining UHC (Prinja et al., 2017).

Even though policy-makers are usually interested in both dimensions, they are also willing to trade off one against the other thereby making it useful to have an index of UHC attainment that reflects this. In operationalizing a UHC index in terms of it being able to use the index to see how a country's performance has changed over time, there is the need to operationalize the index in such a way that it is applicable to multiple time periods. This affects the choices of weights, SC and FRP indicators which need to be relevant and available across a range of time periods. Data availability therefore tends to be a major constraint in this type of exercise (Wagstaff et al., 2016).

2.7 Measuring Primary Health System's Readiness

Measuring PHC system's performance is critical to identifying areas for reforms that will strengthen health systems performance in general as well as evaluate the impacts of these reforms to guide policy makers and implementers on performance improvement (Veillard et al., 2017). Whereas research abounds in the field of health system research, not much can be said of the ability of health facilities to provide essential care particularly those related to UHC. In order to reap the full benefits of UHC therefore, facilities need to be service ready in terms of having the capacity to deliver high-quality services. This demands the fulfilment of some requirements such as trained and supported health workers, essential medicines, health products and equipment and information systems, along with key infrastructure foundations (Fore & Gurría, 2019; Savedoff et al., 2012).

Since health service delivery primarily focuses on immediate results in most health systems, a useful representative measure for health service delivery is a health facility readiness measure which is often defined as the ability of the health system to deliver either general services or service-specific related services using indicators from SPA surveys (Backman et al., 2008; Ssempiira et al., 2018).

The WHO between 2003 and 2013 computed a general service readiness index which was subsequently updated in 2013 to cover about fifty items comprising of basic amenities, basic equipment, infection prevention, diagnostic test and essential medicines (O'Neill & Sheffel, 2013). The general service readiness refers to the ability of health facilities to offer health services and measured by the availability of tracer items contained in the Service Availability and Readiness Assessment (SARA) tool of the WHO (O'Neill & Sheffel, 2013; Ssempiira et al., 2018). This index is now frequently used globally to assess health systems and health interventions. For example in a study aimed at assessing the effect of the introduction of the NHIS on health service delivery in mission health facilities in Ghana, there was an overall improvement in general service readiness indices in the southern, middle and the northern zones with associated indices of 0.69 to 0.76, 0.80 to 0.91 and 0.72 to 0.81 respectively from 2002 to 2010 (Aryeetey et al., 2016). Similarly, the general mean index of facility readiness to deliver basic emergency obstetric and neonatal care (BEmONC) declined slightly from 5.16 in 2005 to 3.98 in 2009 in a study that analysed the role of supply-side factors, particularly health facility readiness and management practices for provision of quality maternal health services in five Nigerian states (Gage et al., 2016).

On the other hand service specific readiness adapted from the general service readiness, measures the ability of health facilities to deliver minimum acceptable service packages. This is measured by the availability of certain tracer items including: trained staff, service delivery

guidelines, equipment, diagnostic capacity, medicines and commodities necessary for the provision of a particular service (Backman et al., 2008; Katende et al., 2015; Ssempiira et al., 2018).

Facility readiness scores in the form of composite indices using SPA surveys adapted from the SARA guidelines have been developed in several countries throughout East and South Asia (Lama et al., 2020; Leslie, Spiegelman, et al., 2017) and sub-Saharan Africa (Boyer et al., 2015; Gage et al., 2016; Holmer et al., n.d.; Jackson et al., 2015; Oyekale, 2017; Ssempiira et al., 2018) to assess the effects of health facility readiness on health systems and outcomes such as PHC, FP and clinical care. However most of these facility readiness indices have often been measured by estimating the means of the tracer items (indicators). A lot of these estimates in the literature either often do not make provision for weighting or assumes equal weights for the tracer indicators.

Few studies have however adapted more robust methodological approaches of computing health service readiness indices to account for the short falls of weighting. Jackson et al. (2015) provide useful methods to improving the use of health data in Tanzania by estimating the system's readiness to provide service using PCA (Jackson et al., 2015). Similarly a robust measure of health system capabilities in Ghana was developed by the construction of indices derived from the 2010 Ghana EmONC survey using PCA (Boyer et al., 2015). In Uganda, a more robust statistical approach employing multiple correspondence analyses (MCA) was used to construct a composite facility readiness score for both general service and malaria-specific readiness indicators obtained from the 2013 Uganda service delivery indicator survey (Ssempiira et al., 2018). However despite these robust methodological attempts at resolving weighting challenges by these studies, they have been limited by their inability to determine how changes in a measured index score which are input-focused, impacts on health service

coverage or population health primarily due to lack of data that links household surveys to facility surveys.

2.8 Linking Health Facility Surveys to Household Surveys

Improvement in population health outcomes especially regarding measuring quality of health care has not been consistently and adequately documented despite observed increases in access to health services throughout the era of the MDGs (Do et al., 2016; Marchant et al., 2015; Pell et al., 2013; Requejo et al., 2015).

Not all interventions of MCH services can be monitored using population level surveys as often seen from data in developing countries during measurements of UHC notwithstanding their importance in population level access to health care. In addition, household surveys find it difficult to estimate quality of health interventions as respondents of such surveys are often unable to respond adequately to quality questions. As a result, facility based surveys are best suited for quality related surveys but are in themselves limited due to considerable overlaps in settings with different mortality rates (Footman et al., 2015; McCarthy et al., 2016; Munos et al., 2017; Stanton et al., 2013).

Linking data of both population and facility level surveys can be viewed as one approach of producing good measures of population health outcomes accounting for quality of health care delivery (Bryce et al., 2013; Do et al., 2016; Kanyangarara & Victoria, 2018). In addition, household and facility surveys are seen as key inputs for program managers or decision makers to use in understanding the health seeking behaviours, health service utilization, and health service preparedness for a given country. Further, linking household and facility assessment data can be used to examine the relationship between individual care-seeking behaviours and the facility service environment (Burgert & Prosnitz, 2014).

2.9 Linking Approaches

Two main approaches of linking data of household and facility surveys have been identified in the literature. Do and colleagues in a systematic review of linking household and facility data for better coverage measures in reproductive, maternal, new-born and child health care identified 59 studies that had adapted one of the two linking approaches of linking household and facility data (Do et al., 2016).

2.9.1 Direct Linking (Exact Matching)

This method involves linking clients to the actual health facility they seek health care. This method of linking is often done typically at the district level and in remote areas which tend to have fewer health facilities. A variety of interventional studies have employed this linking approach ranging from care for the sick to delivery care amongst others. Measures of service provision in these studies have involved measuring service availability, access and readiness. In the studies that have used this approach, interactions between providers and clients are observed on a separate sample of clients independent of those interviewed in the household survey and as a result assessing actual quality of care becomes a problem. This approach also assumes that the quality of care does not change during the period of observation and household interviews. Typically two approaches were used to collect data in these studies. The first approach was the collection of data on readiness and service quality from facility records and also identifying clients to subsequently follow up at home. The second approach was that individuals who sought care were first asked for the names of specific facilities where they sought care and these facilities were subsequently surveyed (Do et al., 2016; Kruger et al., 2013; Willey et al., 2018).

One of the few studies that adopted a direct linking approach was a study in Ghana that linked data of women of reproductive age to data from health facilities where they received

maternal health care services from (Nesbitt et al., 2013). Similarly, two other studies in Kenya also employed the direct linking approach with the first study linking data of women to the facilities they last received care from (Tumlinson et al., 2015) and the second linking existing data of all children under five years from a demographic surveillance site to health facilities they visited (Feikin et al., n.d.).

Although this approach is seen as the gold standard, two limitations have been identified mainly related to sampling. The first limitation was that sampled households from registers at health facilities did not represent the general population meaning this approach cannot be used for estimating population level coverage intervention. Another limitation was that health providers or facilities that were sampled based on sources of care reported by households, resulted in a sample of providers that were not representative but however, allowed for population level measures as households are sampled to be representative of the population. In either case, the requirement to link the sampling for the two surveys is likely to complicate data collection (Do et al., 2016).

2.9.2 Indirect Linking Approach (Ecological Approach)

This approach is the most widely used one in the literature and was predominantly found in studies that used different data sources population and facility level surveys such as the DHS and SPA.

In the ecological linking approach, individuals and households were linked to either all or the nearest health facility within a given geographical area. Data on health care seeking behaviours collected from the household level in the area were then linked to an aggregated regional data of health facilities (Do et al., 2016; Footman et al., 2015). The use of data from a population census and a facility census for linking purposes at the national and sub-national levels is limited in the literature with one study in the Zambia (Gabrysch et al., n.d.) and the

other in Burkina Faso (Hounton et al., 2008). Generally in settings with fewer health facilities within a given geographical area, many more locations or zones were included in the surveys to cater for the limitation of representativeness (Do et al., 2016; Gage et al., 2016). In some instances linking household surveys to facility surveys in a geographical area have been achieved through the use of cluster/area identification where one or more facilities within that area were linked to each household in the same area. Other forms of geographical linking have been through the use of GPS coordinates to establish geographical distances from each household to each of the connected providers within their cluster/geographical area and possibly with providers within the neighbouring clusters (Al-Taiar et al., 2010; Katende et al., 2003). In a few instances administrative methods were employed link household data to facility data where facilities have been assigned serve geographic area or the most frequently used facility within that geographical area (Marchant et al., 2015).

Contrary to the commonly held believe that the ecological linking approach is unlikely to produce more valid estimates than the ecological linking approach, Willey et al. (2018) intimated otherwise after adjusting for level of facility by comparing the two methods in the same population in Uganda. Based on this finding they recommend that they ecological approach be used as a proxy (Do et al., 2016; Willey et al., 2018).

There are a number of limitations associated with the indirect linking approach as identified in the literature. The first limitation results from the phenomenon of bypassing because the facilities surveyed may not be the ones that individuals or households accessed health care from (Akin & Hutchinson, 1999). Another limitation of this approach was that the interval periods between surveys affected estimates because certain factors such as staff, medicines, supplies and equipment are not always constant in health care delivery. Furthermore it was observed that some of the facilities surveyed did not represent all the services of interest

especially FP, ANC and child immunization since people could always obtain those services from outside surveyed areas leading to their exclusion in most service assessments (Hounton et al., 2008; *Influence of the Service Delivery Environment on Family Planning Outcomes in Nigeria — MEASURE Evaluation*, n.d.). The administrative linking approach has also been saddled with certain misidentification and displacement errors (Wang et al., 2012). The last but not the least limitation of his linking approach was that geographical distances that used straight–lines in linking did not consider differences in terrains and transports (Gabrysch et al., n.d.; Kyei et al., 2012).

2.10 Gaps in the Literature

Literature abounds in the measurement of both health system's strength and progress of UHC although apparently there is no consensus on a measuring metric for UHC. One of the first gaps identified in the literature was that most studies that measured progress of UHC focused on measuring either only one dimension of it separately, or did so through a desk review of the entire health sector progress and performance using limited indicators. The approach of this study therefore fills this essential gap by measuring the progress of UHC using all the dimensions of UHC and also in the context of the PHC system considering the vital role it plays in the realization of UHC instead of the approach adapted by most studies. This study also moves a step further by including indicators that measure other determinants of health such as water and sanitation and lifestyle in addition to most the widely used indicators.

Another gap in the literature has to do with how measured outcomes of UHC have failed to assist decision makers to take certain key decisions in respect of trade-offs and identification of areas for interventions and actions. Although some few studies have tried to address this challenge by using composite indices, they were often confronted with weighting challenges

as they resorted to using arbitrary weights in the computation of their composite indices. In addition these studies did not account for quality (Barasa et al., 2018; Boerma, AbouZahr, et al., 2014; Chan, 2016; Leslie, Malata, et al., 2017; Ng et al., 2014; Nguhiu et al., 2017; World Health Organization & The World Bank, 2015). This current study fills this huge gap by computing a composite UHCI through the use of a robust statistical approach (PCA) that accounts for weighting challenges. This study also included quality indicators in estimating its UHCI. Through the computation of intermediate indices called principal components, this study identifies key areas of interventions and actions for policy or decision making on the path towards attaining UHC in Ghana.

A good proxy for measuring service delivery is health facility readiness since health service delivery focuses mostly on immediate outputs of health systems. The health facility readiness indicates the capacity of the health system to deliver critical health services. The literature mainly identifies two types of facility readiness comprising of general service and service-specific readiness. Whereas facility readiness indices using SPA surveys adapted from the WHO have been developed in several countries throughout East and South Asia (Lama et al., 2020; Leslie, Spiegelman, et al., 2017) and sub-Saharan Africa (Boyer et al., 2015; Gage et al., 2016; Holmer et al., n.d.; Jackson et al., 2015; Oyekale, 2017; Ssempiira et al., 2018) to measure the effects of facility readiness on health systems and population outcomes such as FP and clinical care, little is known of facility readiness towards the attainment of UHC. This study filled this gap by measuring health facility readiness scores in the form of composite indices using robust statistical analysis that accounted for true weights of indicators rather than assume equal weights or use mean scores of tracer items or indicators as carried out by previous studies. This study is even more important and timely as it will guide the MoH of Ghana to determine which areas to focus on considering the fact that the MoH had recently

developed a National UHC Roadmap which is a health sector plan focused on strengthening PHC delivery in health facilities across the country.

One of the biggest limitations of studies that have computed composite indices scores of facility readiness has been their inability to determine how changes in a measured index score impacts on health service coverage or population health. This study filled this knowledge gap by measuring index scores and determined how these scores affected health service coverage or population health by linking data sets from both household and health facilities surveys.

Finally this study contributes to the literature of limited existing studies that have adapted a direct (exact matching) linking approach of household and facility surveys by using a direct linking approach of linking household data set to facility survey.

2.11 Theoretical and Conceptual Considerations

The conceptual framework of this study is adapted from the theory of change (ToC) and systems thinking theory. Within the context of achieving UHC therefore, the ToC outlines how the implementation of interventions such as the CHPS and NHIS at the national level and the CHPS+ project at the district level is expected to lead to the desired outcome of attaining UHC. This is illustrated graphically in Figure 2.1. Similarly the system thinking theory outlines how the various dimensions of UHC interact to achieve the desired outcome of UHC whilst the various categories or components of the PHC through the health facilities also interact to be service ready in order to achieve UHC.

2.11.1 The Theory of Change (ToC)

The ToC was developed by Weiss and others within the tradition of theory-driven evaluation (Breuer et al., 2016; *Nothing as Practical as Good Theory : Exploring Theory-Based*

Evaluation for Comprehensive Community Initiatives for Children and Families | Semantic Scholar, n.d.). Theory-driven approaches to program evaluation are traced back to the 1930s through the late 1950s and the 1980s with their basic tenet being that understanding the theory underlying a program approach is necessary to understand whether, and how, it works (De Silva et al., 2014). Although definitions of ToC vary, its basic principle is that it's a theory of how and why an initiative works which can be empirically tested by measuring indicators for every expected step on the hypothesized causal pathway to impact. It is often developed in collaboration with stakeholders and modified throughout the intervention development and evaluation process through an on-going process of reflection to explore change and how it happens. It is visually represented in a ToC map which is a graphic representation of the causal pathways through which an intervention is expected to achieve its impact within the constraints of the setting in which it is implemented (De Silva et al., 2014).

2.11.2 Systems Thinking Theory

System thinking theory was introduced by Ludwig von Bertalanffy in the 1940s where the theory was described as a general science of wholeness (Von Bertalanffy et al., 1968). Systems theory places emphasis on the importance of looking at systems from a broader perspective rather than simple parts, which make up the system and stresses on the importance of understanding the complete system and the underlying interactions of all the forces or components that make up that system. In other words, systems thinking as opined by Atun and Manade and cited in Mutale et al. (2016) is a way of helping an individual to view systems from a broad perspective that includes seeing overall structures, patterns and cycles in systems, rather than seeing only specific events in the system. The application of this theory is termed as systems analysis and one of its major tools is systems thinking. This concept has been applied in several fields such as engineering, economics and ecology

amongst others where components of the systems tend to have non-linear relationships and usually unpredictable (Mutale et al., 2016). Following recent developments in the sciences of complexity, health systems are being seen as complex entities governed by non-linear interaction laws, self-organization and emergent phenomena which are unpredictable (Martínez-García & Hernández-Lemus, 2013).

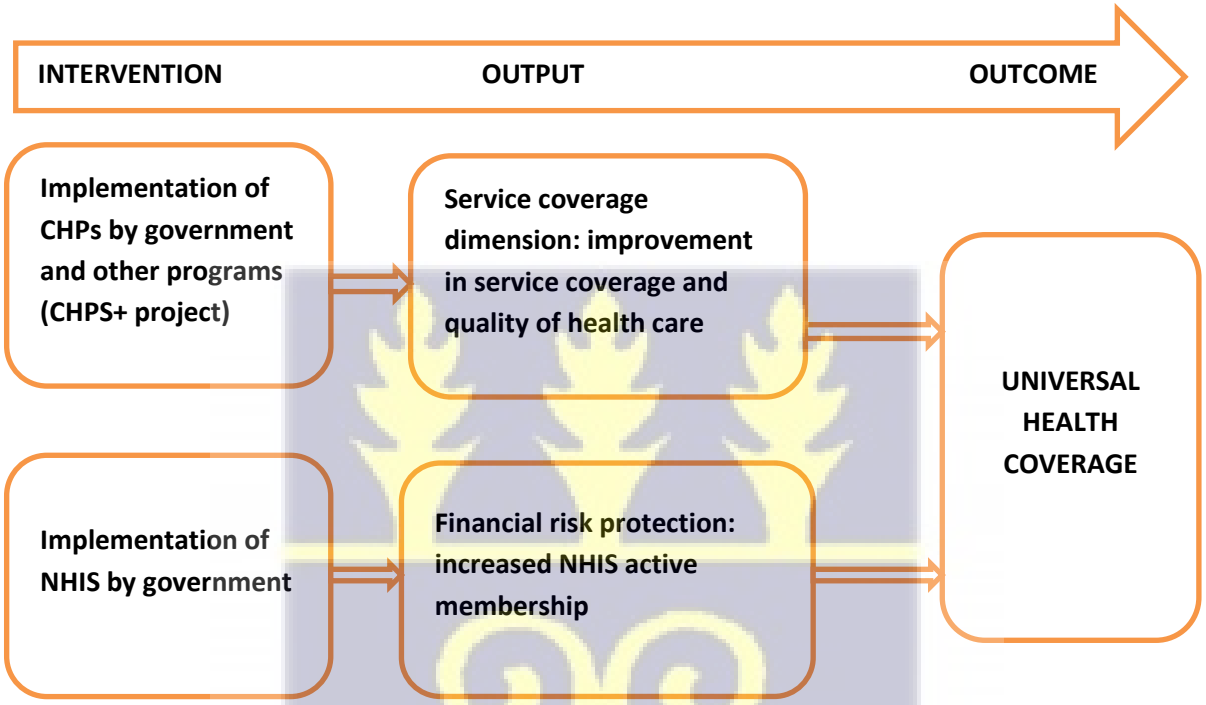

Figure 2.1 : Theory of change of UHC

Source: Apanga (2021)

2.11.3 Conceptual framework

The conceptual framework of this study is shown in figure 2.2 below and excludes some indicators especially under the financial risk dimension. This is so because the household surveys did not collect any data on household incomes and therefore cannot determine catastrophic expenditure and impoverishment from OOP spending**.** This conceptual framework conceptualizes UHC and the PHC system to be complex systems and that the

various components (dimensions in the case of UHC and categories in the case of PHC system) act as a whole and tend to interact with each other in a non-linear manner in accordance with system thinking theory.

Similarly following the implementation of interventions such as the CHPS and NHIS by the government and other health systems strengthening interventions such as the CHPS+ project, it is expected that through the ToC the desired outcomes of UHC and a more service readied PHC system will be attained after measuring these outcomes over time.

The conceptual framework of this study consists of the two dimensions of UHC with their associated indicators grouped as coverage indicators and quality indicators for the service coverage dimension and financial risk indicators for the financial risk protection dimension. The PHC system readiness also consist of a number of indicators that are categorised as trained staff, equipment, medicines, supplies, community volunteer, types of service delivery, monitoring and infrastructure adapted from the SARA tool.

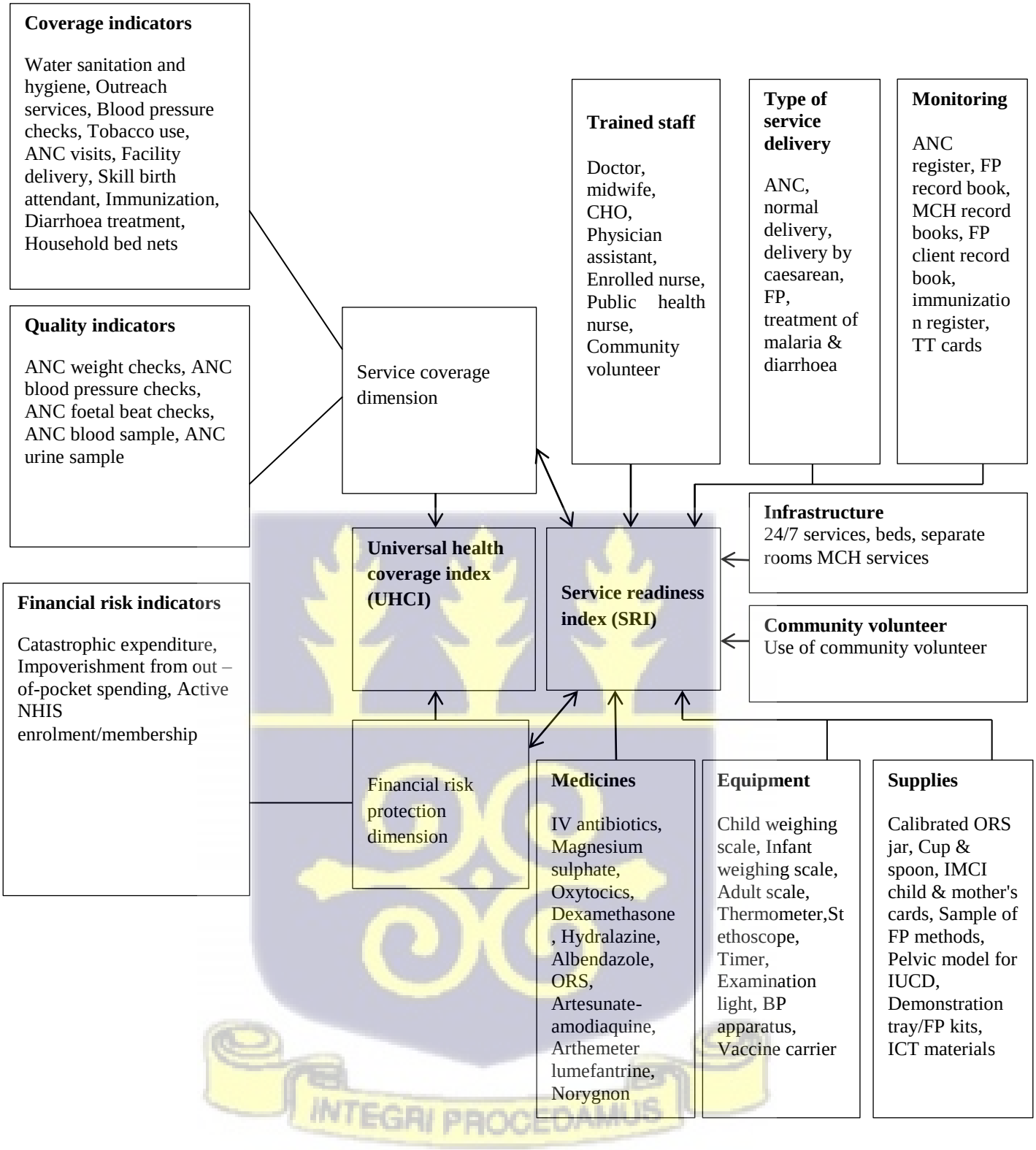

Figure 2.2: Conceptual Framework for Measuring UHC and Health System's Readiness Indices

Source: Apanga (2021)

CHAPTER THREE

PROFILE OF STUDY AREA AND METHODOLOGY

3.0 Introduction

This chapter first described the profile of the study area in terms of its geographical location, climate, vegetation, administrative system, languages, economic activities, health systems and sanitation situation. The chapter also discussed into detail, the methodological approach adopted by this study. Information on the study design, brief description of the CHPS+ project, data sources, data management, study population, key variables or indicators and their definitions and the statistical analysis are presented here.

3.1 Study Area and Population

The Volta region (now Oti and Volta regions) is located between latitudes 50 45‟N and 80 45‟N along the southern half of the eastern border of Ghana which it shares with the Republic of Togo. It shares boundaries to the west with Greater Accra, Eastern and Bono East regions, to the north with the Northern Region and has the Gulf of Guinea to the south. Its total land area is 20,570 square kilometres representing 8.7 percent of the total land area of Ghana. The region has a tropical climate characterized by moderate temperatures of 21-32^0 Celsius for most of the year. The region has two rainfall regimes, the first from March to July and the second from mid-August to October. Rainfall figures vary greatly throughout the region being highest in the central highland area and the forest zone and lowest in the Sahel-savannah zone in the northern part of the region. The average annual rainfall is reported to be between a low of 1,168 mm and a high of 2,103 mm. Its' vegetation spans all the vegetation zones of the country including costal grassland, mangrove swamps, guinea savannah, semi

deciduous forests, Sahel-savannah and mountainous wooded savannah in the north (Ghana Statistical Service, 2013).

The Volta Region has a decentralized political and administrative system that is divided into twenty five administrative Municipal/District Assemblies headed by Municipal/District Chief Executives. There are eight major ethnic groups in the region speaking different languages. The major ethnic group is the Ewe, followed by the Guan, the Akan and Gurma. The less prominent ethnic groups include the Ga-Dangme, MoleDagbon, Grusi and the Mande-Busanga (Ghana Statistical Service, 2013). Agriculture, fishing, hunting and forestry and related work are the dominant economic activities in the region and the major sources of employment for the economically active population. However fishing is the main economic activity in Keta and Krachi districts. Other economic activities in the region include manufacturing, mining and quarrying, construction, wholesale and retail trade and tourism. As at 2010, the region had a total of 326 health institutions out of which 242 are administered by the Ghana Health Service (GHS), 18 are mission owned, one is quasi-government and 65 are privately owned (Ghana Statistical Service, 2013). The Volta region is noted to be one of the poorer performing regions in the country in terms of health service coverage indicators notably immunization and contraceptive utilization (Ghana Health Service, 2018).

Only a very small proportion of communities have access to piped water. Two main sanitation facilities are available to households in the region comprising of public toilets (30.0%) and pit latrine in the house (18.7%). Some households have no toilet facility and therefore resort to the use of the bush and the beach especially in the coastal districts (Keta and Ketu South) (Ghana Statistical Service., 2013).

This study was purposively carried out in seven out of the twenty five districts of the Volta region: Akatsi North, Central Tongu, Afadjato South, Krachi East Krachi Nchumuru, Nkwanta North and North Tongu as shown in the map (Figure 3.1) below.

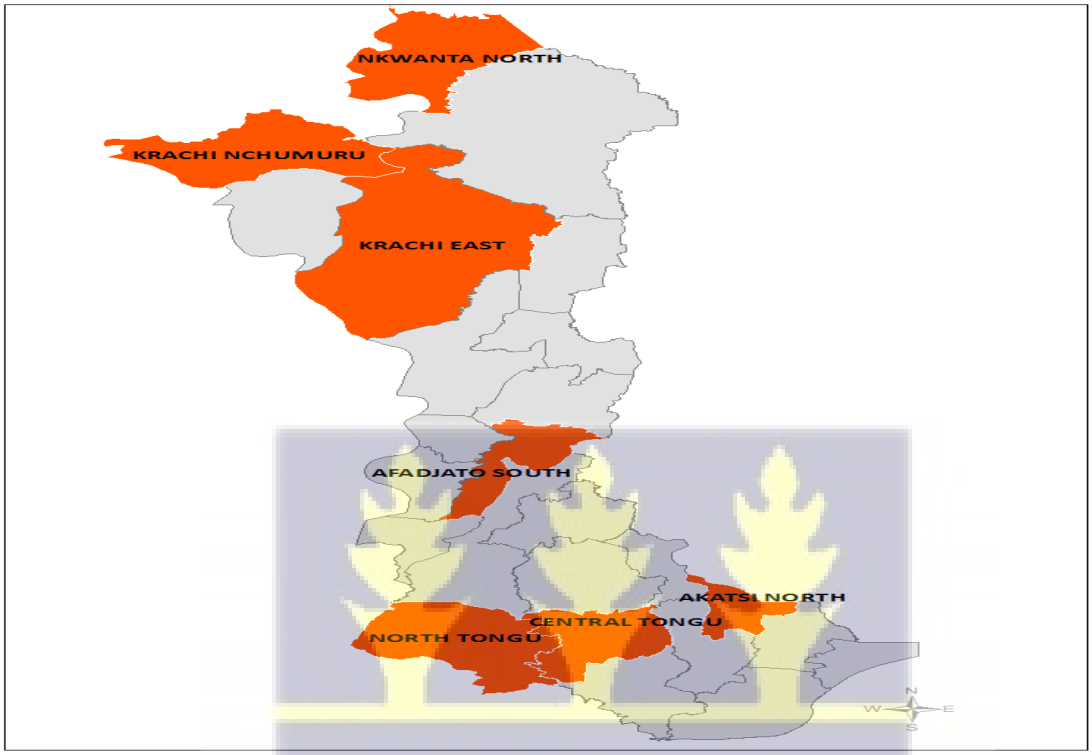

Figure 3.1: Map of the Volta Region showing Study Districts

3.2 Unit of Analysis

The unit of analysis were women/children and facility.

3.3 Methodology

3.3.1 Study Design

This study used repeated cross-sectional survey of household women aged between 15-49 at two different time periods (baseline in 2016 and endline in 2020) and a health facility survey in 2020 in seven study districts of the CHPS+ project.

3.3.2 The CHPS+ Project

The CHPS+ project known as the Program for Strengthening the Implementation of the Community-based Health Planning and Services Initiative in Ghana (CHPS+) is a five-year project launched and implemented by the Ghana Health Service in collaboration with three academic institutions. The academic institutions include the Regional Institute for Population Studies from the University of Ghana, University for Development Studies and University of Health and Allied Sciences with technical support from Columbia University's Mailman School of Public Health in 2016.

This project is a scale up of the Ghana Essential Health Intervention Programme (GEHIP) where demonstration districts known as System Learning Districts (SLDs) provide models of excellence in health system delivery and implementation at the community level by strengthening the country's community health service delivery platform (Awoonor-Williams et al., 2013; Phillips et al., 2018; Sheff et al., 2020).

The project aims to test the transfer of GEHIP strategies to two other regions (Upper East Region to the Northern and Volta Regions), assess the milestones and processes of effective CHPS scale-up in doing so and determine the child survival impact of the scale-up of GEHIP on the survival of under-five aged children. This project which is designed with the intention of decentralizing and reforming the CHPS concept will be achieved through the following:

i) **Learning platform for development**. Developing 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 through the creation of SLDs to serve as centres of excellence for systems strengthening.

ii) **Partnership for systems development.** Develop links between SLD and university-based learning processes as an activity of the Ghana Health Service Policy Planning Monitoring and Evaluation Division (PPME). This partnership utilizes SLDs not only as training sites, but as policy development field stations for creating a national knowledge management system and a national coordinating unit for monitoring process and communicating results to key stakeholders.

iii) **Data capture, utilization and knowledge generation**. Implement a research strategy that integrates data capture, analysis and use into peer learning operations. Project activities also build evidence-based programming capabilities that are decentralized, decision-oriented and focused on resilient systems planning for use in building district leadership capabilities.

iv) **National capacity to utilize data and generate knowledge for improving health and survival.** Data capture and utilization methods are piloted in SLDs and used in training for disseminating; simple, low cost and rapid turnaround tools for impact monitoring to inform policy and guide practical decision-making at all levels of the GHS system.

3.3.3 Data Sources

The sources of data for this study were from both household (baseline and endline) and endline facility surveys of the CHPS+ project.

3.3.3.1 Household Survey

Data for the household survey was from the CHPS+ project baseline and end line surveys conducted in 2017 and 2020 respectively in the seven study districts.

Sampling procedure involved a two-stage stratified cluster sampling approach. The first stage involved the sampling of Enumeration Areas (EAs) from the seven selected districts. The sampling frame for the first-stage was all EAs in all the seven districts from the 2010

Population and Housing Census. The sampling frame included information regarding the location (rural or urban) and size (estimated number of households in the EA). EAs were first stratified into three groups: small, medium, or large. EAs were then sampled from each stratum using probability proportional to population size (PPS). At the second stage, households were drawn from the EAs selected in the first stage. To obtain a sampling frame for the second stage sampling, a complete household listing of all households in each of the EAs was conducted in all the selected EAs. This listing collected information on household size and the number of women of reproductive age (15-49) in each household. The sampling frame was restricted to only households with eligible women. Approximately an equal number of eligible women were sampled from each EA. All women within the reproductive age (15-49 years) in sampled households were eligible to be interviewed to elicit information on both their health and that of their children.

3.3.3.2 Health Facility Survey

The CHPS+ baseline and endline health facility assessments were conducted in 2017 and 2020 respectively to collect information on all facilities delivering health services in the seven CHPS+ survey districts and some neighboring districts of the region. The surveys included functional CHPS zones with or without compounds (functioning service posts), sub-district health centres, private clinics and district hospitals. However for the sake of addressing the third and fourth objectives of this study, only data of the endline health facility survey was used.

3.4 Data Management

Data collection was done using a paperless Open Data Kit (ODK) technology and tablets which ensures instantaneous data collection, editing and correction at the time of interviews. This technology is a suite of tools that enables users to collect their own rich data and

designed to let users own, visualize, and share data without the difficulties of setting up and maintaining servers. The tools are easy to use, deploy, and scale (Anokwa et al., 2009). In this study, the surveyCTO platform was used for both household and facility surveys after which data was downloaded from the surveyCTO server and imported into to Stata version 14 software for further data screening, cleaning and coding.

3.5 Key Indicators and Variables

The process of selecting variables and/or indicators was based on the theoretical framework and empirical evidence for measuring UHC (MDGs indicators) and health systems' readiness as identified in the literature and guided by the GHS/MoH protocols.

These variables/indicators are categorised and defined in Tables 3.1 and 3.2

Table 3. 1: Indicators for UHC

Dimension	Variable/Indicator	Definition
Coverage (access)	Water sanitation and hygiene (WASH)	Household using toilets with flush systems
	Outreach services	Households visited by health worker in the past three months
	Blood pressure checks (proxy for NCD coverage)	Women who had their blood pressures checked in past one year
	Tobacco use (proxy for NCD coverage)	Household member who smokes
	ANC visits	Women with four or more ANC visits
	Facility delivery	Women who delivered in a health facility
	Skill birth attendant	Delivery conducted by a skill birth attendant (Doctor, Nurse, Midwife, CHO)
	Immunization against DPT	Child receives all three doses of DPT
	Immunization against measles	Child received dose of measles vaccine
	Immunization against polio 0	Child receives first dose of polio vaccine
	Diarrhoea treatment	Child received ORS or fluids after having diarrhoea in the past 2 weeks
	Household bed net	Household possession of bed net
(Quality)	ANC weight	Weight checked during ANC
	ANC blood	Blood sample taken during ANC
	ANC blood pressure	Blood pressure checked during ANC
	ANC urine	Urine sample taken during ANC
	ANC heart rate	Heart rate of foetus checked during ANC
Financial risk protection	NHIS enrolment	Active NHIS membership

Source: Author's

Table 3. 2: Indicators for PHC Systems' Readiness

Categories	Variables/indicators
Trained staff	Doctor Public health nurse Nurse Professional Midwife CHO/CHN Enrolled nurse Medical/Physician Assistant Health Assistant Community health Volunteer/workers
Types of service delivery	ANC Normal Delivery Delivery by Caesarean section FP Immunization Treatment of diarrhoea Treatment of malaria Rapid Diagnostic Testing for malaria Static Child Welfare clinic Post-natal care
Equipment	Child weighing scale Infant weighing scale Thermometer Stethoscope Timer or watch with seconds hand, Staff has watch with second hand or other device (e.g., cell phone) that can measure seconds, Digital BP apparatus Manual BP apparatus Adult scale Examination light Vaccine carrier
Supplies	Calibrated 1/2 or 1-litre measuring jar for ORS Cup and spoon IMCI chart booklet IMCI mother's cards Sample of FP methods Pelvic model for IUCD Demonstration tray/FP kits Information Communication materials
Medicines	IV antibiotics, Magnesium sulphate (MgS04), IV Diazepam, Oxytocics, Dexamethasone / Betamethasone, Hydralazine, Albendazol, Cytotec, Sulfadoxine - Pyrimethamine (SP), Artesunate-amodiaquine, Arthemeter lumefantrine, Depo-Provera (DMPA), Norygnon, ORS, iron tablets, Tetanus Toxoid, Folic Acid, Mebendazole, Ferrous Sulphate
Monitoring	ANC care register Child Health Record Book FP register FP client record books FP month report Immunization register Maternal Health Record book Community register Vaccine logistics register
Community volunteers	Facility works with community-based agents, community health volunteers, community surveillance volunteers
Infrastructure	Beds for overnight stay, provides 24/7 service, separate rooms for maternal and child health care

Source: Author's

3.5.1 Outcome Variables

There were two sets of outcome variables. The first outcome variables were UHCI and SRI from household and facility surveys respectively constructed from PCA. The second set of outcome variables were some selected population coverage indicators such as four or more ANC visits, all three doses of DPT, contraceptive use and active NHIS membership.

3.5.2 Explanatory Variables

Explanatory variables were the extracted principal components from eighteen (18) variables (Table 3.1) each in both the baseline and endline surveys and from seventy (70) variables (Table 3.2) in the health facility survey from PCA.

Other explanatory variables were age group (the age group a woman belongs to); woman's education (level of education); husband's education (husband level of education); SRI score (a final single PCA score); distance from health facility (distance in km of the woman from the health facility she accesses health care); pregnancy intention (whether woman intended becoming pregnant for this particular child); religion (religion of woman); wealth quintiles (socio-economic status); literacy (ability to read some basic text provided to the respondent); and occupation (type of job/profession). The SRI score was used as the main explanatory variable in order to determine its effect on other set of outcome or population level variables (ANC visits, immunization against DPT, contraceptive use (woman or partner currently using any form of contraceptive) and active NHIS membership.

3.6 Metrological procedure

3.6.1 PCA

This is multivariate analytic technique involving a mathematical procedure that transforms a set of correlated variables into a smaller set of orthogonal (uncorrelated) variables called

principal components. These principal components are linear combinations of the original variables and contain much of the information that is contained in the original variables. Because PCA is unit dependent, variables are usually standardized before performing PCA to account for different units of measurement. This technique has been used extensively in the construction of single scale measurements of socioeconomic status and other economic analysis. PCA has the ability to deal with the issue of assigning weights to the variables in constructing composite indices and is suitable for a mix of both discrete and continuous data sets (Bawah & Zuberi, 2005; Jackson et al., 2015).

PCA generates a new set of variables that describe the commonality of a set of related indicators. PCA scales representing the best linear representation of their common variance (principal components) are then constructed from the variables. The first principal component accounts for as much of the variance in the data as possible and each succeeding component that is estimated in turn have the highest variance possible under the condition that it is orthogonal (uncorrelated) to the preceding components. Each indicator used in the PCA estimation generates a corresponding coefficient (loading) which represents the relationship of that indicator with the corresponding principal component. These coefficients are often taken as the weights of the indicators when constructing the composites. By multiplying each of the coefficients by the corresponding indicator and summing all the products produces a composite index. Therefore with PCA a single variable is generated that describes the commonality of a set of related indicators (Bawah & Zuberi, 2005; Chao & Wu, 2017; Jackson et al., 2015; Thattil et al., 2015).

The estimates of UHCI and SRI are obtained as follows:

$$UHCI/SRI = L_1x_1 + L_2x_2 + L_3x_3 \ldots + L_kx_k \quad (1)$$

Where:

UHCI/SRI = universal health coverage index/service readiness index

$L_1 \ldots L_k$ = the indicator loadings

$x_1 \ldots x_k$ = indicators

3.6.2 Binary logistic regression

In this analysis outcome variables include certain selected population coverage indicators or outcomes such as four or more ANC visits; all three doses of DPT; contraceptive use; and active NHIS membership. The main explanatory variable was the single SRI score generated from the PCA of the endline health facility survey. Other explanatory variables or covariates serving as confounders were also included in each logistic regression model to determine how the PHC systems' readiness or changes in SRI scores impacts on population health or UHC. The choice of this method is due to a number of population coverage outcomes. The assumptions underlying the binary logistic regression includes the following: (i) outcome follows a binary distribution which is linked to the covariates through a link function as in ordinary logistic regression; (ii) independence of observational units; and (iii) linear relation between covariates and expected outcome. One of the population coverage indicators or variables was used as the reference group or base outcome.

The binary logistic regression is given as:

$$\text{Logit}(P) = \log(p/1-p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots + \beta_k X_k$$

Where:

Log (p/1-p) = log function

β_0 = intercept

$\beta_1 \ldots \beta_k$ = coefficients of the covariates

$X_1 \ldots X_k$ = covariates

3.7 Statistical Analysis

Several analyses were carried out to answer the research questions in order to achieve the objectives of the study. All estimations were done using STATA 14 and the svy suite in STATA was used to take into consideration the complex survey design of the CHPS+ project. The standard errors are also clustered at the primary sampling unit which happens to be the EA in the data used for this study especially in the household surveys to allow for possible correlation amongst observations in the same EA.

3.7.1 Descriptive Analysis

The descriptive analysis involved the generation of frequencies to describe the socio-demographic characteristics of variables and identified indicators for measuring UHC and health systems' readiness based on the theoretical framework and empirical evidence from the literature.

3.7.2 Multivariate Analysis

Principal Component Analysis (PCA) was used as the first multivariate analytic technique to construct UHCI and SRI.

In carrying out the analysis, the first step which involved categorical variables from the questionnaires were converted or recoded into dummy variables as indicators when there was no information about the ordering of the categories whilst ordinal variables were maintained as done in similar studies (Boyer et al., 2015; Jackson et al., 2015).

The second step involved the maintenance of internal consistency, removing the effect of multicollinearity and ensuring that the data was suitable for such PCAs. This was achieved by correlations analysis and calculating Cronbach coefficient alphas (c-alphas) for the entire group of indicators in all surveys. Indicators with very low and very high correlations were

dropped after the correlation analysis. C-alpha is a coefficient of reliability based on the correlation between individual indicators. That is if the correlation is high then there is evidence that the individual indicators are measuring the same underlying construct. Therefore a high c-alpha (a high reliability) indicates that the individual indicators measure the latent phenomenon well. Although cut-off-values for c-alpha ranges from 0.6 to 0.8 amongst different authors, this study adapts 0.7 as suggested by Nunnally (1978) and cited by (Nardo et al., 2005) by deleting each indicator one at a time until at least this cut-off-value was achieved.

In the third step, the robustness of the composite indices to be computed was tested using statistical tests to evaluate the quality of the PCA results. Although other statistical tests for determining robustness such as conducting sensitivity analyses and constructing confidence intervals around composite indices are available, this study used the Kaiser–Meyer–Olkin (KMO) and the Bartlett's test of sphericity as a statistical test for determining the robustness of the PCA models before performing the PCAs. However the choice of these statistical tests was based on the fact that they offered beforehand an opportunity to determine both the sampling adequacy and test of non-correlation between variables before running the PCA model. It is recommended that the KMO and the Bartlett's test of sphericity be used prior to the PCA itself. The KMO test on one hand evaluates the sampling adequacy by comparing the magnitudes of the partial correlation coefficients to the magnitudes of the observed correlation coefficients. For values greater than 0.5, the test indicates that PCA is appropriate to be applied. On the other hand, the Bartlett's test of sphericity checks for any redundancy between variables and it is used to test the null hypothesis that the individual indicators in a correlation matrix are uncorrelated (i.e., the correlation matrix should be an identity matrix). The test is statistically significant if the associated probability of the test is less than 0.05

following which the null hypothesis of non-intercorrelation is rejected (Nardo et al., 2005; Popescu et al., 2018).

The fourth step in the construction of the PCA dealt with the decision on how many principal components should be retained in the analysis without losing too much information or when to stop extracting components. This basically depends on there being very little "random" variability left and is rather arbitrary. However various guidelines ("stopping rules") have been developed in the social science by Dunteman (1989) and cited in Nardo et al. (2000). They include: (1) Kaiser criterion which specifies that all factors with eigenvalues below 1.0 be dropped. The simplest justification for this is that it makes no sense to add a factor that explains less variance than is contained in one individual indicator, (2) Scree plot method proposed by Cattell which plots the eigenvalues. It suggests retaining all eigenvalues in the sharp descent before the first one on the line where they start to level off, (3) Variance explained criteria which some researchers simply use the rule of keeping enough factors to account for 90% (sometimes 80%) of the variation, (4) Joliffe criterion which drops all factors with eigenvalues under 0.70. This rule may result in twice as many factors as the Kaiser criterion and (5) Comprehensibility method which is strictly not a mathematical criterion (Nardo et al., 2005). In this study the scree plot proposed by Cattell was used to retain the principal components.

The final step of the PCA was the prediction of scores of the retained principal components and computation of single UHCI and SRI scores to measure progress of UHC and PHC system readiness towards attaining UHC respectively.

To account for issues of equity, PCA was used to categorise households into five wealth quintiles measuring socio-economic status (SES): poorest, poorer, middle, richer and richest. Household assets such as television, radio, refrigerator, telephone, lighting type, type of

roofing material, type of floor material, vehicles, motorbikes and livestock were used in the PCA. The computed composite UHCI was subsequently sub classified according to the SES of respondents to explain the progress of UHC amongst different wealth quintiles to account for the population coverage dimension of UHC.

The direct or exact linking approach was used to link the endline household survey data to the endline health facility survey data (using place of birth) by generating a unique ID and merging both data sets after performing the PCA for the endline health facility survey and generating a single SRI score.

Binary logistic regression was run as the second multivariate analysis. A total of four regression models were run based on each outcome variable. This was done to assess the effect of the PHC system readiness on UHC at the population level. Adjusted odds ratios (AOR) together with their 95% confidence intervals were presented. P-values of less than 0.05 were considered statistically significant.

In the first model (Model 1), four or more ANC visits was regressed on SRI scores as main explanatory variable and other explanatory variables such as woman's education; husband's education; distance from health facility; pregnancy intention; religion; wealth quintiles; literacy; and occupation as confounders. These other explanatory variables were selected for this model because they have been found to influence ANC attendance in the literature (GSS et al., 2017b; Gupta et al., 2014; Heredia-Pi et al., 2016; Joshi et al., 2014; Laksono et al., 2020; Obse & Ataguba, 2021; Seidu et al., 2020).

In the second model (Model 2), all 3DPT immunizations was regressed on SRI scores as main explanatory variable and other explanatory variables such as woman's education; husband's education; distance from health facility; pregnancy intention; religion; wealth quintiles; literacy; four or more ANC visits; and occupation as confounders. These other

explanatory variables were selected for this model because they are known to influence childhood immunizations (Chowdhury et al., 2021; Galadima et al., 2021).

In the third model (Model 3), contraceptive use was regressed on SRI scores as the main explanatory variable and other explanatory variables such as woman's education; husband's education; distance from health facility; pregnancy intention; religion; wealth quintiles; literacy; and occupation as confounders. These other explanatory variables have been found to influence contraceptive use in other studies (Alo et al., 2020; Farhan Asif et al., 2020; Shiferaw et al., 2017; Skogsdal et al., 2018).

The fourth model (Model 4) involved regressing active NHIS membership on SRI scores as the main explanatory variable and other explanatory variables such as woman's education; husband's education; distance from health facility; pregnancy intention; religion; wealth quintiles; literacy; and occupation serving as confounders as found in the literature (Badu et al., 2018; Nsiah-Boateng et al., 2019).

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results of the study after the analysis. The results of the household surveys (baseline and endline) are presented first and followed by that of the endline health facility survey. The socio-demographic characteristics and descriptive statistics of the main variables or indicators according to each objective are presented in the form of tables, graphs and text narratives after univariate analysis. The results of the multivariate analysis using PCA to compute both UHCI and SRI and binomial logistic regression analysis to determine the effect of the PHC system's readiness on population coverage or UHC are also presented in tabular, graphical, and narrative forms.

4.2 Results of Household Surveys

In total, 13,193 women of reproductive age (15-49 years) with live births and children under five years old made up the sample for this study. At baseline 7,624 women were included whilst 5,569 women were included from the endline. No woman was dropped from the analysis due to missing data on one or more variable of interest.

4.2.1 Socio-demographic characteristics of household surveys

The socio-demographic characteristics of the respondents at both baseline and endline are presented together in Table 4.1 to enable easy comparison.

Majority of the respondents comprising 80.76% at baseline and 67.76% at endline were married. Approximately 13.00% and 26.00% at baseline and endline respectively were either cohabiting or living together. A relatively small proportion of the respondents were either

widowed or divorced at both baseline and endline. The 24-29 years and 30-34 years age groups accounted for the majority of the respondents in both baseline and endline surveys whilst those in the 45-49 years age group were the least. Christianity was the dominant religion amongst the respondents representing 76.64% and 78.88% at baseline and endline respectively. More than half of the respondents were educated (59.13% at baseline and 64.39% at endline). Out of those educated, more than half of them consisting of 58.65% at baseline and 56.11% at endline respectively had secondary education. The illiteracy rate was quite high at both baseline and endline surveys representing 72.11% and 64.87% respectively of those surveyed.

Table 4. 1: Socio-demographic characteristics of household respondents

Characteristics	Baseline	Endline
	%	%
Marital status		
Married	80.76	67.76
Widowed	1.18	1.29
Divorced	1.44	1.33
Separated	4.10	3.44
Cohabiting/Living together	12.51	26.16
Educational status		
Educated	59.13	64.39
Not educated	40.87	35.61
Educational level		
Primary	39.71	41.24
Secondary	58.65	56.11
Tertiary	1.64	2.65
Literacy level		
Not literate	72.11	64.87
Semi-literate	9.58	9.97
Literate	18.31	25.16
Age group		
15-19	4.09	5.37
20-24	18.59	22.14
25-29	25.34	23.33
30-34	22.97	21.26
35-39	16.16	16.12
40-44	8.79	8.82
45-49	4.07	2.96
Religion		
Christianity	76.64	78.88
Islam	4.68	5.23
Traditional religion	12.12	9.97

TABLE 4.1 CONTINUED		
Characteristics	**Baseline**	**Endline**
No religion	6.56	5.93
Occupational status		
Farming	52.19	45.09
Trading	22.65	25.21
Hairdressing/Dress making	7.54	9.03
Civil servant	1.35	1.65
No occupation	13.76	14.20
Others	2.50	4.82
Total (N)	**7624**	**5569**

Source: CHPS+ project (2017-2020)

Education and literacy play a crucial role in health education and promotion ultimately affecting health seeking behaviour. Although persons with some education are expected to be literate, that is always not the case. Table 4.2 therefore shows a cross tabulation of literacy level amongst the educated respondents to find out the proportion of educated respondents who were literates. Most of those with primary education in both surveys were found to be illiterates with a general improvement in semi-literacy level at endline however. As shown in Table 4.2, the level of literacy increased as the level of education increased.

Table 4. 2: Cross tabulation of level of education and literacy level

Level of education	**Literacy level**					
	Baseline			**Endline**		
	Not literate %	Semi-literate %	Literate %	Not literate %	Semi-literate %	Literate %
Primary	89.38	7.04	3.58	81.12	11.71	7.17
Secondary	29.82	22.58	47.59	22.22	18.79	59.00
Tertiary	1.35	0	98.65	2.11	0	97.89
Total (N)	**1790**	**2639**	**74**	**1478**	**2012**	**95**

Source: CHPS+ project (2017-2020)

4.2.2 Distribution of universal health coverage indicators

Measuring progress of UHC requires the use of both service coverage (access and quality) and financial risk protection indicators. Table 4.3 presents the distribution of UHC indicators showing the performance of these indicators following the implementation of the CHPS+ project together with already existing strategies (CHPS concept and NHIS) introduced by government to attain UHC.

Table 4. 3: Percentage distribution of indicators of UHC of baseline and endline

Dimension	Indicators	Baseline	Endline	p-value
		%	%	
Service coverage (access and quality)	Outreach services	13.01	35.55	0.045
	Blood pressure checks	51.65	51.21	0.499
	Had four or more ANC visits	68.30	75.96	0.059
	Weight during ANC	91.49	94.60	0.771
	Blood pressure during ANC	91.64	94.95	0.345
	Blood sample during ANC	90.35	94.36	0.004
	Urine sample during ANC	89.82	94.15	0.205
	Foetal heart rate during ANC	90.46	93.70	0.007
	Facility delivery	45.26	60.21	0.907
	Skilled birth attendant	45.95	58.92	0.839
	WASH	0.81	2.24	0.086
	Household bed net	86.04	97.07	0.000
	Tobacco use	19.22	8.19	0.000
	Immunization against DPT	83.88	84.84	0.342
	Immunization against measles	73.99	74.83	0.002
	Immunization against polio 0	59.40	64.22	1.000
	Diarrhoea treatment	42.54	53.41	0.415
Financial risk protection	NHIS enrolment/active NHIS membership	28.24	27.35	0.000
Observations (N)		7624	5569	

Source: CHPS+ project (2017-2020)

Overall there was an improvement in the performance of UHC indicators from baseline to endline with the exception of immunization against measles and active NHIS membership. However whereas the improvement was marginal for some indicators such as diarrhoea treatment, blood pressure checks and immunization against DPT it was substantial for other indicators such as outreach services, WASH and tobacco use. There was an improvement of over 100% in outreach services, tobacco use and WASH between baseline and endline. Indicators such as facility delivery, skilled birth attendant, household bed net and treatment of diarrhoea recorded improvements of over 10% at endline.

4.2.3 PCA model (composite measure of progress) at baseline

This PCA model was carried out to compute the UHCI at baseline. The result of the model which consists of two outputs is presented in Tables 4.4 and 4.5. Table 4.4 which is the first output presents the results of eigenvalues of the principal components of the PCA model. Eigenvalues ranged from 4.6025 (highest) for component 1 to 0.0379 (lowest) for component 13. Using Cattell's criterion (Nardo et al., 2005) the first three components which were retained accounted for 59.43% of the total variance in the initial data whilst the remaining ten components accounted for the remaining 40.57% of the total variance in the initial data.

Table 4. 4: Distribution of principal components eigenvalues of baseline data

Principal components/correlation		Number Of Observations	=	7,408
		Number Of components	=	13
		Trace	=	13
Rotation: (unrotated = principal)		Rho	=	1.0000
Component	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Comp1	4.6025	2.7519	0.3540	0.3540
Comp2	1.8505	0.5779	0.1423	0.4964
Comp3	1.2726	0.2234	0.0979	0.5943
Comp4	1.0492	0.0546	0.0807	0.6750
Comp5	0.9947	0.0756	0.0765	0.7515
Comp6	0.9191	0.1819	0.0707	0.8222
Comp7	0.7372	0.0534	0.0567	0.8789
Comp8	0.6839	0.4026	0.0526	0.9315
Comp9	0.2812	0.0475	0.0216	0.9531
Comp10	0.2338	0.0405	0.0180	0.9711
Comp11	0.1933	0.0492	0.0149	0.9860
Comp12	0.1442	0.1063	0.0111	0.9971
Comp13	0.0379	0.0000	0.0029	1.0000

Source: CHPS+ project (baseline, 2017)

Figure 4.1 shows a scree plot of the eigenvalues of the principal components after the model. This scree plot indicates a steep fall in components from component 1 to component 3 before levelling off of components from component 4 through to component 13.

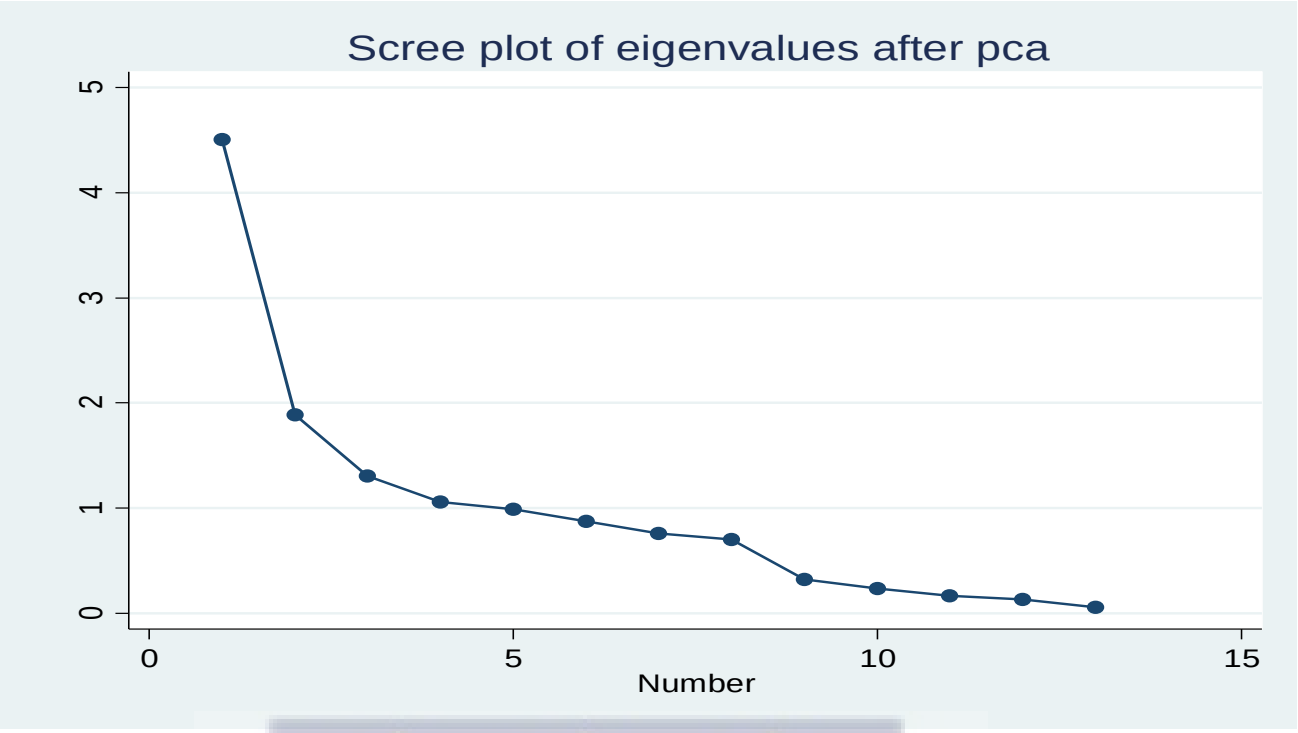

Figure 4. 1: Screeplot of eigenvalues after PCA at baseline
Source: CHPS+ project (baseline, 2017)

Table 4.5 which is the second output presents the loadings of the initial indicators on the principal components. All the 13 components generated together explained or accounted for all the variance in the data. Outreach services had positive signs and high loadings of 0.7275 and 0.5987 on components 4 and 6 respectively. Blood pressure checks had a positive sign and high loading (0.6985) on component 3 and a negative sign and high loading (-0.7030) on component 8. ANC visits had a positive sign and loaded heavily (0.9544) on component 7. ANC weight had positive signs and high loadings of 0.4154 and 0.4093 on components 1 and 9 respectively. It also had negative signs and high loadings of -0.4256 and -0.6657 on components 10 and 12 respectively. ANC blood pressure had positive signs and high loadings of 0.4191 and 0.7411 on components 1 and 12 respectively. ANC urine had a positive sign and high loading (0.4094) on component 1 and also had negative signs and high loadings of -0.6508 and -0.61 on components 9 and 11 respectively. ANC heart rate had a positive sign

and high loading (0.4073) on component 1 and a positive sign and high loading (0.8032) on component 10 as well.

Table 4. 5: Retained principal components (eigenvectors/loadings) of baseline data

Variable	Comp1	Comp2	Comp3
Outreach services	0.0140	0.0194	0.2363
Blood pressure checks	0.0649	0.1016	**0.6985**
ANC visits	0.2504	0.1307	-0.0109
ANC weight	**0.4154**	-0.1536	-0.0191
ANC blood pressure	**0.4191**	-0.1536	-0.0243
ANC urine	**0.4094**	-0.1238	-0.0229
ANC heart rate	**0.4073**	-0.1428	-0.0208
Facility delivery	0.1856	**0.6483**	-0.1344
ANC blood	0.4117	-0.1446	-0.0224
Skill birth attendant	0.1863	**0.6468**	-0.1365
Active NHIS membership	0.0752	0.1250	**0.6440**
WASH	0.0260	0.1073	0.0477
Household bed net	0.0790	0.0508	-0.0012

Source: CHPS+ project (baseline, 2017)

Facility delivery had a positive sign and high loading (0.6483) on component 2 and a negative sign and high loading (-0.7075) on component 13. ANC blood had positive signs and high loadings of 0.4117 and 0.7708 on components 1 and 11 respectively and a negative sign and high loading (0.4337) on component 9. Skilled birth attendant had positive signs and high loadings of 0.6468 and 0.7065 on components 2 and 13 respectively. Active NHIS membership had positive signs and high loadings of 0.644 and 0.6781 on components 3 and 8 respectively. WASH had a positive sign and loaded heavily (0.9307) on component 5. Finally households' bed net had a positive sign and high loading (0.6208) on component 4 and a negative sign and high loading (0.7035) on component 6.

Based on Cattell's criterion for retaining principal components (see Figure 4.4), the retained components or intermediate composites determining progress of UHC were components 1, 2 and 3. Component 1 which explained 35.40% of the total variance in the initial data was correlated with quality indicators of the service coverage dimension. Component 2 which explained 14.23% of the total variance in the initial data was correlated with access indicators of the service coverage dimension. Component 3 which explained 9.79% of the total variance in the initial data was correlated with access indicators of service coverage dimension and active NHIS membership which is an indicator of financial risk protection dimension.

4.2.4 PCA model (composite measure of progress) at endline

Similar to the PCA model at baseline, this model was replicated to compute the UHCI at endline. The result of the model just like in the case at baseline consists of two outputs and is presented in Tables 4.6 and 4.7. The first output which is represented by Table 4.6 presents the results of eigenvalues of the principal components of the PCA model. The component with the highest eigenvalue (4.5073) was component 1 whilst that with the lowest eigenvalue (0.0561) was component 13. Based on Cattell's criterion (Nardo et al., 2005), the first three components accounted for 59.26% of the total variance in the initial data whilst the remaining ten components accounted for 40.74% of the variance in the initial data.

Table 4. 6: Distribution of principal components eigenvalues of endline data

Principal components/correlation		Number of Obs =		5,432
		Number of comp. =		13
		Trace =		13
Rotation: (unrotated = principal)		Rho =		1.0000
Component	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Comp1	4.5073	2.6194	0.3467	0.3467
Comp2	1.8880	0.5792	0.1452	0.4919
Comp3	1.3088	0.2486	0.1007	0.5926
Comp4	1.0602	0.0697	0.0816	0.6742
Comp5	0.9905	0.1163	0.0762	0.7504
Comp6	0.8741	0.1141	0.0672	0.8176
Comp7	0.7600	0.0605	0.0585	0.8761
Comp8	0.6995	0.3771	0.0538	0.9299
Comp9	0.3223	0.0890	0.0248	0.9547
Comp10	0.2333	0.0649	0.0179	0.9726
Comp11	0.1685	0.0369	0.0130	0.9856
Comp12	0.1315	0.0754	0.0101	0.9957
Comp13	0.0561	0.0000	0.0043	1.0000

Source: CHPS+ project (endline, 2020)

Figure 4.2 shows a scree plot of the eigenvalues of the principal components after the model. This scree plot indicates a steep fall in components from component 1 to component 3 before levelling off components from component 4 through to component 13.

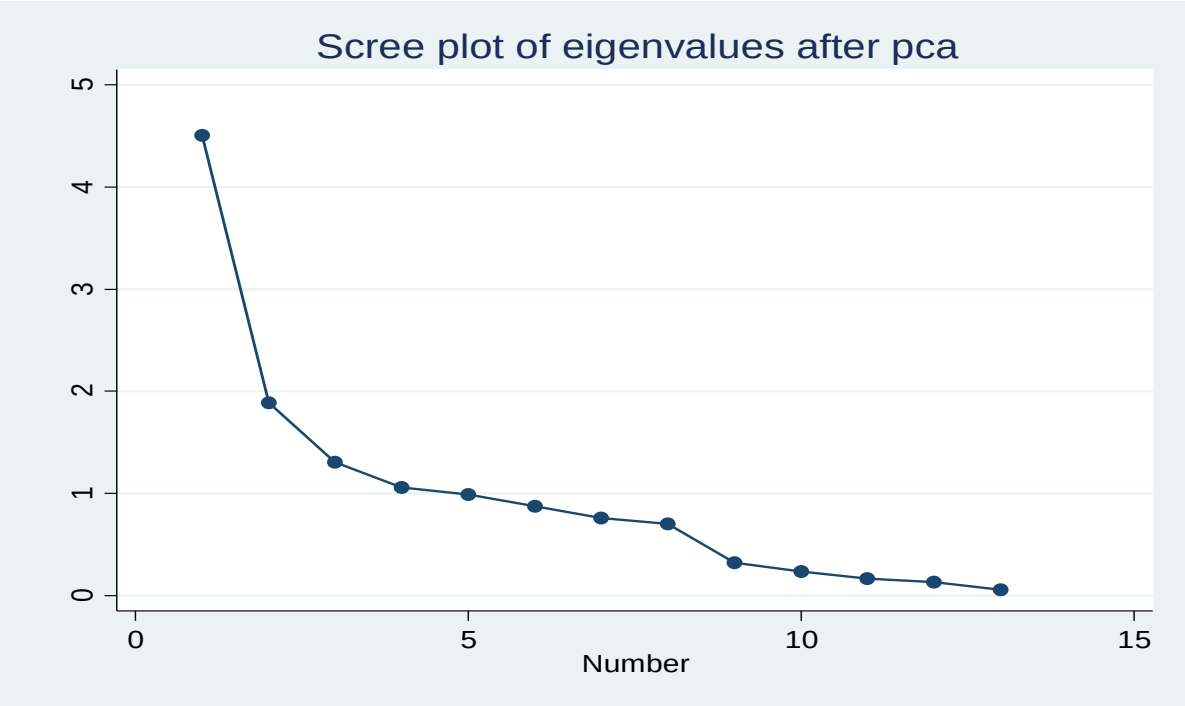

Figure 4. 2: Screeplot of eigenvalues after PCA (endline)
Source: CHPS+ project (endline, 2020)

Table 4. 7: Principal components (eigenvectors/loadings) of endline data

Variable	Comp1	Comp2	Comp3
Outreach services	0.0064	0.0940	0.2684
Blood pressure checks	0.0641	0.1237	**0.5875**
ANC visits	0.2397	0.1547	0.0079
ANC weight	**0.4197**	-0.1345	-0.0083
ANC blood pressure	**0.4330**	-0.1339	-0.0216
ANC urine	**0.4180**	-0.1281	-0.0169
ANC heart rate	0.3959	-0.1265	-0.0093
Facility delivery	0.1693	**0.6438**	-0.1771
ANC blood	**0.4252**	-0.1360	-0.0156
Skill birth attendant	0.1699	**0.6411**	-0.1851
Active NHIS membership	0.0584	0.1506	**0.6068**
WASH	0.0273	0.1296	0.2495
Household bed net	0.0279	0.0011	0.2922

Source: CHPS+ project (endline, 2020)

Table 4.7 which is the second output presents the loadings of each indicator on the principal components. All 13 components together explained the total variance in the data. Outreach services had a positive sign and high loading (0.6820) on component 4 and also had a negative sign and high loading (-0.6694) on component 6. Blood pressure checks had a positive sign and high loading (0.5875) on component 3 and a positive sign and high loading (0.6687) on component 8 as well. ANC visit had a positive sign and high loading (0.8991) on component 7. ANC weight had a positive signs and high loadings of 0.4197 and 0.4397 on components 1 and 12 respectively and a negative sign and high loading (-0.7175) on component 10. ANC blood pressure had a positive sign and high loading (0.4330) on component 1 and a negative sign and high loading (-0.8303) on component 12. ANC urine has positive signs and high loadings of 0.4180, 0.5644 and 0.5916 on components 1, 10 and 11 respectively. ANC heart rate had a positive sign and high loading (0.8818) on component 9. Facility delivery had a positive sign and high loading (0.6438) on component 2 and a negative sign and high loading (-0.7078) on component 13. ANC blood had a positive sign and high loading (0.4252) on component 1 and a negative sign and high loading (-0.7438) on component 11. Skilled birth attendant had positive signs and high loadings of 0.6411 and 0.7061 on components 2 and 13 respectively. Active NHIS membership had a positive sign and high loading (0.6068) on component 3 and negative sign and high loading (-0.6726) on component 8. WASH had positive signs and high loadings of 0.4617 and 0.5932 on components 4 and 6 respectively and a negative sign and high loading (-0.5910) on component 5. Finally household bed net had positive signs and high loadings of 0.7859 and 0.4201 on components 5 and 6 respectively.

Based on Cattell's criterion for retaining principal components (see figure 4.4), the retained components or intermediate composites determining progress of UHC were components 1, 2

and 3. Component 1 which explained 34.67% of the total variance in the initial data was correlated with quality indicators of the service coverage dimension. Component 2 which explained 14.52% of the total variance in the initial data was correlated with access indicators of the service coverage dimension. Component 3 which explained 10.07% of the total variance in the initial data was correlated with access indicators of service coverage dimension and active NHIS membership which is an indicator of financial risk protection dimension.

4.2.4 Progress towards universal health coverage

Table 4.8 presents the percentage distribution of UHCI scores generated from PCA that have been ranked on a scale ranging from below average to that of above average as a matrix of measuring progress of UHC. In this table, the percentage scores of the UHCI at both baseline and endline are presented to demonstrate the progress of UHC within the study period (2016 to 2020).

There was a reduction (six percentage points) in the proportion of UHCI scores ranked as below average and an increase (nine percentage points) in the proportion of UHCI scores ranked as average at endline from baseline. The proportion of UHCI scores ranked as above average decreased by three percentage points at endline from baseline.

Despite the decrease in the proportion of UHCI scores ranked as above average at endline, some progress was made towards attaining UHC because of the reduction in the proportion of UHCI scores ranked as below average with a corresponding increase in the proportion of UHCI scores ranked as average at endline.

Table 4. 8: Percentage distribution of UHCI scores illustrating progress of UHC

Progress	Baseline (%)	Endline (%)
Below average	41.51	35.47
Average	25.54	34.83
Above average	32.95	29.69

Source: CHPS+ project (2017-2020)

In order to measure the population dimension of UHC and to determine the progress of UHC based on equity, UHCI scores were categorized according to the various wealth quintiles and presented in Table 4.9 below.

The proportion of UHCI scores ranked as above average was highest amongst those in the lower (poorest and poor) wealth quintiles when compared to those in the higher (rich and richest) wealth quintiles at both baseline and endline. On the other hand, the proportion of UHCI scores ranked as below average was highest amongst those in the higher (rich and richest) wealth quintiles when compared to those in the lower (poorest and poor) wealth quintiles at both baseline and endline.

From the forgoing as shown in Table 4.9, the progress that has been made towards attaining UHC was realized more amongst those in lower wealth quintiles as compared to those in the higher wealth quintiles.

Table 4. 9: Percentage distribution of UHCI scores according to wealth quintiles at baseline and endline

Wealth quintile	Percentage of UHCI score					
	Below average		Average		Above average	
	Baseline	Endline	Baseline	Endline	Baseline	Endline
Poorest	10.83	10.00	14.01	15.91	25.03	25.54
Poor	16.59	16.81	20.08	21.56	24.38	22.50
Middle	20.91	22.31	23.26	20.98	16.96	17.85
Rich	25.52	22.73	21.09	17.49	17.45	18.29
Richest	26.15	27.97	21.56	24.04	16.18	15.81
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00

Source: CHPS+ project (2017-2020)

4.3 Results of Facility Survey

The health delivery system in Ghana consists of health facilities delivering health services at different levels of health care. Different health facility types exist in Ghana with different levels of sophistication in terms of functionality and availability of equipment. Facilities range from those at the basic level in communities known as CHPS compounds to the highest level known as hospitals which can either be at the district or regional level. The results of the different facility types are presented below.

4.3.1 Health facilities type

The PHC system in Ghana consists of health facilities ranging from CHPS zones to district hospitals which offer health care services at different levels. However CHPS zones, maternity homes and health centres function as lower level facilities in the health care system. These lower level health facilities play a significant role towards attaining UHC by rendering close-to-client services at the community level by ensuring that health care services are accessible to many people as possible.

The distribution of health facilities in the study area are presented in Table 4.10. A total of 268 facilities were surveyed. Close to 45.00% of the facilities surveyed were CHPS zones with compounds followed by CHPS zones (23.13%) without compounds. Maternity homes and polyclinics accounted for the least number (about 1.00% each) of facilities surveyed. The lower level health facilities constitute 91.42% of all facilities surveyed indicating how health services are diffused to the community level and their contribution to the progress of attaining UHC in the study areas.

Table 4. 10: Distribution of health facilities in the study area

Facility type	Frequency (N)	Percentage (%)
CHPS zone without compound	62	23.13
CHPS zone with compound	120	44.78
Health Centre	60	22.39
Maternity Home	3	1.12
Clinic	16	5.97
Hospital	4	1.49
Polyclinic	3	1.12
Total	**268**	**100.00**

Source: CHPS+ project (endline, 2020)

Facilities classified as CHPS zones without compounds were functional CHPS zones that did not have physical buildings but were operating as temporal mobile facilities in communities and performing most of the functions of a CHPS zone.

4.3.2 Human resource/trained personnel at health facilities

The various levels of the health care system tend to have different human resource strengths and trained health personnel. Table 4.11 presents the number of different categories of trained staff at the health facility level.

Table 4. 11: Number of trained staff at health facility level

Facility type	Trained staff							
	Doctor	Public Health Nurse	Nurse	Professional Midwife	CHO/CHN	Enrolled Nurse	Medical/Physician Assistant	Health Assistant
CHPS zone without compound	0	1	0	5	60	13	0	0
CHPS zone with compound	0	0	32	52	116	93	4	4
Health Centre	1	0	38	57	56	60	30	10
Maternity Home	0	0	2	3	1	2	1	2
Clinic	8	2	11	9	6	13	12	5
Hospital	4	1	3	3	3	3	2	2
Polyclinic	3	0	2	3	3	3	3	2
Total (N)	**16**	**4**	**88**	**132**	**245**	**187**	**52**	**25**

Source: CHPS+ project (endline, 2020)

Out of a total of 16 doctors, half (8) of them worked at the clinics; a quarter (4) at the district hospitals and the remaining distributed between the polyclinics and a health centre as shown in Table 4.11. There were 4 trained public health nurses working at the various levels of health care (2 in clinics and the other 2 in hospitals and CHPS zones without a compound). Majority of the nurses in the study area were concentrated at the health centres and CHPS zones with compounds. Professional midwives were also concentrated at the health centres and CHPS zone with compounds. Five (5) midwives were rendering services in CHPS zones without compounds. Community Health Officers/Community Health Nurses (CHOs/CHNs) were concentrated mainly at CHPS zones with compounds, CHPS zones without compounds and health centres with numbers of 116, 60 and 56 respectively. In the case of enrolled nurses they were concentrated more at CHPS zones with compounds, health centres, CHPS zones without compounds and clinics. Majority (30) of the physician assistants practiced mainly at the health centres and followed by the clinics. About 40.00% (10) of health assistants worked at health centres and the remaining working at other levels of the health care delivery system

except the CHPS zones without compounds. As can be seen in Table 4.11, maternity homes had the least of trained health staff in all categories.

4.3.3 Availability of basic infrastructural facilities

Figure 4.3 shows the percentage of health facilities that had certain basic infrastructural facilities to assist in effective health care delivery.

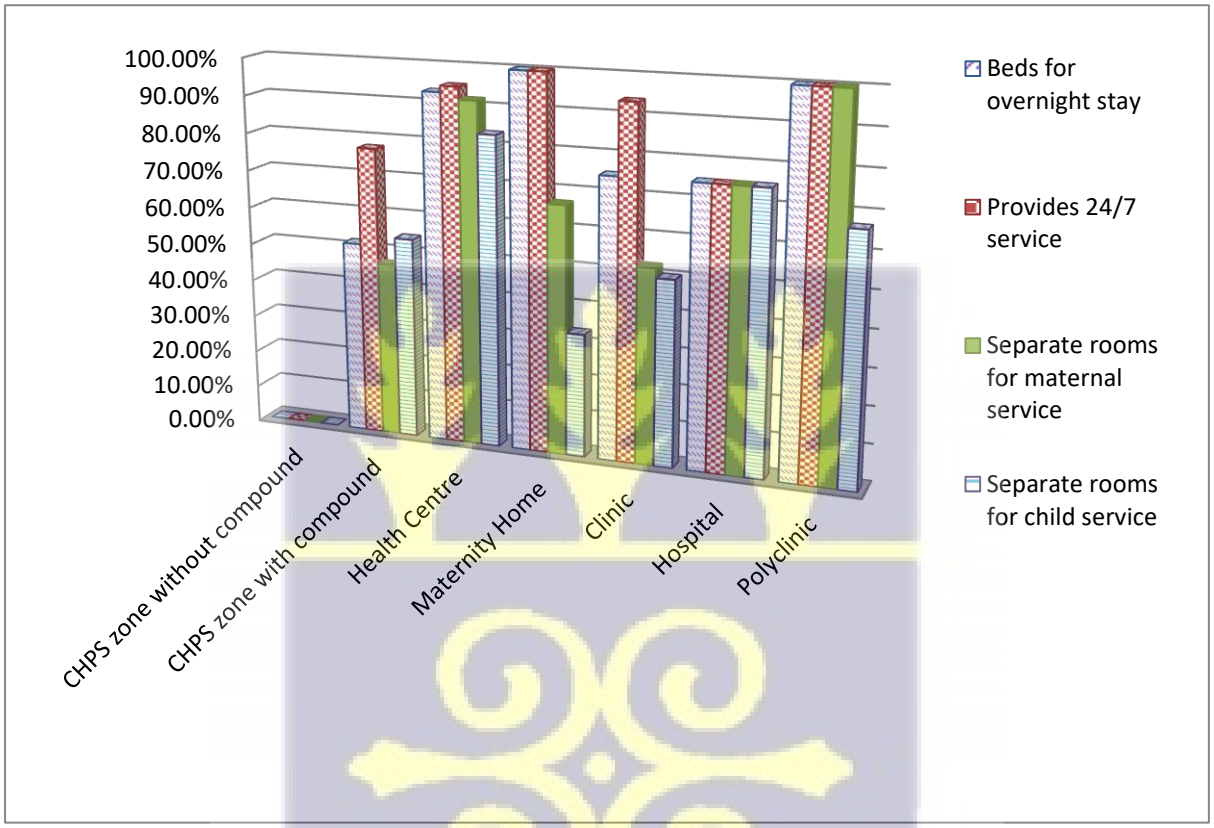

Figure 4. 3: Infrastructure at health facilities
Source: CHPS+ project (endline, 2020)

Per the definition of infrastructure at health facilities adapted in this study, CHPS zones without compounds did not have any infrastructure. Just slightly over half of CHPS zones with compounds had beds for overnight stay and separate rooms for child services. Less than half (46.70%) of CHPS zones with compounds had separate rooms for maternal services. About 76.00% of CHPS zones with compounds provide 24 hours services. Over 90.00% of

health centres had beds for overnight stay, had separate rooms for maternal services and provided 24 hours services.

All maternity homes had beds for overnight stay and provide 24 hours services. However, just about a third of maternity homes had separate rooms for child service. About half of all clinics had separate rooms for both maternal and child health services. Seventy five percent (75.00%) of the hospitals surveyed had all the basic infrastructural facilities assessed as shown in figure 4.3 above. All polyclinics surveyed provided 24 hours services, had beds for overnight stay and separate rooms for maternal services. However separate rooms for child services were provided by about 67.00% of the polyclinics in the study area.

4.3.4 Type of health care delivery by facilities

Not the same type of health care services is delivered by every health care facility. The type of health service delivery depends on the type of health facility. Table 4.12 presents the number and percentage of health facilities delivering various types of health services in the study area. The facility type in Table 4.12 is arranged in ascending order of level of health care.

With the exception of 67.00% of polyclinics providing caesarean sections, the rest of the other types of health services were provided by all (100.00%) the polyclinics. Whereas FP services were provided by half (50.00%) of the hospitals, all other services were provided by 75.00% of hospitals. Only 13.00% of clinics performed caesarean sections. However rapid diagnostic testing for malaria and treatment of diarrhoea and malaria were provided by all clinics. Whereas none of the facilities at the lower level performed caesarean sections, most of them however provided services considered to be of importance at the primary health care level.

Table 4. 12: Types of health service delivery by facilities

Facility type	Types of service delivery									
	ANC	Normal Delivery	Delivery by Caesarean section	FP	Immunization	Treatment of diarrhoea	Treatment of malaria	Rapid Diagnostic Testing for malaria	Static Child Welfare clinic	PNC
CHPS zone without compound	22 (35%)	5 (8%)	0 (0%)	60 (97%)	61 (98%)	29 (47%)	27 (44%)	27 (44%)	51 (82%)	12 (19%)
CHPS zone with compound	82 (68%)	52 (43%)	0 (0%)	119 (99%)	119 (99%)	119 (99%)	118 (98%)	118 (98%)	118 (98%)	72 (60%)
Maternity Home	3 (100%)	3 (100%)	0 (0%)	3 (100%)	1 (33%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)
Health Centre	57 (95%)	56 (93%)	0 (0%)	58 (97%)	58 (97%)	59 (98%)	59 (98%)	59 (98%)	56 (93%)	57 (95%)
Clinic	10 (63%)	10 (63%)	2 (13%)	7 (44%)	6 (38%)	16 (100%)	16 (100%)	16 (100%)	6 (38%)	9 (56%)
Polyclinic	3 (100%)	3 (100%)	2 (67%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)
Hospital	3 (75%)	3 (75%)	3 (75%)	2 (50%)	3 (75%)	3 (75%)	3 (75%)	3 (75%)	3 (75%)	3 (75%)

4.3.5 Basic medical equipment

Every health facility is required to have certain basic medical equipment to enable effective quality PHC delivery. Basic medical equipment include infant, child and adult weighing scales; thermometer; stethoscope; timer; BP apparatus; examination light and vaccine carrier. Table 4.13 presents the proportion or percentage of health facilities that had basic medical equipment. All maternity homes have all the required basic medical equipment's necessary for offering PHC services. Surprisingly not all facilities at the high level of care had all basic medical equipment. For instance only half (50.00%) of hospitals had certain basic medical equipment's such as weighing scales, stethoscopes, timers and vaccine carriers. Only 24.00% of CHPS zone with compound had timers and examination lights which are critical in the labour and during delivery. Similarly, only 40.00% of health centres had examination light which is necessary for conducting delivery. Approximately 67.00% of polyclinics had all basic medical equipment.

Table 4. 13: Percentage of health facilities with functioning basic medical equipment

Facility type	Basic medical equipment									
	Child weighing scale	Infant weighing scale	Thermometer	Stethoscope	Timer or watch	Digital BP apparatus	Manual BP apparatus	Adult scale	Examination light	Vaccine carrier
CHPS zone without compound	61.30%	51.60%	54.80%	35.50%	29.00%	29.00%	29.00%	53.20%	14.50%	54.80%
CHPS zone with compound	67.50%	60.00%	65.00%	64.20%	24.20%	50.00%	50.00%	70.00%	24.20%	55.00%
Health Centre	78.30%	76.70%	75.00%	70.00%	55.00%	53.30%	58.30%	76.70%	40.00%	60.00%
Maternity Home	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	66.70%	100.00%	100.00%	100.00%
Clinic	50.00%	50.00%	81.30%	68.80%	75.00%	68.80%	62.50%	75.00%	68.80%	31.30%
Hospital	50.00%	50.00%	75.00%	50.00%	50.00%	75.00%	50.00%	50.00%	75.00%	50.00%
Polyclinic	66.70%	66.70%	66.70%	66.70%	66.70%	66.70%	66.70%	66.70%	66.70%	66.70%

Source: CHPS+ project (endline, 2020)

4.3.6 Supplies

Essential supplies present at the health facilities necessary for effective PHC delivery are presented in Figure 4.4.

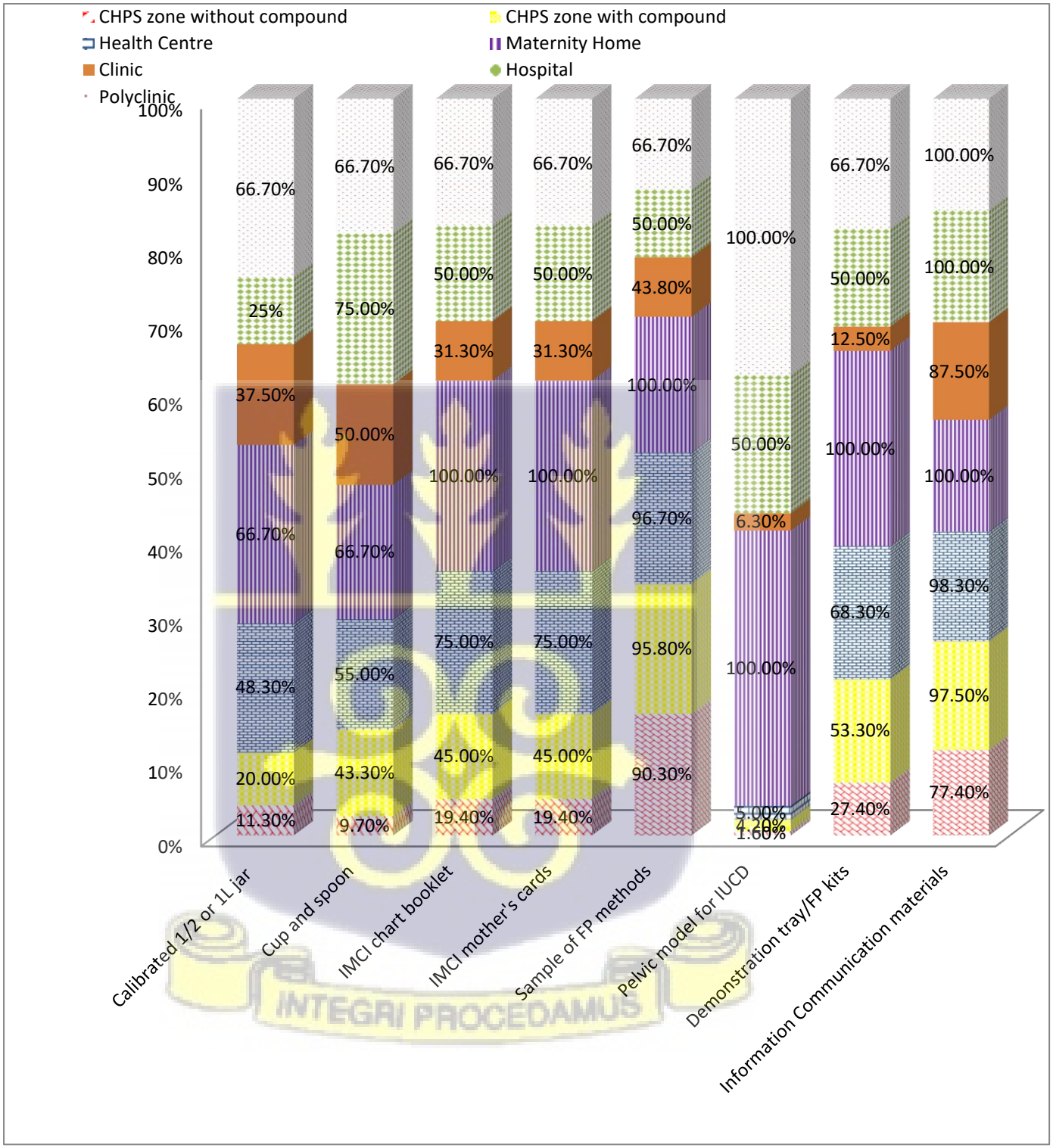

Figure 4. 4: Supplies at health facilities
Source: CHPS+ project (endline, 2020)

In general, a greater proportion of maternity homes and polyclinics had all essential medical supplies as compared to the rest of the facilities. A greater percentage (77.00% to 100.00%) of all facilities had information communication materials. With the exception of FP methods, a greater percentage of the lower-level health facilities (CHPS zones) were performing poorly in terms of having the other essential supplies for health service delivery. Similarly a greater percentage of clinics were also not performing well in terms of having essential supplies.

4.3.7 Essential medicines

Table 4:14 presents the percentages of health facilities were certain essential medicines which serve as tracer items for determining the service readiness of the PHC system were observed. The essential medicines presented here are crucial for achieving MCH care, new-born care and BEmOC services especially.

Only a small percentage of CHPS zones had certain essential medicines observed during this study. Depo-provera was observed in a greater percentage of facilities except in clinics where it was observed in half (50.00%). Except CHPS zones without compounds, certain essential medicines for example, Artesunate-amodiaquine, Arthemeter lumefantrine, Depo-provera, ORS, Albendazole and Tetanus toxoid were observed in a greater percentage of the other facilities. Overall essential medicines were observed in a greater percentage of maternity homes, hospitals and clinics than other facilities. However certain BEmOC tracer essential medicines such as Hydralazine, Oxytocics and Magnesium sulphate were only observed in a small percentage of clinics. With the exception of hospitals and polyclinics, certain essential medicines such as Dexamethasone/ Betamethasone and Hydralazine were observed in a small percentage of facilities. Magnesium sulphate which is an essential BEmOC medicine was observed in 0.00%, 14.20%, 38.30%, 37.50% and 33.30% of CHPS zones without compounds, CHPS zones with compounds, clinics and polyclinics respectively.

Essential BEmOC medicines such as Magnesium sulphate, IV antibiotics, IV Diazepam, Oxytocics and Hydralazine were observed in a small percentage of the lowest level of the health delivery system consisting of CHPS zones without compounds, CHPS zones with compounds and health centres.

Table 4. 14: Percentage with observed essential medicines

Facility type	Essential medicines												
	IV antibiotics	Magnesium sulphate	IV Diazepam	Oxytocics	Dexamethasone/ Betamethasone	Hydralazine	Albendazole	SP	A-A	A-L	Depo-provera	ORS	Tetanus Toxoid
CHPS zone without compound	0%	0.00%	0.00%	1.61%	0.00%	0.00%	33.90%	38.70%	1.61%	38.70%	87.10%	41.90%	41.90%
CHPS zone with compound	10.8%	14.20%	2.50%	21.70%	0.80%	0.80%	85.00%	60.80%	3.30%	86.70%	95.80%	86.70%	63.30%
Health Centre	41.7%	38.30%	28.30%	65.00%	6.70%	6.70%	96.70%	90.00%	13.30%	93.30%	95.00%	86.70%	83.30%
Maternity Home	100.0%	66.70%	100.00%	66.70%	33.30%	33.30%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Clinic	87.5%	37.50%	62.50%	31.30%	37.50%	25.00%	93.80%	56.30%	37.50%	98.80%	50.00%	100.00%	62.50%
Hospital	75.0%	75.00%	75.00%	75.00%	75.00%	75.00%	75.00%	75.00%	50.00%	75.00%	75.00%	75.00%	75.00%
Polyclinic	66.7%	33.30%	66.70%	66.70%	66.70%	66.70%	100.00%	100.00%	66.70%	100.00%	66.70%	100.00%	66.70%

SP= Sulfadoxine+Pyrimethamine, A-A= Artesunate+amodiaquine, A-L= Arthemeter+lumefantrine **Source:** CHPS+ project (endline, 2020)

4.3.8 Monitoring of service delivery

The monitoring of service delivery of the health system is often done through health facilities recording and reporting basic data or information in the form of registers which are critical for decision making.

Figure 4.5 presents the percentage of health facilities with observed items for monitoring certain essential PHC services.

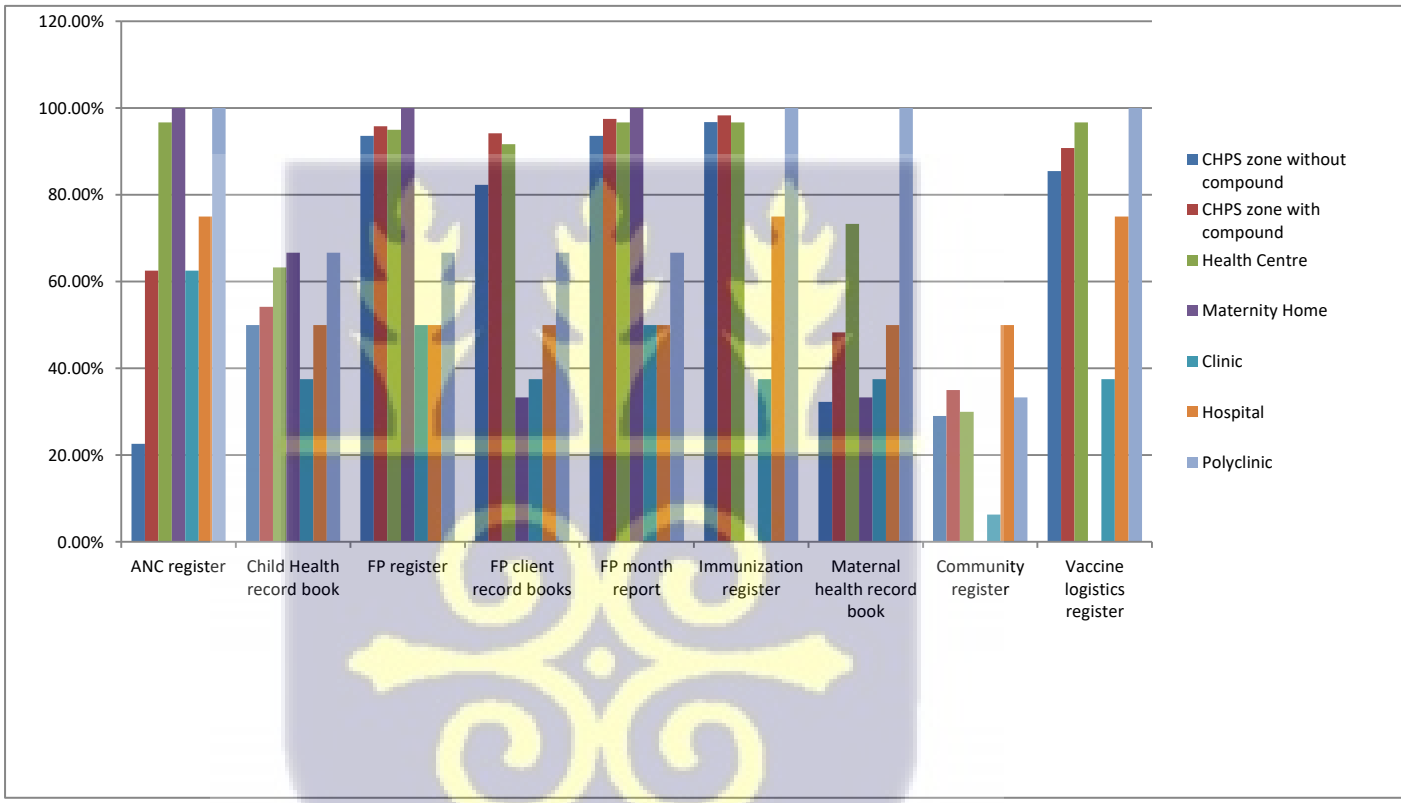

Figure 4. 5: Percentage of health facilities with observed items for monitoring
Source: CHPS+ project (endline, 2020)

Community registers were generally observed in a small percentage of health facilities. For instance, there was no community register observed in any of the maternity homes.

Monitoring items were generally observed in a small percentage of clinics. For example monitoring registers or items were observed in less than 50.00% of clinics except ANC

registers, FP registers and FP monthly reports. FP registers and FP monthly reports were observed in about 50.00% or more of health facilities.

4.3.9 Community volunteers

The use of community volunteers by health facilities is a way of integrating or involving the community in the health delivery system especially at the lowest level of health care such as the CHPS zones.

The percentage of health facilities that work with community-based agents, health volunteers and or surveillance volunteers is presented in Figure 4.6.

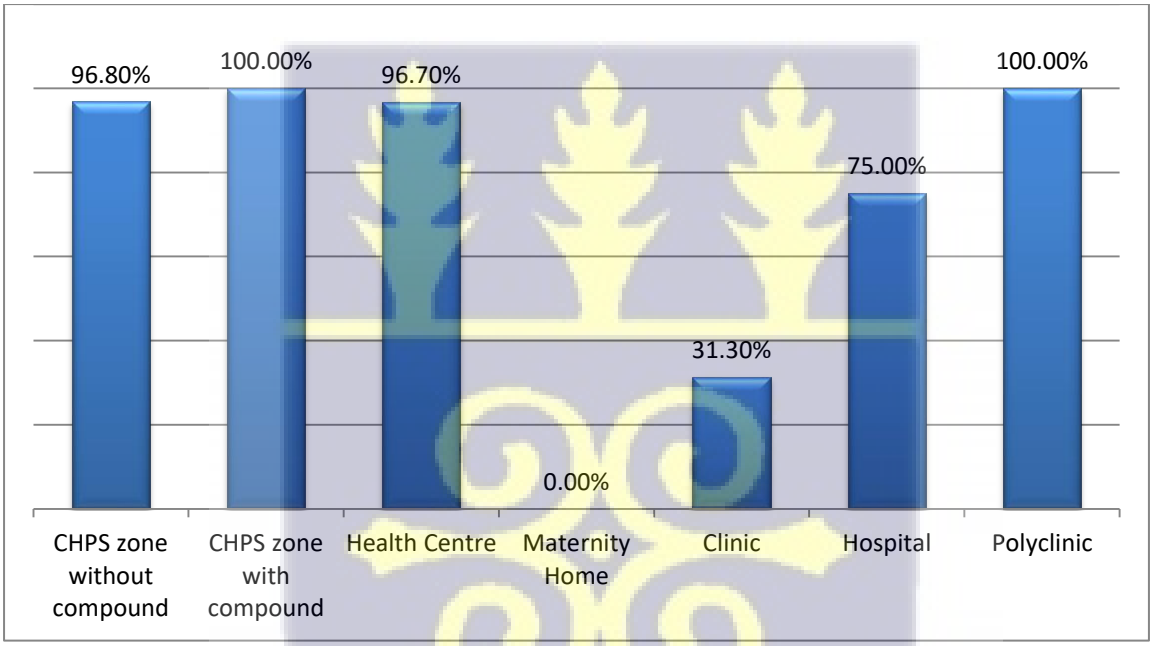

Figure 4.6: Percentage of health facilities who work with community volunteers
Source: CHPS+ project (endline, 2020)

A large percentage of the lower health facilities comprising CHPS zone without compounds, CHPS zone with compounds and Health centres work with community volunteers. Similarly, a large percentage of hospitals and polyclinics that are the highest level of the PHC work with community volunteers.

The percentage of maternity homes and clinics that work with community volunteers was however low. Whereas none of the clinics was working with community volunteers, only 31.30% of maternity homes worked with them.

4.3.10 PCA model (composite measure) for health system's readiness (SRI)

This PCA model was carried out to compute the SRI using data from endline health facility survey. Summary outputs of the model consisting of two panels representing the results of eigenvalues of the principal components and the loadings of each indicator on the principal components are presented in Tables 4.15 and 4.6 respectively. The first output (Table 4.15) of the model presents results of the first seven eigenvalues out of seventy based on Cattell's criterion (Figure 4. 7) for retaining components.

Table 4. 15: Distribution of principal components eigenvalues of facility data

Principal components/correlation		Number of Obs =	206
		Number of comp. =	70
		Trace =	71
Rotation: (unrotated = principal)		Rho =	1.0000
Component	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Comp1	12.4443	3.61207	0.1753	0.1753
Comp2	8.8322	2.42211	0.1244	0.2997
Comp3	6.41008	3.26074	0.0903	0.3900
Comp4	3.14935	0.20113	0.0444	0.4343
Comp5	2.94822	0 .7065	0.0415	0.4758
Comp6	2.24171	0 .3201	0.0316	0.5074
Comp7	1.92163	0.1740	0.0271	0.5345

Source: CHPS+ project (endline, 2020)

The first seven components accounted for 53.45% of the total variance in the initial data whilst 46.55% of the total variance in the initial data was accounted for by the remaining sixty three components according to Cattell's criterion (Nardo et al., 2005).

Figure 4.7 shows a scree plot of the eigenvalues of the principal components after the model which indicates a steep fall in components from component 1 to component 7 before levelling

off components from component 8 through to component 70. Therefore in accordance with Cattell's criterion (Nardo et al., 2005), the first even principal components before levelling off were retained in this model as the composites or indices of health system's readiness.

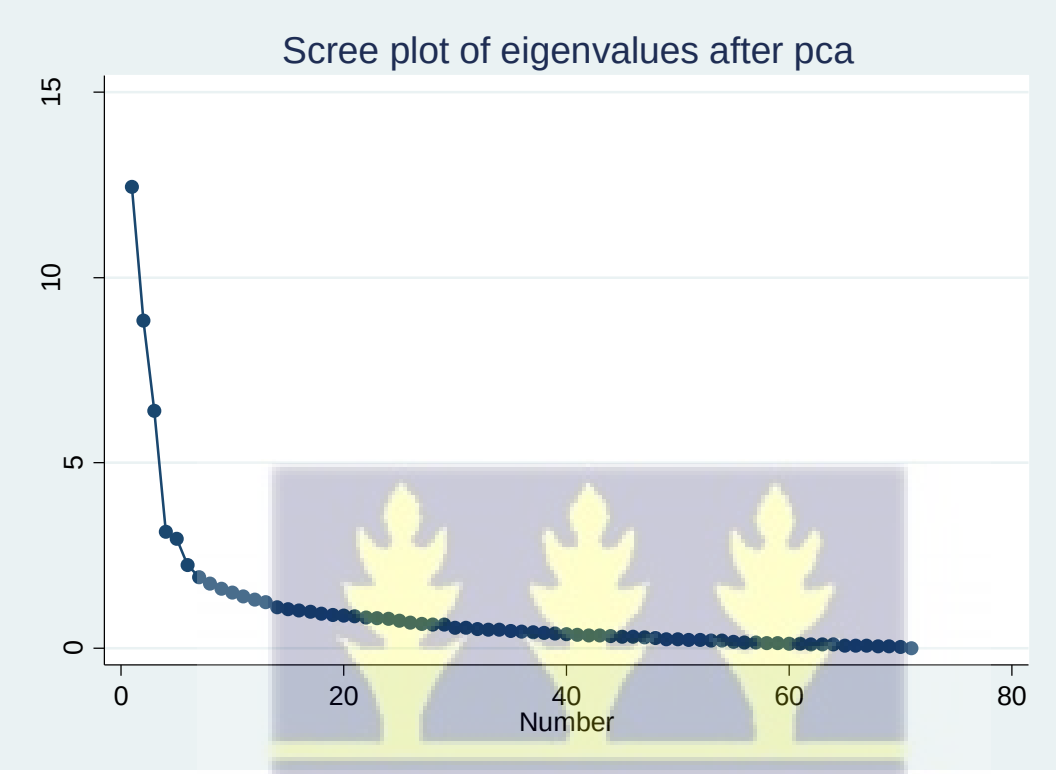

Figure 4.7: Screeplot of eigenvalues after PCA of end-line facility survey
Source: CHPS+ project (endline, 2020)

The second output of the PCA model is presented in Table 4.16 and presents only the eigenvectors/loadings of the retained principal components based on Cattell's criterion (Nardo et al., 2005). The loadings with high values (greater than 0.2000) are indicated in bold. Although each component tends to have a combination of the different categories of indicators (see Table 3.2), there is a dominance of indicators with high loadings that are attributed more to one of the categories in one component than the other components. The dominant indicators in component 1 are attributed to monitoring of service delivery category and include FP month report, immunization register, vaccine logistic register and ANC register with loadings of 0.2160 each. Component 2 is attributed to basic medical equipment

with the dominant indicators being child weighing scale, infant weighing scale, thermometer, stethoscope, timer with seconds, adult scale, digital BP apparatus, manual BP apparatus and staff timer with seconds with loadings of 0.2449, 0.2963, 0.3036, 0.2905, 0.2023, 0.3066, 0.2185, 0.2217 and 0.2505 respectively. Components 3 through to 6 are mainly dominated by indicators that are attributed to the essential medicines category.

Table 4. 16: Retained principal components (eigenvectors/loadings) of endline data

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7
Calibrated ORS jar	0.0623	0.0826	0.1349	**0.2260**	-0.1845	0.0499	0.1475
Cup & spoon	0.0656	0.0623	**0.2587**	0.1386	0.0396	-0.0056	0.0642
Child IMCI book	0.0831	-0.0325	-0.0377	0.1732	**0.3430**	-0.0846	-0.0634
Mother IMCI booklet	0.0247	-0.1230	-0.0355	**0.3130**	**0.2439**	-0.0349	0.0084
Sample of FP	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
FP demonstration tray	0.0693	-0.1238	**0.2145**	**0.2324**	-0.0064	0.0355	-0.1441
IV antibiotics	0.0364	-0.0712	**0.2996**	-0.1130	0.1106	**0.2070**	0.0183
Magnesium sulphate	0.0536	0.0833	**0.2649**	-0.1018	0.0422	0.1421	0.1345
Oxytocics	0.0726	0.0463	0.0481	**0.2193**	0.0105	0.1817	**-0.2397**
Dexamethasone	0.0144	-0.0077	0.1191	-0.0251	**0.2191**	**-0.2692**	0.0349
Hydralazine	0.0075	-0.0759	**0.2401**	**-0.2818**	0.0611	-0.0011	0.1179
Albendazole	-0.0106	-0.0389	-0.0605	0.1053	**-0.2814**	**0.3625**	0.0460
Cytotec	0.0493	-0.0087	**0.2086**	0.0664	0.0215	-0.0254	-0.0435
Sulfadoxine	0.1292	-0.0384	-0.0377	0.0468	**0.2563**	0.0644	-0.1361
Norygnon	0.0732	-0.1215	-0.0489	-0.0355	-0.0468	**0.2247**	0.0137
Tetanus toxid	0.1109	-0.0593	-0.0920	**0.2738**	-0.1608	0.0205	0.0883
Folic acid	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
Mebendazole	0.0455	0.0042	0.0514	**0.2454**	0.0227	0.1852	0.0039
Doctor	-0.0066	-0.1069	0.1333	-0.1232	**-0.2098**	-0.0558	**0.2500**
Registered general nurse	0.0211	-0.0117	0.1383	**-0.2655**	-0.0913	-0.0121	0.0858
Midwife	0.1936	-0.0105	0.0777	-0.0269	-0.1713	-0.0892	**-0.2126**
CHO	0.0856	0.0038	0.0716	0.0891	0.0694	-0.0184	**0.2187**
Physician assistant	0.0549	-0.0457	**0.2741**	-0.1121	0.0689	0.1850	-0.0212
Health assistant	0.0325	0.0629	**0.2586**	0.0434	-0.0453	0.1585	**0.2273**
Community health nurse	0.1612	0.0531	-0.0334	0.0091	-0.0035	-0.0930	**0.2435**
Immunization services	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
FP services	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
Treatment of malaria	0.0267	0.0834	0.1977	-0.0115	**-0.2852**	-0.1311	**-0.4181**
Rapid Diagnostic Test for malaria	0.0056	0.1211	0.0157	-0.0074	-0.0520	-0.0778	**0.2558**
PNC services	0.1936	-0.0105	0.0777	-0.0269	-0.1713	-0.0892	**-0.2126**
Child health care services	0.1095	-0.0453	**0.2046**	**0.2118**	-0.0822	-0.0973	-0.0838
CHC book	0.0604	0.0417	**-0.2365**	-0.1255	0.0503	**0.2280**	-0.1227
FP month report	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
Immunization register	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
MCH book	0.0723	0.0166	-0.1604	-0.1343	0.1360	**0.2414**	-0.1096
Community register	0.0256	-0.0808	0.1389	**-0.2088**	0.1513	0.1337	-0.1759
Vaccine logistic register	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
Work with volunteer	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401
Child weighing scale	0.1044	**0.2449**	-0.1037	-0.0280	0.0445	0.1809	0.0288
Infant weighing scale	0.1109	**0.2963**	-0.0527	-0.0372	0.0402	-0.0006	-0.0745
Thermometer	0.1075	**0.3036**	-0.0418	0.0019	-0.0168	0.0150	0.0015
Stethoscope	0.1009	**0.2905**	-0.0165	0.0845	-0.0061	-0.0247	0.0182
Timer with seconds	0.0819	**0.2023**	0.1357	0.0623	0.1257	0.1448	-0.0026
Staff timer with seconds	0.0753	**0.2505**	-0.0602	0.0066	0.0124	-0.0738	0.0690
Digital BP apparatus	0.0720	**0.2185**	0.0229	-0.1303	0.1605	-0.0341	-0.0335
Manual BP apparatus	0.0770	**0.2217**	0.0065	-0.0102	-0.1095	**0.2384**	-0.0093
Adult scale	0.1125	**0.3066**	-0.0051	-0.0572	0.0279	0.0536	-0.0300
Examination light	0.0529	0.1935	-0.0599	-0.0659	-0.0452	**-0.2252**	0.1035
Vaccine carrier	0.0861	**0.2544**	0.0594	0.1232	0.0046	-0.1055	0.0224
ANC register	**0.2160**	-0.0722	-0.0466	-0.0245	-0.0045	-0.0149	0.0401

Source: CHPS+ project (endline, 2020)

Component 7 is dominated by indicators which include community health nurse, midwife, CHO, health assistant and doctor with loadings of 0.2500, -0.2126, 0.2187, 0.2273 and 0.2435 respectively which are attributed to the category of trained health personnel.

Since the various levels of health care facilities were established to achieve different purposes within the PHC system and considering the fact that they are not resourced equally, it is necessary to measure health system's readiness according to the type of health facility to reflect the various levels of health care delivery within the system. In order to achieve this, system readiness was classified into a scale of five comprising least ready, less ready, average ready, more ready and most ready in terms of readiness to attain UHC. Facility type was then ranked on the system readiness scale and the results presented in Table 4.17.

Table 4. 17: Distribution of PHC system's readiness towards attaining UHC

Facility type	System readiness					
	Least ready	Less ready	Averagely ready	More ready	Most ready	Total
CHPS zone with compound	33	28	34	18	7	**120**
Health Centre	9	10	7	19	15	**60**
Maternity Home	0	0	0	0	3	**3**
Clinic	1	1	3	1	10	**16**
Hospital	0	0	1	0	3	**4**
Polyclinic	1	0	0	0	2	**3**

Source: CHPS+ project (endline, 2020)
NB: CHPS zones without compounds were excluded from the model because they did not contain some of the characteristics or indicators of interest used in determining the service readiness index.

Health facilities at the lower level of the health care system were generally not performing well in terms of their readiness to achieve UHC. For instance only 6.00% and 2.00% of CHPS zone with compounds and health centres respectively were most ready to achieve UHC. All maternity homes were however most ready to achieve UHC.

4.4 Results of linking households and health facilities survey

Linking of the household survey to the facility survey was achieved by merging endline data of both surveys using place of birth or delivery after constructing the SRI through PCA. The results of the merger and subsequent binomial logistic regression models are presented in this section.

In total 1,665 observations were used in this analysis after the merger. Contraceptive use, four or more ANC visits, all 3DPT immunizations and active NHIS membership were the dependent variables whilst the SRI scores and other confounders were the independent variables in the binomial logistic regression models. The binomial regressions were carried out to assess how the PHC system impacts on UHC by determining the effects of the measured SRI scores on certain population health outcomes (dependent variables).

4.4.1 Effect of SRI scores on four or more ANC visits (model 1)

In order to determine how the health system readiness impacts on four or more ANC visits as a population level outcome, four or more ANC visits was regressed on SRI scores whilst taking into consideration other confounders.

Table 4.18 shows the effect of SRI scores on four or more ANC visits after controlling for all other factors. Model 1 indicates no significant relationship (p-value=0.189) between SRI scores and four or more ANC visits. On the contrary there were significant relationships between some confounders and four or more ANC visits such as 30-34 years age group; 40-44 years age group; primary education; husband with middle school education; pregnancy intention; and hairdressing/dressmaking.

Table 4. 18: The effect of Service Readiness Index scores on four or more ANC visits (model 1)

Covariate	Odds Ratio	P-value	95% (Confidence Interval)	
SRI scores	1.05	0.189	0.97	1.14
Age group				
15-19		Reference		
20-24	1.79	0.221	0.70	4.54
25-29	1.87	0.141	0.81	4.29
30-34	4.52	0.001**	1.85	11.08
35-39	2.10	0.131	0.80	5.49
40-44	2.95	0.023**	1.16	7.51
45-49	0.97	0.955	0.32	2.96
Education				
No education		Reference		
Primary	0.59	0.030**	0.36	0.95
Middle School/JHS/JSS	0.60	0.106	0.33	1.11
Secondary +	0.81	0.703	0.28	2.36
Husband's education				
None		Reference		
Primary	1.50	0.183	0.82	2.73
Middle school	3.28	0.000**	1.81	5.94
JHS/JSS	1.97	0.032**	1.06	3.65
SSS/SHS	1.87	0.123	0.84	4.14
Distance(km) of Health facility	0.99	0.842	0.91	1.08
Pregnancy intention	0.65	0.022**	0.45	0.94
Religion				
No religion		Reference		
Christianity	1.02	0.947	0.51	2.04
Traditional religion	0.95	0.919	0.38	2.39
Islam	0.44	0.070	0.18	1.07
Wealth quintiles				
Poorest		Reference		
Poorer	0.80	0.440	0.46	1.40
Middle	0.67	0.131	0.39	1.13
Richer	0.60	0.083	0.34	1.07
Richest	0.42	0.002**	0.24	0.72
Occupation				
No occupation		Reference		
Student	1.02	0.979	0.22	4.71
Farming	1.08	0.831	0.53	2.18
Trading/Selling	1.13	0.714	0.59	2.17
Hairdressing/Dressmaking	2.99	0.034**	1.09	8.20
Housewife	1.29	0.763	0.24	6.81
Other occupation	0.71	0.625	0.18	2.82
Literacy				
Illiterate		Reference		
Partially literate	1.37	0.386	0.67	2.83
Literate	1.22	0.591	0.59	2.49
Number of observations = 1665				
Prob > F (overall p-value) = 0.000				

p<0.05 **Source: CHPS+ project (endline, 2020)

These group of explanatory variables in model 1 show a statistically significant (p=0.000) relationship with four or more ANC visits.

4.4.2 Effect of SRI scores on all 3DPT immunizations (model 2)

Model 2 assessed the impact of the health system readiness on all 3DPT immunizations with other confounders taken into consideration. Table 4.19 presents the regression result of all 3DPT immunizations on SRI sores and other confounders.

Table 4. 19: The effect of Service Readiness Index scores on all 3DPT immunizations (model 2)

Covariate	Odds Ratio	P-value	95% (Confidence Interval)	
SRI scores	0.95	0.223	0.88	1.03
Age group				
15-19		Reference		
20-24	2.57	0.031**	1.09	6.04
25-29	2.20	0.103	0.85	5.71
30-34	5.53	0.001**	1.96	15.63
35-39	5.15	0.001**	2.03	13.07
40-44	9.08	0.000**	3.06	26.98
45-49	11.21	0.004**	2.23	56.36
Education				
No education		Reference		
Primary	1.58	0.065	0.97	2.57
Middle School/JHS/JSS	2.79	0.001**	1.54	5.07
Secondary +	0.90	0.810	0.38	2.14
Husband's education				
None		Reference		
Primary	1.41	0.313	0.72	2.75
Middle school	1.46	0.235	0.78	2.75
JHS/JSS	1.68	0.149	0.83	3.41
SSS/SHS	0.93	0.872	0.41	2.15
Distance(km) of Health facility	1.02	0.703	0.93	1.11
Pregnancy intention	0.72	0.162	0.45	1.14
Religion				
No religion		Reference		
Christianity	0.88	0.785	0.36	2.18
Traditional religion	0.70	0.443	0.27	1.77
Islam	0.83	0.680	0.33	2.06
Wealth quintiles				
Poorest		Reference		
Poorer	0.99	0.996	0.53	1.88
Middle	1.06	0.821	0.64	1.77
Richer	0.81	0.531	0.41	1.59
Richest	1.12	0.769	0.53	2.37
Occupation				
No occupation		Reference		
Student	1.20	0.842	0.20	7.10

TABLE 4.19 CONTINUED			
Covariate	**Odds Ratio**	**P-value**	**95% (Confidence Interval)**
Farming	1.62	0.108	0.90 2.92
Trading/Selling	2.11	0.034**	1.06 4.22
Hairdressing/Dressmaking	1.40	0.274	0.76 2.56
Housewife	1.11	0.867	0.32 3.80
Other occupation	3.08	0.036**	1.08 8.82
Literacy			
Illiterate		Reference	
Partially literate	1.38	0.423	0.62 3.06
Literate	1.28	0.453	0.67 2.46
Four or more ANC visits	1.77	0.006**	1.18 2.65
Number of observations = 1308 Prob > F (overall p-value) = 0.000			

p<0.05 **Source: CHPS+ project (endline, 2020)

After controlling for other confounders, there was no significant relationship (p-value=0.223) between SRI scores and all 3DPT immunizations. With the exception of the 25-29 years age group, all other age groups; middle school/JHS/JSS; trading/selling; and other occupation had significant relationships with all 3DPT immunizations.

The group of explanatory variables in this model (model 2) show a statistically significant (p=0.000) relationship with all 3DPT immunizations.

4.2.2 Effect of SRI scores on contraceptive use (model 3)

The impact of the health system readiness on contraceptive use was determined by regressing contraceptive use on SRI score and other confounders and the results presented in Table 4.20.

Table 4. 20: The effect of Service Readiness Index scores on contraceptive use (Model 3)

Covariate	**Odds Ratio**	**P-value**	**95% (Confidence Interval)**
SRI	1.05	0.389	0.94 1.17
Age group			
15-19		Reference	
20-24	4.71	0.083	0.82 27.27
25-29	3.27	0.225	0.48 22.29
30-34	2.84	0.255	0.47 17.19
35-39	4.58	0.105	0.73 28.94
40-44	5.00	0.108	0.70 35.69
45-49	2.19	0.517	0.20 23.74
Education			
No education		Reference	

TABLE 4.20 CONTINUED				
Covariate	**Odds Ratio**	**P-value**	**95% (Confidence**	**Interval)**
Primary	0.85	0.680	0.38	1.88
Middle School/JHS/JSS	0.78	0.475	0.38	1.56
Secondary +	0.89	0.852	0.27	2.91
Husband's education				
None			Reference	
Primary	1.03	0.965	0.30	3.55
Middle school	2.42	0.031**	1.09	5.37
JHS/JSS	1.64	0.234	0.72	3.70
SSS/SHS	0.84	0.826	0.17	4.11
Distance(km) of Health facility	0.92	0.382	0.76	1.11
Pregnancy intention	0.79	0.327	0.50	1.26
Religion				
No religion			Reference	
Christianity	0.67	0.424	0.25	1.80
Traditional religion	1.05	0.933	0.34	3.24
Islam	0.43	0.310	0.08	2.20
Wealth quintiles				
Poorest			Reference	
Poorer	1.01	0.974	0.43	2.38
Middle	1.57	0.306	0.66	3.74
Richer	0.81	0.684	0.29	2.24
Richest	1.34	0.502	0.57	3.12
Occupation				
No occupation			Reference	
Student	0.43	0.489	0.04	4.72
Farming	0.76	0.456	0.37	1.56
Trading/Selling	0.73	0.512	0.29	1.86
Hairdressing/Dressmaking	1.32	0.430	0.66	2.64
Housewife	3.24	0.111	0.76	13.75
Other occupation	0.20	0.023**	0.05	0.80
Literacy				
Illiterate			Reference	
Partially literate	0.46	0.198	0.14	1.51
Literate	1.81	0.119	0.86	3.81
Number of observations = 1665 Prob > F (overall p-value) = 0.045				

p<0.05 **Source: CHPS+ project (endline, 2020)

There was no significant relationship (p-value=0.389) between SRI scores and contraceptive use after controlling for other confounders. Husband's education of middle school and other occupation of respondents however showed significant relationships with contraceptive use. Model 3 shows that there is a statistically significant (p=0.045) relationship between the group of explanatory variables and contraceptive use.

4.4.3 Effect of SRI scores on active NHIS membership (model 4)

To determine how the health system readiness impacts on active NHIS membership, active NHIS membership was regressed on SRI scores and other independent variables (confounders) and the results presented in Table 4.21 below. The SRI scores had a significant (p-value=0.040) effect on active NHIS membership. Similarly, primary education was also significantly (p-value=0.047) related with active NHIS membership whereas the other confounders had no significant relationship.

Table 4. 21: The effect of Service Readiness Index score on active NHIS membership (Model 4)

Covariate	Odds Ratio	P-value	95%(Confidence	Interval)
SRI	1.06	0.040**	1.00	1.14
Age group				
15-19		Reference		
20-24	0.69	0.302	0.34	1.40
25-29	0.61	0.184	0.30	1.26
30-34	0.50	0.071	0.23	1.06
35-39	0.65	0.282	0.73	1.43
40-44	0.46	0.071	0.20	1.07
45-49	0.20	0.015**	0.06	0.73
Education				
No education		Reference		
Primary	0.64	0.047**	0.42	0.99
Middle School/JHS/JSS	0.98	0.936	0.60	1.60
Secondary +	1.77	0.108	0.88	3.54
Husband's education				
None		Reference		
Primary	1.37	0.251	0.80	2.33
Middle school	1.40	0.172	0.86	2.28
JHS/JSS	0.90	0.666	0.75	1.47
SSS/SHS	0.64	0.250	0.30	1.37
Distance(km) of Health facility	0.98	0.597	0.93	1.04
Pregnancy intention	0.97	0.852	0.70	1.34
Religion				
No religion		Reference		
Christianity	1.19	0.597	0.62	2.28
Traditional religion	0.74	0.434	0.35	1.58
Islam	1.00	0.992	0.39	2.56786
Wealth quintiles				
Poorest		Reference		
Poorer	1.20	0.481	0.72	1.98
Middle	0.96	0.877	0.58	1.60
Richer	1.38	0.302	0.75	2.54

TABLE 4.21 CONTINUED				
Covariate	**Odds ratio**	**P-value**	**95%(Confidence**	**Interval)**
Richest	1.15	0.608	0.66	2.00
Occupation				
No occupation		Reference		
Student	0.56	0.419	0.13	2.31
Farming	0.65	0.100	0.39	1.09
Trading/Selling	0.62	0.075	0.36	1.05
Hairdressing/Dressmaking	1.30	0.377	0.72	2.34
Housewife	1.29	0.645	0.43	3.84
Other occupation	0.61	0.191	0.29	1.28
Literacy				
Illiterate		Reference		
Partially literate	0.80	0.413	0.46	1.37
Literate	0.90	0.669	0.55	1.48
Number of observations = 1665				
Prob > F (overall p-value) = 0.022				

p<0.05 **Source: CHPS+ project (endline, 2020)

The group of explanatory variables in model 4 show a statistically significant (p=0.022) relationship with active NHIS membership.

The SRI scores impacts significantly on active NHIS membership (AOR=1.062, 95%CI: 1.00-1.14, p=0.040) implying that an increase of one unit in the SRI score will result in a 6% increase in the odds of active NHIS membership.

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter presents an in-depth discussion of the results as presented in the preceding chapters. To provide context to the results obtained in this work, the discussion references works published that relate to my work. Finally the limitations and strengths of the study are presented.

5.1 Socio-demographic characteristics of household survey sample

Majority of the respondents in this study were married and engaged in farming activities as their main occupation which is reflective of a typical rural population. The high proportion of married respondents in this study could have a positive effect on attaining UHC in this study setting as other studies have found an association between married people and better health outcomes, owing principally to increased access to health and service utilization (Amoah & Phillips, 2018; Badu et al., 2018). Furthermore, an earlier study in Ghana found out that married people were 1.47 and 4.27 times more likely to use health care and have an active NHIS membership respectively as compared to those who were single (Badu et al., 2018) which can impact positively on UHC.

The educational status of the sampled population was generally high with most of them either having primary or secondary education. Although there is no empirical evidence of a direct link of educational status to UHC, it is expected that the relatively high level of education in this study will have a positive impact on UHC since evidence from other studies in Ghana suggest significant associations between higher levels of education with both access to

healthcare (Seidu et al., 2020) and enrolment in the national health insurance scheme (Nsiah-Boateng et al., 2019) which are important ingredients of UHC.

Despite the fact that over half of the of the respondents in this study were educated, their literacy level was found to be relatively low which could have negative consequences on their health seeking behaviour, especially in terms of literacy and health issues. This many of them might find it difficult to interpret and operationalize information in the course of receiving health care as found in previous studies in Ghanaian studies (Amoah & Phillips, 2018; Lori et al., 2014). The relatively low literacy level in this study could also have implications for the health system as sufficient health literacy levels have been found to enable users discern the strengths and weaknesses of the system and adjust appropriately to them which explains the link of low health literacy with lack of access to health care (Amoah & Phillips, 2018). The high illiteracy level in this study however contrast unfavourably to a similar population in northern Ghana where illiteracy levels were found to be 21.20% at baseline and 37.10% at endline in a study that examine the fertility impact of achieving UHC in an impoverished rural region of northern Ghana (Phillips et al., 2019). Although there is scarcity of empirical evidence of the direct effect of health literacy on UHC, many in the field are of the opinion that efforts to raise health literacy will be crucial if UHC is to be attained considering findings from developing countries linking health literacy with health care access and health insurance enrolments as well (Amoah & Phillips, 2018; Budhathoki et al., 2017).

5.2 Universal health coverage indicators

Although there was a general improvement in the MDGs and SDGs related indicators used in measuring UHC in this study from baseline to endline, the improvement was more in indicators related to outreach services where there was an increase from 13.01% at baseline to 35.55% at endline and WASH related indicators which increased from less than 1.00% at

baseline to over 2.00% at endline. Despite the marked improvement in the sanitation situation in the study area, this still fell far below the national average which stands at 14% and even much far below the global average of 68% (Ghana Health Service, 2018; Hogan et al., 2018) thereby requiring more efforts by stakeholders if this SDG target in particular and UHC in general are to be achieved.

The huge rise in outreach services could be considered as an improvement in the PHC system as this may suggest that health care delivery is increasingly being sent to the door step of community members although it still falls way short of the national target of 100%. This improvement in outreach services at endline was consistent with the findings (39.5% vs 18.0%) of home visits by CHOs after the implementation of a five year project to strengthen the CHPS concept in selected coastal districts in Western Region of Ghana which concluded that implementing pragmatic health systems strengthening programs could be beneficial in engaging facility and community stakeholders to improve health care delivery during scale up of UHC (Maly et al., 2019).

The proportion of pregnant women receiving four or more ANC visits is considered as an international benchmark indicator used as a proxy for determining the adequacy of ANC and also as an indicator for the MDG 5 (Hodgins & D'Agostino, 2014). The proportion of pregnant women receiving four or more ANC visits in most sub-Saharan Africa countries still remains below expectation with some studies indicating that only 44% of pregnant women attend ANC four or more times (Obse & Ataguba, 2021; Pell et al., 2013; Poote & McKenzie-McHarg, 2019). In this study however, there was an improvement in four or more ANC visits from baseline to endline (68.30 % vs 75.96%) which is higher than what exists in sub-Saharan Africa although these figures are from a district or subnational settings. This finding while shows a significant improvement is lower than the national figures of 76%

from Ghana's 2008 DHS data (Hodgins & D'Agostino, 2014), 87% from the 2014 Ghana DHS (GSS & GHS, 2014; Hogan et al., 2018) and 89% from the Ghana Maternal Health survey 2017 (GSS et al., 2017b). Although an increase in four or more ANC visits could signify a step towards attaining UHC, there is growing body of many in the field who think it is about time to stop its use as an indicator because it does not give a reliable measure of the adequacy of ANC services. Program managers, clinicians and other stakeholders who rely on it as a measure tend to focus more on contact as opposed to the content of care (Hodgins & D'Agostino, 2014).

In this study the checking of a pregnant mother's weight, blood pressure, urine, blood and foetal heart rate during ANC visits were considered as quality indicators of the service coverage dimension. There was an observed overall increase in the percentages of these quality indicators between baseline and endline. The findings in this study were consistent with an earlier study in Ghana which recorded 98% and 93% of blood pressure and urine checks respectively during ANC visits (Hodgins & D'Agostino, 2014) implying improved effective coverage. Other studies in some low-income countries have on the other hand shown less than 15% of women receiving a minimum set of essential services during pregnancy by measuring blood pressure or testing blood and urine during ANC services as a form of rendering essential services (Hodgins & D'Agostino, 2014; Marchant et al., 2015; Sharma et al., 2017) with the authors concluding low effective coverage in those instances.

Facility delivery had increased by 15.00% (45.26% to 60.21%) between baseline and endline in this study. This increase however can still be considered to be low as it falls below the regional figure of 63% (GSS et al., 2017a) and the current national figure of 79% (Ghana Health Service, 2018) indicating how this region is lagging behind other regions in the country in terms of facility delivery. The relatively low percentage of facility delivery in the

study districts as compared to regional and national figures might imply a low effective coverage and therefore if the study districts are to be in good positions towards contributing to Ghana's realization of UHC, stakeholders in these districts and regions have to put in more efforts at improving facility deliveries. Similar findings to this study from an earlier study in the Brong Ahafo region of Ghana indicated a low effective coverage and revealing a large quality gap (Nesbitt et al., 2013).

Skilled birth attendant at birth is one of the key SDG (3.1.2) indicators. Delivery by a skilled birth attendant in this study showed an increase from 46% at baseline to 59% at endline. This increase was however below the national average as at 2011 (Nesbitt et al., 2013) and the prevailing current national figure of 79% (Ghana Health Service, 2018) meaning that much still needs to be done to ensure that most deliveries at birth are attendant by skilled personnel if the target of this indicator is to be achieved.

The inclusion of NCDs in measuring the service coverage dimension of UHC has been highly recommended by various stakeholders (Boerma, AbouZahr, et al., 2014; Requejo et al., 2015) considering its increasing burden. However because of inadequate data on NCDs especially in developing countries, proxies for measuring risk factors for NCDs such as non-use of tobacco (Barasa et al., 2018; Boerma, AbouZahr, et al., 2014; Hogan et al., 2018; Wagstaff et al., 2016; Zhang et al., 2019) or tobacco use (Alebachew et al., 2014; Popescu et al., 2018; Veillard et al., 2017) and blood pressure monitoring/control (Burgert & Prosnitz, 2014; Sosa-Rubí et al., 2009; World Health Organization & The World Bank, 2015) have been widely used in the literature. As per recommendations, in the absence of real NCDs data this study used community blood pressure checks and tobacco use by household members as proxies for NCDs in the measurement of UHC progress. Those who had their blood pressures checked in the last one year remained fairly the same (51.65% vs.51.21%) between baseline and endline.

There was however a huge drop amongst those who use tobacco products from 19.22% at baseline to 8.19% at endline which is a desirable outcome and might be indicative of successful good health promotional activities between baseline and endline.

Immunization coverage for all three DPT doses and measles has remained fairly constant over the period of this study. Immunization coverage for all three DPT (DPT3) doses in the study districts was consistent with that of the entire region (84.1%) but however below the national figure of 93.3% (Ghana Health Service, 2018) at the baseline year. Immunization coverage for measles in the study districts of this study was lower than the current figure (80.5%) for the entire Volta region and the national figure (90.1%) (Ghana Health Service, 2018). The findings of this study therefore imply that immunization coverage in the study districts is also lagging behind both the regional and national levels and will therefore requires extra efforts by stakeholders to address this deficit if UHC is to be achieved.

Malaria and diarrhoea still remain amongst the top ten causes of morbidity and mortality in children under five years in Ghana (Ghana Health Service, 2018; Ghana Statistical Service., 2013) thereby requiring that they are appropriately managed in order to reduce their burden. Whereas the appropriate management of malaria remained constantly high within the study period, appropriate treatment of diarrhoea still remained low despite a ten percentage point increase at endline from baseline in the study areas. Since diarrhoea still continue to be a huge burden in under-fives and coupled with its low treatment rate in the study districts as compared to that of malaria, instituting similar measures as done for malaria control will go a long way in improving the treatment of diarrhoea in both the study areas and the entire region thereby contributing to the attainment of UHC.

Active NHIS membership in this study was low (28.24% vs. 27.35%) at both baseline and endline confirming the low active NHIS membership or enrolment into the NHIS since its

inception as found in earlier studies in Ghana (Kusi et al., 2015; Nyonator et al., 2014; Zhang et al., 2019). The low active membership in this study might imply that those seeking health care maybe experiencing some form of financial risk as a result of OOP which may adversely affect progress towards UHC. However it is worth noting that a high active membership does not necessarily protect people from experiencing financial hardship due to OOP as some studies in Ghana have reported high rates of OOP in a relatively high NHIS enrolled population (Nguyen et al., 2011).

The improvements in the MDGs/SDGs service coverage related indicators at endline from baseline in this study could point to the pragmatic efforts put in place by stakeholders including the CHPS+ project over the period towards improving service delivery which is consistent with other findings from earlier studies in Ghana (Maly et al., 2019; Phillips et al., 2018, 2019).

5.3 Composite measure of progress towards achieving universal health coverage

Following PCA using baseline data and replicating the same procedure using endline data, principal components that explained the most variation in the initial data set and used to create a composite index for measuring progress towards achieving UHC were those that correlated with quality, access and active membership indicators. The first objective of this study was to develop a composite measure of PHC system's readiness for achieving UHC. Developing such an index or measure would help policymakers focus on indicators of utmost relevance out of the myriad indicators they are confronted with when measuring the progress of UHC.

The literature indicates that current indicators of the service coverage dimension of UHC are dominated mainly by MCH and infectious diseases and thereby leaving many other services either un-presented or under-represented (Barros & Victora, 2013; Zhang et al., 2019).

Adding complementary indicators of UHC such as WASH (sanitation), NCDs and outreach services in the overall health service package in this study is therefore a good step toward reducing the over-representation of MCH and infectious diseases in previous estimates globally. Determination of financial risk protection through catastrophic health expenditure and impoverishment OOP spending in prior estimates requires large and expensive household consumption data which is often difficult to obtain and compute (Haas et al., 2012; Wagstaff, Flores, Smitz, et al., 2018). Therefore, the inclusion of health insurance enrolment as a financial risk protection indicator which does not require any complex mathematical computation and relatively less cumbersome to obtain in routine household surveys such as in this study in the determination of the overall composite measure of UHC makes this measure more practical and comprehensive.

This index offered a concise set of MDG/SDGs population based indicators that were practical, balanced and valid measures of all the dimensions of UHC as proposed by the WHO and World Bank (Giedion et al., 2013). Therefore from a large list of potential indicators collated from a household survey which is not too different from other routine household surveys, this study selected a set of variables covering the most critical dimensions of UHC such as service coverage (including quality) and financial risk protection resulting in the computation of a more balanced composite index of UHC. This index will therefore serve as a valid measuring index of UHC when related to household data sets and health outcomes. While at present it is difficult to find published measures that fully capture the conceptual construct of UHC proposed by the WHO (Giedion et al., 2013), the constructed index in this study has not only improved on existing approaches to measuring UHC but attempts to fully capture the conceptual construct of UHC proposed by the WHO. The composite measure developed by this study also offers an opportunity for policy makers to be able to take certain critical and early decisions based on routinely collected short term data or indicators rather

than waiting for medium to long term output or impact indicators such as fertility and mortality data that are sometimes used in monitoring progress of UHC.

While a substantial number of UHC indicators were correlated, a reduced set of indicators could therefore perform well as a proxy for the full set of available indicators for measuring the progress of UHC. Furthermore, the approach in this study has also advanced beyond existing composite index measures of UHC (Barasa et al., 2018; Boerma, AbouZahr, et al., 2014; Boerma, Eozenou, et al., 2014; Chan, 2016; World Health Organization & The World Bank, 2015) by using data-driven weights rather than fixed or arbitrary weights.

5.4 Progress of universal health coverage

The progress of UHC was measured based on the percentage distribution of UHCI scores in this study (Table 4.8). The proportion of households that were considered to be below average with respect to the UHCI scores has reduced from 41.15% at baseline to 35.47% at endline. However, there is corresponding increase in households that have move upward to middle class from 25.54% at baseline to 34.83% signifying that there is improvement towards achieving UHC implied by the increase in the percentage of UHCI scores to the middle class which means that there is movement from *below average* to *average* between baseline and endline. The results show that while there is a considerable shift of households that were originally considered to be below the average level to the average class, there is no corresponding increase to the next class, implying that the movement is from lower to the middle class, which is worthy of note. What these results suggest is that there is an overall improvement of progress towards achieving UHC with the direction of progress being more towards average than above average. Therefore if progress towards achieving UHC is to be performing above average, more investment and emphasis needs to be put on the quality, access and NHIS enrolment components of the composite measure of UHC. The need to

place emphasis on service coverage in general and quality of care in particular as found in this study is consistent with other studies especially if SDG 3 is to be achieved in Ghana (De Man et al., 2016; Maly et al., 2019; Sobel et al., 2016).

In a comprehensive assessment of UHC in 111 countries, Ghana's UHC index had a yearly increase of 1.43% and an overall improvement in all indicators (Wagstaff & Neelsen, 2020). In an earlier study in Ghana (Zhang et al., 2019), significant improvements were seen in both service coverage and financial risk protection associated with inequalities across wealth quintiles over 11 years period after using DHS and Ghana Living Standard Surveys (GLSS). However whereas the improvements were more amongst those in the higher wealth quintiles in the earlier study (Zhang et al., 2019), this present study indicated otherwise with progress towards UHC being more in those in the lower wealth quintiles.

From Table 4.9 it was found that the percentage of UHCI scores ranked as above average was highest amongst those in the lower (poorest and poor) wealth quintiles when compared to those in the higher (rich and richest) wealth quintiles whilst the percentage of UHCI scores ranked as below average was highest amongst those in the higher (rich and richest) wealth quintiles when compared to those in the lower (poorest and poor) wealth quintiles. This finding maybe considered to be a desirable one in terms of equity as some actors (Boerma, AbouZahr, et al., 2014; Fore & Gurría, 2019) of health equity advocate that for UHC to be achieved then those at the lower wealth quintile should benefit more so as to narrow the inequity gap. Hosseinpoor and colleagues on the other hand however, recommend that the ideal target for equity-oriented monitoring in the context of UHC should be based on proportional reduction in absolute inequality including that in SES over a period of time (Hosseinpoor et al., 2014). The findings in this study also suggests that the objective of bridging the equity gaps through the introduction of the CHPS concept to ensure that health

coverage is extended to the community level (Ghana Health Service, 2002; Maly et al., 2019; Nyonator et al., 2005) and the implementation of the NHIS which is considered to be pro-poor is being achieved (Amporfu, 2013; Nyonator et al., 2014; Zhang et al., 2019) and thereby putting the country on the right track towards attaining UHC.

5.5 Health facility survey

In Ghana PHC services are delivered through PHC facilities with CHPS zones as the lowest and district hospitals as the highest. In this study, facilities at the lower level of health care delivery comprising of CHPS zones and health centres constituted about 90% of all facilities which is consistent with the national distribution of health facilities in the country (Ghana Health Service, 2018). Since facilities at the lowest level of the health care delivery system are considered to be close to communities and households where they are situated, the high distribution of facilities at this level in the study area can be an indication of high access to PHC services although it is entirely not the case in all situations.

The high concentration of CHNs at the CHPS zones is possibly indicative of the fulfilment of the CHPS policy in respect of human resources. The lower level of the health care delivery system in Ghana like in many other countries in sub Saharan Africa is often not well endowed with high calibre of health personnel and hence not surprising that doctors are never found at this level in this study. Similarly the CHPS policy does not require the presence of high calibre health personnel especially doctors at CHPS zones and hence the absence of doctors at this level (Ghana Health Service, 2002; Nyonator et al., 2005). Despite the low proportion of trained health personnel (no doctor, few physician assistants and nurses) at maternity homes, they appear to be rendering most (67% to 100%) of the services only next to polyclinics.

Adequate infrastructure and supplies are not only important sources of essential health care, but are required by any health care system especially the PHC system to enhance delivery of services in an efficient, effective and timely manner (Leslie, Spiegelman, et al., 2017; Oyekale, 2017). In this study all or 100% of maternity homes and polyclinics had beds for overnight stay and also provided services for 24 hours a day. The low percentage of health facilities in this study with separate rooms for MCH services might have some implications for quality of health care considering the role that health infrastructure plays in quality health care delivery. Medical supplies in this study were limited to supplies for the provision of certain MCH care services which is consistent with WHO recommendations (O'Neill & Sheffel, 2013) and information communication materials for health promotion and education. The high percentage (77% to 100%) of health facilities having information communication materials could possibly be an indication of good health educational and promotional activities being carried out by the health system. However the assertion of good health educational and promotional activities being carried out by the health system cannot be verified since this data was not readily available. The low percentage of CHPS zones having essential supplies for health service delivery (Figure 4.4) is worrisome considering the fact that the CHPS strategy was meant to operationalize PHC towards achieving UHC. However the high percentage (90.3%) of CHPS zones with samples of FP might imply that FP services at the lowest level of the health system is being pursued and subsequently fulfilling one of the key functions of the PHC system towards attaining UHC.

With the exception of Caesarean section not provided at the lower level of the health delivery system such as CHPS zones, maternity homes and health centres, the other types of service delivery used in this study are provided by the higher levels of the health care delivery system. Caesarean section services are generally offered at higher level facilities where doctors are concentrated and hence the non-delivery of these services at CHPS zones, health

centres and maternity homes in this study. This finding is also consistent with studies in other LMIC where caesarean sections were performed at higher levels of health care such as district hospitals amongst others (Alebachew et al., 2014; Nesbitt et al., 2013).

Essential medicines considered in this study as were related to ANC, MCH care, new-born care and BEmOC services. These medicines are part of the WHO tracer items for measuring the specific readiness of these services which are critical in achieving UHC (O'Neill et al., 2013; O'Neill & Sheffel, 2013). With the exception of Artesunate+amodiaquine, between 60% and 96% of CHPS zones had Sulfadoxine+Pyrimethamine, Arthemeter+lumefantrine, albendazole, Depo-provera, ORS and Tetanus toxoid (Table 4.14) which are part of the required medications under the CHPS policy (Ministry of Health, 2014). This finding therefore suggests that close to 40% of CHPS zones are not meeting the requirement of stocking certain essential medicines as stipulated in the CHPS policy. Although some of the medicines used in this study such as IV antibiotics, Magnesium sulphate, IV Diazepam, Oxytocics, Dexamethasone/Betamethasone and Hydralazine were found in a low percentage of CHPS zones, this cannot be an indication of poor performance since these medicines are not part of the required medication package at the CHPS zone level according to the CHPS policy (Ministry of Health, 2014). The absence of some of these medicines in some facilities at the higher level of the health system could have certain implications on both the access and quality of ANC, MCH care, new-born care and BEmOC services subsequently affecting the readiness of the health system a whole.

All the basic equipment employed in this study was in conformance with the WHO tracer items for determining service readiness. One advantage of this study is that it went beyond just finding out the availability of basic equipment but actually assessed their functionality. Only maternity homes satisfied the minimum standard of the WHO (O'Neill & Sheffel, 2013;

WHO, 2012) of having functioning basic equipment. Surprisingly not all health facilities at the higher level of the health system had functioning basic equipment which could have negative consequences on quality health delivery especially considering the fact that they serve as referral centres for the lower level health facilities including maternity homes. The finding in this study was also consistent with a similar study in Nigeria where some observed basic equipment were no longer functioning (Oyekale, 2017).

The monitoring of health care service delivery of the PHC system by various stakeholders is mostly done through the use of information contained in registers at health facilities. Health facilities are often required to keep registers for certain key intervention areas including those presented in Figure 4.5 which are important in generating MDGs/SDGs indicators. In this study, there were varying proportions of health facilities with observed registers. The CHPS policy highlights the importance of these registers as monitoring items or tools of the PHC system (Ministry of Health, 2014) and therefore not too encouraging that certain registers were not observed in some CHPS zones in this study. Health workers especially CHOs are supposed to be supported by community volunteers who assist with community mobilization, the maintenance of community registers and other essential activities (Ministry of Health, 2014; Nyonator et al., 2005). The low percentage of all health facilities that keep community registers in this study therefore imply that this all important function of maintaining a community register in PHC service delivery is not being performed. The non-availability of immunization and vaccine logistics registers in maternity homes can have adverse consequences considering the fact that maternity homes are referral centres for CHPS zones and sometimes are even the first point of contact where CHPS zones are not present (Ministry of Health, 2014).

The role of community volunteers in the PHC system of Ghana cannot be overemphasised when it comes to their function as community mobilization and liaison agents. CHOs working together with community health volunteers have been demonstrated to achieve a high proportion of significant standards related to community engagements in Ghana (Maly et al., 2019). The high percentage of some health facilities at the lower level of health care especially CHPS zones working with community volunteers in this study is therefore encouraging as it will go a long way in improving service delivery at the community level. However a lot still remains to be done when it comes to maternity homes which are also considered as lower level health facilities (Ministry of Health, 2014), as no single maternity home worked with a community volunteer.

5.6 A composite measure for the health system's readiness towards achieving universal health coverage

Having and ensuring access to quality health is seen as one of the main functions of a health system. One way of measuring this function has often been through service readiness in the form of facility readiness index which is critical in measuring and tracking progress in health systems strengthening (Boyer et al., 2015; Jackson et al., 2015; Lama et al., 2020; O'Neill et al., 2013).

In this study, the selected indicators used in the initial PCA were subsequently reduced to few components which still contained much of the information in the initial indicators. These components also called intermediate indices which were attributable to monitoring of health services; functioning basic equipment; essential medicine; and availability of trained health personnel at health facilities categories explained 53.45% of the total variance in the initial data. Therefore a composite measure for measuring the PHC system readiness towards the achievement of UHC in Ghana involved mainly measuring these components or intermediate

indices. Furthermore this finding of the study also suggests that if Ghana is to succeed in the implementation of its' national UHC roadmap focusing on strengthening PHC delivery in health facilities across the country (Health & Roadmap, 2019), then stakeholders and decision makers should be investing in monitoring of health service delivery, provision of basic equipment, supply of essential medicines and ensuring that trained health personnel are available at health facilities.

Consistent with the finding in this study is a study in Tanzania by Jackson et al. (2015) who also identified the presence of higher level health personnel in hospitals and health centres as a principal component in an estimation of indices of health service readiness with PCA using TSPA data (Jackson et al., 2015). Similar to the findings of this study, other studies have also highlighted the need to fulfil certain requirements such as trained and supported health workers, essential medicines, health products and equipment along with information systems and key infrastructure foundations which are critical in achieving UHC (Fore & Gurría, 2019; Savedoff et al., 2012).

Since health systems are seen as complex entities governed by non-linear interaction laws, self-organization and emergent phenomena which are often unpredictable (Martínez-García & Hernández-Lemus, 2013), the WHO currently advocates for a system thinking approach of strengthening health systems through the six health system building blocks which include service delivery, health workforce, information, medical products and technologies, financing and governance which are found to be critical in achieving UHC (Mutale et al., 2016; Sherr et al., 2017). However the health system in Ghana like in other countries in sub Saharan Africa is structural in nature with focus on health facilities delivering health services instead of the system-wide approach proposed by the WHO. A recent health systems strengthening strategy that adopted the WHO's approach of system thinking using the health system building blocks

in the northern part of Ghana indicated tremendous improvements in the health system after implementation (Awoonor-Williams et al., 2013; Phillips et al., 2018). This may therefore suggest that if Ghana's health system is modelled along the line of the WHO's approach of strengthening health systems, there would be a general improvement in the system instead of its current state.

One way of improving health systems measurement to reflect the six health system building blocks will be to include other indicators that fully capture this approach in health facility surveys. Of particular importance will be the inclusion of indicators that measure the building block of 'governance and leadership' considering the fact that leadership and governance is critical for the functionality of the other building blocks (Sherr et al., 2017).

5.7 Linking household and facility surveys (effect of PHC system readiness on UHC)

Linking of the household survey to the facility survey was achieved by merging endline data of both surveys using place of birth or delivery after constructing the SRI through PCA.

Contraceptive use; four or more ANC visits; all 3DPT immunizations; and active NHIS membership were the dependent variables while the SRI score was used as the main independent variable in the binomial logistic regression models.

Most studies linking data from household surveys to those of SPA surveys have often been used to generate population level measures of health outcomes or effective coverage which accounts for quality service of service delivery (Do et al., 2016; Kanyangarara & Victoria, 2018; Nesbitt et al., 2013; W. Wang et al., 2017; Willey et al., 2018) rather than determining the effect or impact of system readiness on population health outcomes or coverage.

By linking these two data sets and performing regression models using the SRI score as a predictor of population health outcomes this study appears to be the first of its kind that has attempted to determine how an increase in index score affects population health which has been a limitation of previous studies that linked household surveys to SPA surveys. The results from the binary logistic regressions (models 1, 2 and 3) indicate that the SRI scores are not significantly correlated with certain population health outcomes, notably four or more ANC visits, all 3DPT immunizations and contraceptive use after controlling for other factors.

Current interventions and implementation research programs (including the CHPS+ project) appear to be targeted at improving and strengthening the health system with more focus towards quality health delivery rather than health financing or addressing financial hardships of health care seekers. This gives a comparative advantage of the service coverage dimension over the financial risk protection dimension of UHC as is depicted by the percentages of the measured indicators (Table 4.3) at baseline and endline. This might also possibly explain the outcome of the regression analysis where the population outcomes that are related to the service coverage dimension are not significantly associated with the SRI.

The NHIS is saddled with some challenges which could adversely affect its FRP function in spite of the fact that enrolments into the scheme have been proven to grant access to health care and FRP to residents in Ghana. Although a number of factors have been found to be associated with enrolments into the NHIS according to previous studies (Akazili et al., 2012; Alatinga & Williams, 2015; Kusi et al., 2015; Nguyen et al., 2011; Nsiah-Boateng et al., n.d.), there is currently scarcity of knowledge on how the readiness of the health system affects enrolment into the scheme.

The result of this regression analysis therefore offers valuable information to policy makers by encouraging them to continue to invest in strengthening the health system since this will have a replica effect on active membership leading to the attainment of UHC in Ghana.

Future studies measuring the progress of UHC should consider adopting the system thinking approach based on the six WHO building blocks of health systems strength.

5.8 strengths and limitations

A major strength of this study is that, it has been able to demonstrate how scores or changes in scores of computed composite indices of service readiness impacts population health or service coverage. One other strength of this study is that the set of indicators used in the computation of the UHCI moved beyond commonly used indicators of service coverage, which focused on treatment of infectious diseases and MCH, to include other indicators such as water and sanitation, quality of maternal health services and outreach services (homes visited by health personnel's) which are key components of PHC. A major criticism of a lot of studies that have measured the progress of UHC has been their inability to include indicators that measure NCDs as part of the package of service coverage. This study therefore has an added strength by including indicators for measuring NCDs, strength other studies lack. Community volunteers are often seen as link agents between the PHC system and the community and so the inclusion of community volunteers in the estimation of the SRI adds to the strength of this study since most studies in this area rarely include this indicator when measuring service readiness. The inclusion of these indicators has resulted in a more balanced composite index of UHC and service readiness. This study is amongst one of the very few studies that has considered all the three dimensions of UHC and therefore in a much better position to make policy recommendations to stakeholders involved in Ghana's road map towards achieving UHC. Lastly this study used a direct linking approach which is considered

as the gold standard of linking household and facility data. The facility survey in this study was a census of all facilities within the study area plus other facilities outside the area and therefore could be said to be representative of all facilities in the study area.

Notwithstanding these strengths, this study also has some limitations. The first limitation of the study is that the indicators considered for quality in this study do not capture all aspects of the quality of care spectrum such as respectful care, client satisfaction, provider competence and adherence to standards practice or protocol as there was no direct observation. Another drawback was recall bias since the study participants had to recollect events that occurred up to several months before the study period or day of interview. These limitations do not affect the validity of this study because (i) quality indicators used in this study have widely been used as indicators to measure quality from population level surveys (Heredia-Pi et al., 2016; Hodgins & D'Agostino, 2014; Marchant et al., 2015; Sharma et al., 2017) and (ii) recall of events up to this level of time is not peculiar to this study alone but applies to similar population level surveys such as the DHS (GSS & GHS, 2014; Seidu et al., 2020) and Ghana Maternal Health Surveys (Ghana Health Service, 2018) that have been proven to be valid.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

This study examined the PHC system progress and readiness towards the attainment of UHC following the implementation of the CHPS concept, NHIS and recently CHPS+ project by the Government of Ghana. The study was conducted in seven rural districts in the Volta and Oti regions of Ghana employing quantitative analytical techniques to achieve its objectives. Univariate analyses were carried out to describe socio-demographic variables and indicators for measuring UHC and health systems' readiness. Principal component analysis was used to construct composite measures for measuring progress towards the attainment of UHC and the PHC system readiness towards attaining UHC. Binary logistic regressions were performed to determine how the readiness of the PHC system affects UHC at the population level and how a change in the SRI scores affected population health outcomes.

Although currently there is a lack of global consensus on a measuring matrix for measuring the progress of UHC, the use of composite indices as a measuring matrix has been shown to have some advantages including supporting decision makers and serving as a communication channel to the general public. The WHO recommends that measuring progress of UHC should involve all its dimensions: service coverage, financial risk protection and population coverage. However, in most instances only two (SC and FRP) dimensions are measured independently of each other. With the exception of a few studies that have attempted to measure the progress of UHC using composite indices from two (SC and FRP) dimensions of UHC simultaneously (Barasa et al., 2018; Boerma, AbouZahr, et al., 2014; Boerma, Eozenou, et al., 2014; Chan, 2016; World Health Organization & The World Bank, 2015), most studies have measured progress by using only one of these dimensions separately. Furthermore in a

number of instances measuring progress of UHC is embedded in the measurement of health systems strength in general. Measuring progress of UHC in most developing countries including Ghana is through the entire health sector progress and performance review (Nyonator et al., 2014) which often does not offer a clear cut picture for decision makers and the general public at large.

The lack of complete adequate quality data has been one of the main challenges in measuring progress towards UHC. This study overcomes this challenge by using data from the CHPS+ project which was collected at both the population and health facility levels in two regions to facilitate a scientific evaluation of the project impact. The inclusion of indicators such as blood pressure checks and tobacco use that measure the burden of NCDs, outreach services, NHIS enrolment and WASH in this study makes the data more suitable for a study in this field since indicators cover a wide range of sectors related to UHC.

This study employed robust statistical methods through which progress of UHC and health systems readiness towards attaining UHC are measured by developing composite indices. First a composite index (UHCI) for measuring progress of UHC was developed after which this index was used to measure the progress of the PHC system towards achieving UHC. Similarly a composite index (SRI) for measuring the health systems readiness towards the attainment of UHC was also developed and subsequently used to measure the readiness of the health system. The development of these composite indices is expected to help stakeholders and decision makers adopt more scientific approaches to measuring progress of UHC in Ghana whilst also making it easier for them to interpret the results of these measurements rather than trying to find a trend in many separate indicators. Other expected uses of these constructed composite indices will be for strategic planning and reporting at the population

level and the identification of areas for interventions and action towards attaining the goal of UHC.

The composite index is used for measuring progress towards attaining UHC, and this was with indices of service quality, access and active membership indicators. Scores of the UHCI were computed and classified into below average progress, average progress and above average progress. There was some progress towards attaining UHC by the PHC system based on two main findings. First apart from active membership, there was an overall improvement in the percentages of all other UHC related indicators from baseline to endline. Second there was an increase in the percentage of the average progress scores from baseline to endline and a decrease in the percentage of below average scores from baseline to endline which implies that if the country wants to make more progress towards attaining UHC, it is important decision makers focus their attention at improving quality, access and active membership.

The construction of the composite index (UHCI) together with its scores accounted for both the service coverage and financial risk protection dimensions of UHC. However to cater for the population coverage dimension in accordance to both the WHO and World Bank's global framework on UHC (Boerma, AbouZahr, et al., 2014), the UHCI scores were categorized according to wealth quintiles with the results indicating that progress towards attaining UHC was pronounced in the lower quintiles (poorest and poor) as compared to the higher quintiles (rich and richest) at both baseline and endline.

Likewise the principal components which explained most of the variation in the initial data and used as intermediate indices of the composite measure (SRI) to measure the PHC system readiness towards attaining UHC were correlated with monitoring of health services, functioning basic equipment, essential medicine and availability of trained health personnel at health facilities indicators. Therefore a composite measure for measuring the PHC system

readiness towards the attainment of UHC in Ghana should involve mainly measuring these indicators rather than measuring a plethora of health system indicators. This finding also suggests that if Ghana is to succeed in the implementation of its' national UHC roadmap which focuses on strengthening PHC delivery in health facilities, then interventions should be focused on improving these areas of the health care delivery system.

Scores of the SRI were generated for health facilities at the various levels of the health care system to determine the extent to which these levels are ready towards driving the attainment of UHC. All maternity homes were found to be most ready in this regard. However several facilities at the lowest level of the health care system such as CHPS zones and health centres were between least ready to averagely ready towards driving the UHC agenda. Majority of facilities at the higher level of the health system were found to be most ready towards the course of attaining UHC.

With regards to the effect of the health system readiness on population health, the findings of this study indicated that the health system readiness which was determined using a composite measure (SRI) affected only active NHIS membership and not the other population health outcomes such as four or more ANC visits, all 3DPT immunizations and contraceptive use. The finding in this study showed that an increase in the SRI score by one increases the odds of active membership by 6%.

6.2 Conclusion

This study was successful in constructing a composite measure for measuring the progress of the PHC system towards attaining UHC and a composite measure for measuring the PHC system readiness towards attaining UHC based on a robust scientific approach using quality data.

There was some progress made by the PHC system towards attaining UHC between baseline and endline. Whereas majority of health facilities at the lower level of the health delivery system where least ready to drive the course towards attaining the goal of UHC, most of the facilities at the higher level of the health delivery system were most ready towards attaining that UHC.

Population health outcomes such as four or more ANC visits, all 3DPT immunizations and contraceptive use were not affected by the SRI. Active NHIS membership as a population health outcome was however affected by this index with changes in the scores of this index increasing the odds of active membership in the study area.

6.3 Recommendations

6.3.1 Policy recommendations

Based on the low active NHIS membership from this study, it is recommended that National Health Insurance authority of Ghana which is the manager of the NHIS, together with other stakeholders within the health sector take proactive steps to increase active membership of the NHIS since the scheme has been proven by previous studies to offer some FRP. Since this study has found a correlation with the service readiness index and active NHIS membership, one possible way of improving the active NHIS membership could be to make the PHC system more ready to deliver UHC services as part of the packages of encouraging enrolment into the NHIS.

In order to improve on the progress towards attaining UHC based on the UHCI scores from this study where progress was found to be average, there is the need for the government and all relevant actors of UHC in Ghana to concentrate their efforts and investments in quality health care delivery, making health more accessible and improving active NHIS membership.

In order to improve on the readiness of the health system towards attaining UHC especially amongst facilities at the lower level of the health system, there is the need for government through the GHS and all other stakeholders particularly leaders of health facilities to invest in areas such as monitoring of health services, functioning basic equipment, essential medicines and trained personnel as these were correlated with the SRI.

6.3.2 Further research needs

This study used proxies such as blood pressure checks and tobacco use as indicators for measuring NCDs instead of actual prevalence and control rates of NCDs. In future studies to measure UHC and its progress, it will be useful to use actual prevalence and control rates of NCDs.

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