Towards Universal Health Coverage: Mapping the Development of the Faith-Based Non-Profit Sector in the Ghanaian Health System

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Abstract

The equitable provision of accessible quality health services and the achievement of universal health coverage (UHC) continue to be prominent on the global health agenda, yet remains an elusive target for many low- and middle-income countries (LMIC). In these contexts, the private not-for-profit (PNFP) sector plays a significant role, and in many African countries, faith-based non-profit (FBNP) providers dominate this sector. Robust public-private partnerships are increasingly being recognised as important to building and maintaining strong, resilient health systems. However, there is a lack of evidence on whether collaborations between FBNPs and the public sector are complementary, have achieved their intended aims, or exactly how these relationships developed over time to shape these health systems. Furthermore, reliable information on both the historical and current spatial distribution of services and how this relates to geographic accessibility and the achievement of UHC is limited. This study explores this in Ghana, a country with a large FBNP sector, mostly networked under the Christian Health Association of Ghana (CHAG) which has an influential and now formalised relationship with the government. The following health systems research study utilises a mixed methods approach, synthesising geospatial mapping with varied documentary resources (secondary and primary, current and archival). The evolution of the FBNP sector and the shifts in service footprint are reflected in the geospatial maps, aligned with key historical events and contextualised by a narrative analysis. The study highlights that many faith-based facilities were initially located in rural and remote areas beyond colonial governance control (or boundaries), and many of these facilities still exist, demonstrating resilience to change over time. However, this service footprint has changed and today, public and private health facilities are located in similar areas throughout the country. This trend is in-line with social and political events,

changing population dynamics and an increasing population of urban poor. The analysis assesses how the growth of the public sector, and these shifts in presence and profile for the FBNPs has influenced their perceived and measured contribution to UHC – in particular geographic accessibility. This study provides a model for representing the evolution of the relationship between public and a particular type of non-state provider over time, characterising the historical development of the health system, which should be considered in efforts to strengthen and develop the Ghanaian health system, and other relatable LMIC health systems.

Acronyms

ACHAP	Africa Christian Health Associations Platform
AHPSR	Alliance for Health Policy and Systems Research
AMM	Ahmadiyya Muslim Mission
CERSGIS	Centre for Remote Sensing and Geographic Information Services
CHA	Christian Health Association
CHAG	Christian Health Association of Ghana
CHAM	Christian Health Association of Malawi
CHART	The Collaborative for HIV and AIDS, Religion and Theology
CHPS	Community-based Health Planning and Services
DHIS	District health information software
DRC	Democratic Republic of Congo
FBNP	Faith-based non-profit
FBO	Faith-based organisation
GHS	Ghana Health Service
GIS	Geographical information systems
GPS	Global positioning system
HPSR	Health Policy and Systems Research
HREC	Human Research Ethics Committee
IRHAP	The International Religious Health Assets Programme
LMIC	Low- and middle-income country
MOH	Ministry of Health
MOU	Memorandum of Understanding
NCHS	National Catholic Health Service
NGO	Non-governmental organisation
NHIS	National Health Insurance Scheme
NSP	Non-state provider
PHC	Primary health care
PNFP	Private not-for-profit
SAM	Service Availability Mapping
SARA	Service Availability and Readiness Assessment
SDA	Seventh Day Adventists
SDG	Sustainable Development Goal
SSA	Sub-Saharan Africa
UCT	University of Cape Town
UHC	Universal health coverage
WCC	World Council of Churches
WHO	World Health Organisation

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Part A: Protocol

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Introduction

"Health for all", the goal of the Alma Ata Declaration in 1978 and the provision of accessible quality health services to the entire population are targets which remain elusive in many low- and middle-income countries (LMIC). Lack of access to services and vast health inequities are issues which continue to predominate in these contexts [1]. National governments, both from a human rights as well as a socio-economic development perspective, have the ultimate responsibility for ensuring the delivery of services across any country. However, in many LMICs, given the scarcity of resources, the low level of government expenditure on health and influence of donor funding, there is growing recognition that the public sector alone is unlikely to be able to achieve better health outcomes for the population [2, 3]. As a result, the health systems of many LMICs consist of and are delivered by a complex mix of public and private for- and not for- profit providers and the latter must be considered in efforts to strengthen these health systems [4].

Faith-Based Non-Profit Providers

Private or non-state health providers have been important to service delivery in African health systems since colonial times [5, 6]. This sector consists of an array of formal and informal, international and national providers [7, 8]. Within almost half of the countries in Africa, one particular type of provider dominates the private not-for-profit (PNFP) sector: faith-based non-profit providers (FBNP) [9]. Within sub-Saharan Africa, in most countries in which there are a

significant number of FBNPs, they are usually encompassed under national Christian Health Associations (CHA) which are loose umbrella networks of providers and facilities who share a religious identity and particular goals [9]. Evolving from a missionary base, many of these organisations and networks were in place prior to independence and have long been a component of these health systems [2, 5]. In many cases they were responsible for establishing the first formal biomedical health services [10]. Current estimates suggest that FBNPs make a significant contribution, said to provide 30-70% of the national health services in some countries in sub-Saharan Africa – although these estimates are considered to be problematic [9].

The collaborative relationship and approach between FBNPs and state actors has been distinct in LMIC contexts due to their shared goals of outreach to the poor and the achievement of universal health coverage (UHC). Historically, these providers have marketed themselves and obtained support on the premise that they provide quality health services to the poor, needy and vulnerable, those in remote and rural locations which struggle to retain health workers and the typically underserved, complementing and filling gaps in government services [11]. This positionality along with arguments around their market share, pro-poor focus and quality of service, have been important sources of leverage for funding and government support. While there are broad assumptions that such collaborations between different sectors support health system strengthening [6] and the achievement of UHC, there is a dearth of systematic evidence on the effects of such relationships, the mechanisms used to incorporate FBNPs, their historical evolution and whether they are successful in achieving the desired goals [9, 10].

Universal Health Coverage

Universal health coverage has been a dominant feature of the global health rhetoric since 2005 and is now a goal of many FBNP providers. The attainment of UHC requires that all individuals have access to essential and quality health services without being exposed to financial hardship [12]. It is currently considered to consist of three main dimensions; (1) the quality of services provided, (2) population coverage, which also relates to equity in provision of services and utilisation according to need, and (3) financing [12, 13]. In the face of the continuing struggles to achieve high standards of health and reduce inequities in many countries around the world, the international community has aligned, encouraging countries to transition and strive towards this goal, solidified by the inclusion of UHC within the Sustainable Development Goals (SDGs) [14].

Crucial to achieving this ambitious target is the need for strong, sustainable and resilient health systems [15]. There is a tendency for the attention around UHC and health systems strengthening to focus on the ability of the public (government) sector to achieve these goals. However, as suggested above, inadequate resources and low government expenditure in LMICs constrain the ability of the public sector to accomplish this alone [2, 3]. In striving to achieve UHC, governments should engage the varied mix of health service providers, harnessing private sector resources to provide far-reaching health services, improve outcomes and ultimately achieve UHC [16, 17].

Although the ethos behind UHC is clear, with a focus on individual rights and socio-economic development, it is a multidimensional concept that is challenging to measure. The World Health Organisation (WHO) framework for monitoring UHC refers to two aspects of measurement: service delivery (encompassing human and infrastructure resources) and financial protection [12]. However, these measures do not capture all of the information required to assess the capacity of

the facilities to deliver the services offered ('readiness'), quality of services, and utilisation according to need [18]. Crucially, even if the financial aspect of UHC is addressed, if resources of the appropriate quality are not available in the required geographical locations, equitable service delivery and UHC will not be achieved [19].

Geographic Coverage

The dimension of availability of services within UHC is broad-reaching and somewhat ill-defined but can refer to how physically accessible resources are to the population [20]. It is closely linked to elements of affordability (ability of the user to pay for the service), acceptability (socio-cultural dimension) and the quality of services provided, but the prerequisite to all of these aspects is the geographical accessibility of the service [21]. At its most basic and physical level, service availability refers to the location of the seeker of health services in relation to the point of service delivery, that is, the infrastructure where appropriate services and personnel are located [22].

Numerous studies have shown that geographic inaccessibility is a critical barrier to accessing health care [23-25], and that primary health care utilisation is closely linked to the physical proximity of the health facility or service [20]. The necessity for reliable information on this element of UHC has been recognised by the WHO, which has implemented a variety of measurement tools for Service Availability and Readiness Assessments (SARA) since 2004 (SARA being the most recent tool). The explicit intention of this service availability mapping approach is to carry out country-focused systematic surveys to fill data gaps by monitoring a number of key domains, including health infrastructure. The overall purpose is to improve health systems management, increase accountability and ultimately with the aim of achieving national and global health targets [21].

The issue of geographic accessibility and coverage towards achieving UHC is one of particular pertinence for FBNPs. As highlighted, their ethos of providing services to those in typically rural areas has been an important feature of their development, creating a historical spatial footprint of health services which still remains today – or at least the generally accepted perception of such (which will be interrogated in this study). However, with the increase in urbanisation in previously rural areas and a burgeoning urban poor in many LMICs, their current contribution to UHC is being questioned by government counterparts and international funders [9].

Assessing the national health system and acquiring knowledge of the location of facilities, both public and private, from a spatial perspective is important for monitoring equity, access and utilisation, and would provide potentially valuable information for both government and FBNPs [21, 26]. Such mapping can be used to inform evidence-based planning, policy development and resource prioritisation to ensure both availability and accessibility, aimed at reducing disparities and improving health services while ensuring the efficient use of resources and provision of services to the most in need [20, 27, 28].

FBNPs in the Ghanaian Health System

In Ghana, the Christian Health Association of Ghana (CHAG) dominates the private non-profit (and FBNP) sector. Established in 1967 and operating as a network of affiliated facilities run by a variety of Christian Church denominations, they currently have a membership of 282 facilities and 18 training institutions across the country. Considered one of the strongest of the CHAs in Africa [29], they are currently a recognised agency of the Ministry of Health (MOH), with a Memorandum of Understanding (MOU) in place since 2006, but working collaboratively since CHAG's formation [6]. CHAG estimate that they provide around 35-40% of the country's health services [30], making them

a significant player in the national health system. While there are other FBNPs and private non-profits in Ghana, including Islamic providers (estimated as providing 2%), CHAG are by far the most prominent - historically and currently within the national health system.

There is limited evidence-based research on FBNPs and their contribution towards national health systems [9]. There has been some recent empirical research on FBNPs in Ghana, which has included CHAG facilities – such as studies on service satisfaction, the pro-poor focus and national market share [26, 31]. However, there has been little focus on the historical evolution of the relationship between CHAG and the government. A historical lens provides the opportunity to examine why a health system has evolved to its current state and what social, contextual and economic factors have been important in systems change [28]. Examining the historical collaboration between the government and CHAG can provide useful learning and insights towards their potential continued cooperation towards the ultimate goals of UHC and health systems strengthening, as well as applicability for other countries and contexts.

Assessment of spatial patterns and distribution of health services has also been limited in Ghana, with little research carried out assessing geographic availability, although it is largely described as inequitable [32]. Access to accurate information on the distribution of health services is key to planning of services, to the allocation of resources, and for informing policy change. Schmid et al. call for the mapping of religious entities “for optimal alignment in resource constrained settings […] and the establishment of a comprehensive database” [10, p.174].

Crucially, preliminary investigation into this topic shows that neither CHAG, its member organisations nor the MOH have a substantial or complete up-to date map of all health services available across the country, either in paper or digital form. (Although there is said to be an MOH database, this is not openly accessible). Figure 1 demonstrates this, showing the paper map currently in use in the main office of a CHAG member institution - highlighting the location of their facilities. Digitisation of this and historical material would ensure accurate records and enable better coordination and knowledge sharing between sectors and health system actors.

Figure 1: Wall map showing location of facilities

Source: Photo taken by research in national FBNP office in Ghana in 2017

Research Purpose and Question

This study seeks to address the question: *'How have faith-based non-profit providers contributed to the historical development of the Ghanaian health system towards UHC – with a focus on geographic availability and distribution?'*

This study intends to answer this by undertaking a geospatial mapping of the development of the private not-for-profit health sector in Ghana (in particular CHAG), showing the distribution of

facilities across the country. It seeks to show the evolution of CHAG (and other FBNP) facilities in relation to the public health system, reflecting changes in service footprint (for example, showing the location of main facilities, regional differences, or how the health system has developed since independence in the 1950s). By examining the evolution of the health system over the last 50 years, it aims to assess the development of the relationship, the contribution of FBNPs to the accessibility aspect of UHC and health system development and what this mapping can contribute to future learning.

Sub-Study Arrangement

This research project is a sub-study within a broader WHO - Alliance for Health Policy and Systems Research (AHPSR) funded project *'Systems integration towards universal health coverage: Strengthening the collaborative relationship between faith-based non-profit providers and the Ghanaian public health system'* (Human Research Ethics Committee (HREC) reference 190/2015 – see Appendix B). This primary study, conducted by researchers at the University of Cape Town (UCT) and the University of Ghana examines the historical relationship between the Ghana public health system and non-state non-profit providers (mainly faith-based under the umbrella of CHAG) with the ultimate goal of strengthening the Ghanaian health system and progress towards UHC (main study brief inserted as Appendix B). The primary study's researchers have longstanding associations with CHAG and the National Catholic Health Service (NCHS) who will provide contributions to the primary study and are aware of and in support of this sub-study research. This sub-study will contribute to the primary study by providing geospatial maps showing the historical development of both the public and FBNP facilities over time providing an additional form of evidence for the researchers to synthesise, draw findings and conclusions from.

Methodology

This study will utilise a mixed methods research strategy combining geospatial mapping with varied documentary resources (secondary and primary, current and archival). Flexible data collection and analysis methods will evolve as the research is carried out, collating both qualitative and quantitative data. Three phases of research will occur concurrently with continuous data analysis and synthesis carried out throughout the study period (see Figure 2). This mixed methods approach with multiple sources of information provides the researcher with a rich picture, enabling greater insights through the incorporation of contextual information and the triangulation of data [33, 34].

The research is focused at the macro level of the health system, examining the historical development of the entire national health system but with a specific focus on the location and distribution of public and FBNP health facilities [28].

Phase 1: Scoping Literature Review

The output of this phase is a scoping literature review focused on the historical development and current status of the Ghanaian health system. Activities in this phase will include the collation and synthesis of peer reviewed and grey literature as well as review of relevant secondary documentary and archival literature acquired through the primary study. It is anticipated that the literature will be thematically organised under the following categories: FBNP providers in sub-Saharan Africa, UHC (with a focus on geographic availability and distribution), and the development of and current state of the Ghanaian health system.

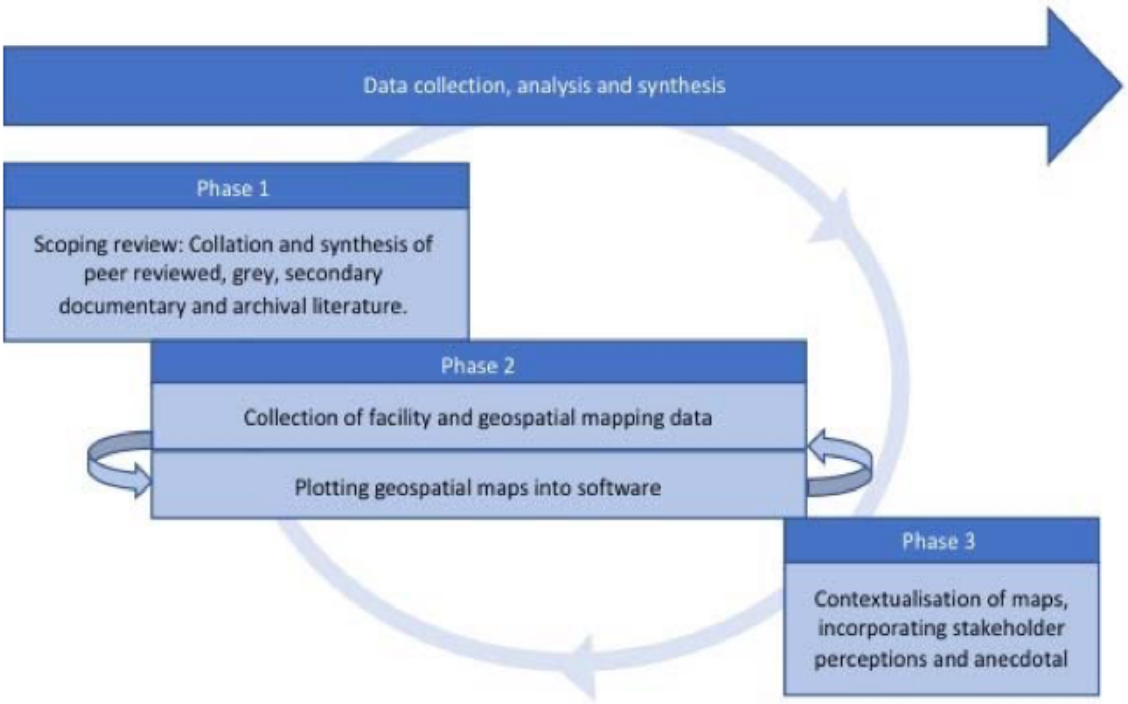
Phase 2: Geospatial Mapping

The second phase of this research will be the process of geospatial mapping which involves two key activities; the gathering and synthesising of a variety of facility, quantitative and geospatial mapping data (as detailed below), and the plotting of the facilities onto maps using appropriate software. The intention is to produce both an up-to-date as well as historical maps of the health system to show change over time (basically a geographic time-series analysis). This process will commence after the start of Phase 1, but the two phases will run in parallel for part of the time, as it is expected that the data acquired for each phase will 'cross-pollinate' into the other.

Phase 3: Contextualisation

The final phase of this research will occur once the geospatial maps have been plotted. Primary materials from the main study will undergo secondary analysis for this thesis project. This will include already collected key informant interview transcripts, archival and documentary literature, and anecdotal evidence – which will be synthesised with the purpose of contextualising and analysing the maps developed in the prior phase. Stakeholder perceptions and anecdotal evidence will be used to gather historical and current views on geo-locations of FBNPs in Ghana and the change in service availability over time.

Figure 2: Research Strategy



Source: Author

Conceptual Framing

This study is conceptually situated within the field of Health Policy and Systems Research (HPSR) which is an interdisciplinary field, combining a variety of theoretical perspectives, academic disciplines, knowledge paradigms and research methods, to improve understanding and performance of health systems [28]. Crucial within this approach is the recognition that health systems are complex adaptive open systems that are influenced by historical, social, political and economic factors which change over time [35]. The transition to UHC and the geographic distribution of health services in particular, which is the focus of this sub-study, is strongly dictated by historical events creating spatial footprints. Also, strongly ingrained within HPSR literature is the engagement and involvement of stakeholders and actors in research about the health system [36]. This role is not only as an entry point for primary research but as in this case, to provide insights

and contextualisation on the information gathered. By applying a historical lens, a variety of research methods drawn from social science and geography, and utilising a diverse range of data sources - this research endeavours to apply the principles and ethos of HPSR to this study and in the process, make a contribution of direct relevance to actors in the Ghanaian health system.

As noted earlier, this study is also nested within the broader WHO-AHPSR funded study, which uses a historical realist case study approach to examine the development of the Ghanaian health system from independence to current day. This impacts on the framing of the sub-study, in particular its focus on history and change over time. It also responds to the high demand for HPSR which looks at health systems change over time [28].

This mixed methods HPSR study therefore seeks to synthesise data from a variety of sources. In so doing, the intention is to create both current and historical geospatial digital maps in order to show the changes in the spatial footprint of the Ghanaian health system over the last 50 years as well as the development of the relationship between non-state non-profit providers and the public system. The process of geospatial mapping is one which has evolved from geography and is a useful method to examine multiple data sets for the purposes of spatial planning. It has been utilised across a number of disciplines and is increasingly used in health care settings to influence decision making [20, 37, 38]. Previously, much of this research has focused on particular aspects of service delivery or disease surveillance [39]. Initial review suggests that this methodology has never been used for this particular purpose, to examine the historical development of a health system, so part of this study is intended to assess whether this is a useful approach for health systems analysis [40].

Data Collection

This research study will involve collection, analysis and synthesis of a variety of both qualitative and quantitative data, as detailed in Table 1. The qualitative component, the descriptive data, will be drawn from a variety of peer reviewed and grey literature, documentary and archival data, and secondary interview transcripts acquired through the primary study. The quantitative data that is required for this research is the geo-location data for health facilities (global positioning system (GPS) coordinates), which are required for the purposes of geospatial mapping.

Data Collected in Scoping Literature Review

The first phase of this research will involve a scoping literature review focused on understanding the evolution of the Ghanaian health system (reported in Part B). The purpose of a scoping review is to "examine the extent, range and nature of research activity in a topic area", mapping the body of literature, summarising and identifying research gaps, enabling the researcher to explore the literature around the topic of focus [41, 42]. This review will also draw on the narrative interpretive review method which incorporates elements of a systematic review but enables a more reflective analytic approach to examine the nuanced aspects of health systems that do not fit into the specific categories required for a systematic review [43]. This is particularly appropriate for the historical perspective that this study takes.

This review will draw on, analyse and synthesise a broad body of literature and evidence, focused on key areas which it is anticipated will be thematically organised under the following headings: FBNP providers in sub-Saharan Africa, UHC (with a focus on geographic availability and distribution), and the development of and current state of the Ghanaian health system. A broader

review has been conducted by the researchers in the main study which will be used as a platform from which to further analyse and refine the literature for the purposes of this study.

The majority of the literature required for this scoping review will be acquired through extensive digital searches. Peer reviewed literature will be searched for using key databases including Google Scholar, PubMed and EBSCO amongst others. Key search terms relating to the aforementioned themes will be used to refine the search. A snowballing approach will then be used to identify any other relevant research studies or literature. In addition to this academic literature search, a search of grey literature will also be conducted using Google Search and a series of particular databases and websites such as but not exclusive to, those maintained by the Ghanaian MOH, CHAG and the Ghana Health Service (GHS). The intention is to further source particular Ghana-specific and organisational information. Only publications in English will be included in the search and review due to translation limitations (but English is also the main language of communication in the Ghanaian health system, so this is not a major limitation).

In addition, for richer contextual analysis and historical understanding, as part of the literature review, this study will examine organisational (CHAG, NCHS), and governmental (GHS, MOH) documents and materials, both electronic and paper based. This may include as relevant, maps, membership documentation, annual reports, agreements and other archival material. Some of this will be found through the digital grey literature search but it is anticipated that the majority will draw on paper-based literary, documentary and archival data acquired through the primary study (which has all appropriate ethical clearance). This data will be subject to secondary review and synthesis for any relevant information for the scoping review.

Data Collected for Geospatial Component

From an initial review, geographical information systems (GIS) software (such as ArcGIS™) has been identified as the most appropriate software to use for the purposes of the geospatial mapping component in this study. The advantage of this software is that multiple data sets can be combined and displayed as independent layers simultaneously, creating layers of information and enabling a rich and useful visualisation of the data for interpretation. It enables quick assessments of trends and interrelationships, presenting data in a more accessible and insightful manner than traditional tabular formats [38]. It has been utilised in a variety of fields and although increasingly being used to evaluate the distribution of health resources and analyse needs, disparities and utilisation, it is still under-utilised in health contexts but shows great value in planning and monitoring [20, 38].

It should be noted that the use of this software is reliant on either obtaining the global positioning system (GPS) coordinates of the facilities under study or obtaining an already existing GIS base map of the health system from which to build on. Initial searches suggest that the latter is possible. However, as the process commences, if it becomes apparent that GIS software is not appropriate, the use of Google Maps as an alternative mapping method will be considered. This has the advantage that it can use addresses (rather than coordinates) to pinpoint facilities and it is an open-source software which will perhaps enable higher utilisation by stakeholders.

The basic data required for the geospatial mapping component of this study will be quantitative. In order to carry out a mapping of the health system as it currently stands, the crucial data that will be required are the GPS coordinates and/or addresses for the location of the health facilities. For the purposes of this research, information on facility ownership is also essential. Additional (non-essential) information will also be collected to supplement this, in order to achieve a fuller

contextual analysis, including facility type and establishment date (full details of which are presented in Appendix D). The search will initially focus on data for CHAG and public health facilities (as the main focal points of the study) and then will broaden to other private non-profit providers. Initial searches have suggested that this information will be obtained in the form of private or open source GIS software, which will create a base map. This data that will then be verified, cleaned and updated based on additional information acquired through sources such as CHAG and GHS.

The other stage of the mapping process is the historical component, showing spatial changes in the health system since the 1950s. The crucial data required for this is establishment date and ownership details and changes. It is again anticipated that much of this information is available through the base GIS map and particularly through supplementary organisational and governmental archival materials (acquired through the main study). Much of this information is likely to be paper based so will require the transfer of information to digital sources and the mapping software.

Data Collected for Contextualisation

The additional information required for the contextualisation of the maps is already held (by the researcher and within the main project archives). Information will be drawn from organisational, documentary and anecdotal materials already used in the literature review and mapping processes. However, most importantly it will utilise information from existing key informant interview transcripts from the primary WHO-AHPSR study. This study will involve secondary analysis of the transcripts, drawing on any relevant information to contextualise and enrich the analysis of the maps and literature.

Table 1: Data sources and types to be collected

	Description	Source	Availability
Qualitative	Peer review and grey literature - Ghana FBNP sector - Ghana health system - FBNPs in Africa - Mapping methodologies	Google Scholar, PubMed, Scopus, Google search	High - Much available through main study but requires narrowing and synthesis - Publicly available - Institutional (UCT) access for peer reviewed journals
	Organisational and archival data - Contracts, meeting notes, annual reports, policies - Historical and current maps showing location of facilities - Facility specific data e.g. establishment dates, changes in ownership, HRH, service type, etc. - Date facilities joined CHAG - Diocese / zone information	CHAG database and archives NCHS database and archives	Medium - Relationship built and information largely obtained through primary study but will require some negotiation around access.
	Anecdotal information on facilities, change over time, ownership, HRH, service type.	Main study – key informant interview transcripts	High - Acquire through main study for secondary data analysis.
Quantitative	Coverage data - GIS maps - Google maps - Historical maps - WHO SAMs/SARAs - Open source Facility data - Address, ownership, establishment date, HRH, service type, etc.	Google search, CERGIS	High - Google maps is publicly available - A number of facilities have information online and websites - CERGIS has a GIS map of health facilities in Ghana, this would provide an excellent starting point but would require cleaning and verifying.
	Organisational health system tracking data - Lists of CHAG facilities - Maps of facilities - Facility data e.g. address, ownership, establishment date, HRH, service type.	CHAG database and archives NCHS database and archives	High - Relationship built and information largely obtained through primary study but will require some negotiation around access.
	Government health system tracking data - GHS database, maps and/or lists of facilities - MOH database, maps and/or lists of facilities	GHS database MOH database	Low - Challenges around changes in staff due to changes in government
	Other data - Area poverty profile - District / province information		
	Access to and utilisation of geospatial mapping software - GIS - Google maps	Google maps, UCT Dept. of Geography	High - Google maps is publicly available - GIS is institutionally (UCT) available

Data Analysis

Data analysis will be an iterative process throughout the study, taking the form of narrative thematic and time-series analysis. However, the overarching and most important design feature of

the analysis process is the continuous amalgamation and *synthesis* of data, occurring iteratively throughout the duration of the study. Drawing on the multiple sources of information, themes and concepts will be refined throughout the duration of the study resulting in the consolidation of findings. Anticipated specific forms of analysis are as follows.

Thematic Analysis

Thematic analysis is the most appropriate method for parts of this study as it enables the organisation and comparison of information acquired through multiple sources [44]. As described, during the scoping literature review, materials will be categorised and subsequently analysed along some key themes; and the transcripts from the main study will undergo secondary analysis. The trends and themes picked up throughout this process will then be analysed and verified against those noticed in the process of creating the geospatial maps. Depending on the availability of time and information, the mapping analysis will potentially compare the spatial footprint of the health system with additional layers of information available such as poverty and disease profiles, districts and diocese, allowing for more specific areas of thematic analysis. During the contextualisation of the maps, perceptions, descriptions of geography and conditions, and anecdotal information on change over time will be further incorporated and analysed. Constant comparative methods will allow the continuous comparison of themes throughout the study period.

Time Series Analysis

As described previously, the geospatial mapping component of the research will take place through a number of stages, commencing with verifying and updating the most recent map of the Ghana health system, followed by building historical maps based on the data available. The analysis of these maps (alongside all other materials) will examine the change over time. This historical ‘time

series analysis' (a term which has a different meaning in other fields) will be used to examine and track factors around service provision such as location, ownership, availability and coverage.

Rigour

Processes to ensure and maintain rigour will be applied throughout the study period. These will include; multiple methods of design and data collection, constant data analysis and synthesis, triangulation (cross verification) of all data and findings, and peer and supervisor debriefing and support [28]. A clear detailed account of all steps taken within the method, analysis and synthesis will be provided to enhance the validity and reliability of the research.

The researchers conducting the primary study from which some data will be drawn have also taken a number of steps to carefully manage rigour. Most importantly for the purposes of this sub-study, key informant interview transcripts have been subject to cross team analysis and member checking (participant validation) of interview transcripts.

Because this study relies on synthesis of multiple forms of secondary materials – a main rigour requirement will be the regular checking and cross-checking of data (triangulation). It is anticipated that some data will contradict each other – and that there will be conflict between different forms of evidence. Each form of data will be scrutinised rigorously, applying the most relevant form of assessment for that type of data – as it is synthesised into the main study. At all times, the researcher will seek to apply the rigour requirements of critical assessment, and be transparent about data quality assessments. Drawing themes and assumptions from the amalgamation of the range of materials to reach substantial conclusions is anticipated to be the most challenging aspect of this research.

Ethical Considerations

Ethical standards will be maintained throughout the research, complying with international, national and institutional requirements. The ethical approval for this study will be obtained from UCT's Human Research Ethics Committee (HREC) for the Faculty of Health Sciences. The ethical risk is considered minimal (low) and will operate under the existing ethical considerations of the primary study, approval for which has been obtained from the WHO Research Ethics Committee, Ghana Health Service Ethical Review Committee and UCT HREC (and also annually updated). In addition, verbal and email verified permission (not a formal requirement) has been obtained from GHS, Ghana Department of Health and CHAG for the focus of this sub-study.

This research draws on secondary interview transcripts from the primary study. As required by the Declaration of Helsinki [45], the participants were briefed on the purpose of the study, what participation entailed and their right to withdraw. Participation was voluntary and individual written informed consent was provided by those taking part. No remuneration was received for participation. The interviews were confidential and were recorded to enable transcription and checking. During transcription, data was anonymised with names replaced by a unique identifier. All data was handled appropriately, stored and backed up on a secure password protective drive and will be destroyed within three years of the end of the study. Any of this secondary data utilised during the sub-study will be handled within the ethical guidelines of the main study.

The fundamental ethical principles of beneficence and non-maleficence, referring to the prevention of harm and maximum benefits from research will be maintained throughout the research. The greatest risk and unintended consequence resulting from this research is the impact on the

relationship between the government and private non-state non-profit (largely FBNP) providers. For example, if the research demonstrates that FBNPs compete rather than complement the public health system, or do not have a pro-poor focus (one of their key comparative advantages) then there is a risk that the government will reassess their financial or contractual relationships with these providers (specifically CHAG, the primary focus of this research). Every effort will be taken to mitigate this risk which is considered low and that the benefit of the research to stakeholders will outweigh the possible harm to the health system. The relationship between the research team (of the main study) and CHAG is strong, and any possible challenges that arise will be negotiated by the PI (who is also the supervisor for this study).

Lastly, it is considered that the use of GIS and making the location of facilities publicly available for the purposes of this study does not pose a substantial risk. Ethical concerns have been raised around unintentionally making public, personal patient data and disease information which is often gathered with the use of GIS in public health research [40]. However, this information will not be collected or shared as part of this study which focuses on the facility level. The main but unlikely risk that is posed by making information on the location, ownership and service type of a facility publicly available, is that they may become easier targets for protest action due to ethos, medical beliefs or religious ideology. However, this is considered an extremely unlikely risk. Furthermore, the majority of the data and information compiled for the study is already in some realm of public domain so is not presenting an additional risk by exposing already available information.

Study Limitations

The main limitation of this study is the necessity to rely on secondary data sources. Due to time, funding and research scope constraints, it is not possible to collect and substantiate data from

every health facility in Ghana. The ability to assess the current state of the health system and verify the coordinates and details of facility locations, required for geospatial mapping, relies on the quality and currency of the data obtainable from alternative sources. It is considered that there are a number of reliable sources from which to obtain this information providing a feasible alternative but this is acknowledged as a limitation.

In addition, the ability to assess change over time and the development of the Ghanaian health system depends on being able to access historical records and archival documents and also on the quality of this information. Initial scoping and research carried out through the primary study suggests that this evidence is available and accessible through a variety of sources. However, it is accepted that the information may be incomplete which will dictate the level of detail and comprehensiveness of the historical review which may limit the study.

The primary intention of this research is to map changes in the health system over time. However, one outcome of this will be to produce an up-to-date map of current facilities in Ghana representing the existing state of the health system. While it does not impact on or negate the usefulness of this map, it is recognised that it may have a time limited value. The inherent nature of dynamic adaptive health systems means that they constantly change and this map would need regular revising and updating to ensure its continuous usefulness.

Dissemination

The results of this research will be submitted as a thesis in fulfilment of the requirements of the Masters of Public Health at UCT. Part of this thesis is a journal article – which will be submitted for publication in a peer reviewed journal in 2017.

The research findings will also be disseminated and utilised by stakeholders in other ways. Firstly, the resulting thesis and anticipated journal article will be shared with the various stakeholders in the project, including CHAG and NCHS. Secondly, the geospatial maps developed during the research highlighting the location of health facilities in Ghana and other pertinent information will be made publicly available and shared with stakeholders.

The researchers conducting the primary WHO-AHPSR study have long standing relationships with the leaders of CHAG and the organisational leaders are aware of and in support of this sub-study. This year (2017) coincides with CHAG's half centenary celebrations, which will involve significant publicity and the need for updated communication and policy materials and evidence of research has been identified. It is anticipated that the maps and accompanying research will be a useful informational, policy engagement and advocacy tool for the organisation, representing CHAG's historical development and their continued relevance and contribution to the Ghanaian national health system.

Project Timeline

Component	Activity	2017							
		Feb	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**
Part A: Protocol	Draft								
	Finalise								
Part B: Literature Review	Draft								
	Finalise								
Part C: Journal Article	Data collection								
	Analysis & mapping								
	Write up findings								
	Intention to submit								
	Finalise								
Submission of thesis									
Dissemination to stakeholders									

Budget

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Part B: Literature Review

Mapping Faith-Based Non-Profit Providers towards Increased Accessibility and the Achievement of Universal Health Coverage in Sub-Saharan Africa: A Scoping Review

Introduction

In many sub-Saharan African (SSA) countries, faith-based non-profit (FBNP) providers[1] have had a longstanding role and still make up a significant proportion of the non-state, non-profit health sector. In recent years, there has been increasing recognition of their role within national health systems [1-3] and their contribution towards the achievement of universal health coverage (UHC), increasing equity and access to quality and essential services. Collaboration between the government public sector and non-state health providers has been encouraged on a national level by global actors and institutions, in recognition of the value of engaging the full spectrum of providers in order to develop strong resilient health systems and achieve public health goals [4-6]. However, information on FBNPs' history, current role, geographical distribution, the services they provide and how much they complement or compete with the public sector is sparse [7, 8]. The empirical research that has been conducted is limited, and often reports conflicting findings [9].

Geographical distribution and physical accessibility to health services is a fundamental issue, and is essential for the achievement of UHC [10, 11]. Addressing these aspects of the provision of services in rural and marginalised areas where government services are often absent is the principle on

[1] The classification of a FBNP is one in which there is terminological discord. In this article, the term FBNP refers to non-state, non-profit health providers who self-identify as being driven by religious values.

which many FBNP organisations and networks were established, and formed the foundation for their engagement and collaboration with the government [12]. Despite their important and historical role in achieving UHC, scarce research has been carried out on the contribution of FBNP providers to this aspect of the provision of UHC and particularly how it has evolved over time [7, 9]. In this section (part B), we will show that little is known about the impact of changing political and social contexts on the overall spatial footprint of the health system and how the initial distribution of colonial mission health work has impacted on the public-private configuration that is present today. Furthermore, in the context of the rapid urbanisation and changing population dynamics across much of SSA, this assumption of this continued focus on the underserved and the contribution of FBNPs to geographic accessibility has been questioned [9].

The requirement to *map* religious health assets in order to understand their geographical distribution, their contribution to the provision of health services and their overall role in national health systems has been identified in a number of studies [7, 8, 13]. From around 2004 such calls became stronger as there was realisation that FBNPs were largely 'invisible' on global health provider maps and hence the requirement for mapping was reinforced [14]. These claims are ongoing, with a recognised need for more empirical evidence [15], reinforced by renewed calls this year from the World Council of Churches (WCC) on the need to develop indicators in order to map Christian health services [16]. There are a variety of methods that could be used in this process; from hard geographic to soft interpretative mapping, with the most widely used being geographic. The increased availability of free or low cost geographic information system (GIS) software, widespread use of smartphones (which can be used to ascertain global positioning system (GPS) coordinates) and the versatility of mapping technology has provided the tools to undertake this. Through the production of visual representations of the health system, maps can increase the

understanding of the infrastructure and location of services and provide insights for system planning and resource distribution [11, 17]. Beyond its use as a research tool, the production of such maps has practical uses within health systems management, for both public and private managers, decision and policy makers [18].

This scoping literature review brings together information on these somewhat disparate bodies of work. Although inherently interconnected, little previous work has drawn together all of the literature to describe how historical and current socio-economic and political contexts, health system infrastructure and accessibility, influence and are influenced by these FBNPs, in a way that actually contributes to achieving UHC (by showing data visually) and incorporating open-source GIS software.

Literature Search Strategy

A desk-based scoping literature review was conducted drawing on Arksey and O'Malley's [19] methodology and incorporating elements of a narrative review method [20]. The purpose of the review was to collate and summarise peer-reviewed and grey literature, thematically organised around the topics of; the historical development and current status of the FBNP sector in SSA, the contribution of FBNPs to UHC (with an emphasis on geographic accessibility) and the mapping of FBNPs in SSA. The review sought to examine the range of literature and identify where it is situated, how the topics intersect or overlap and any research gaps. It was conducted to better understand where information is situated, what research has been done and how and if these concepts are related in the literature.

This scoping review commenced by drawing on a number of databases on FBNPs in SSA. These have been collated by experts in the field (including thesis supervisor) and were used as a platform from which to explore further literature, linking to ongoing research and to avoid repetition of work. It initially drew on a three-volume review, containing 38 articles or chapters in total, examining the role of faith-inspired health providers in SSA, their comparative nature, and efforts to map their reach [21]. Secondly, it drew on articles collated by two systematic review projects, the Collaborative for HIV and AIDS, Religion and Theology (CHART) at the University of KwaZulu Natal collecting literature on religion and HIV/AIDS (materials covering 1985-2017) [22], and the International Religious Health Assets Programme (IRHAP) at the University of Cape Town (UCT) on religion and public health (spanning 1960-2017) [23]. This research is a sub-study situated within a broader project (see Appendix B) for which materials have already been collected and these were also drawn upon, especially for the country specific (Ghana) literature documented in Part C of this research project.

Following this initial review, electronic databases were searched in order to identify additional relevant published studies and to explore mapping techniques. Several electronic databases searched included Google Scholar, PubMed, BioMed Central and Scopus analysing and synthesising a wide range of academic and peer reviewed publications and reports. Search terms included but not limited to multiple combinations of 'faith' (including variations such as FBNP, relig*, FBO, mission), 'map' (including variations such as geography, GIS, geospatial), 'health' (including variations such as facility, hospital). Literature searches were focused on the geographical region of SSA from the last 15 years and only included documents published in English. Through the examination of reference lists of identified articles, a snowballing search approach was utilised to

extend and identify further literature for review. Literature searches were carried out until saturation point was reached (that is, no new studies were being found).

In order to achieve a richer contextual analysis, a search of grey literature was also conducted. A number of key websites such as those maintained by international organisations including the World Health Organisation (WHO) and World Bank were searched, identified as the most relevant to this research on public-private engagement. Smaller organisational websites belonging to government bodies and faith-based organisations such as the Africa Christian Health Associations Platform (ACHAP) and the Christian Health Association of Ghana (CHAG) were also utilised, as well as Google searches.

In total, just 7 studies were found explicitly conducting research on *geospatial* mapping of health-focused FBNPs in SSA, reflecting the paucity of literature on this issue (see Table 2 below).

Defining and Measuring Universal Health Coverage

The focus of this literature review is on FBNPs and their contribution to UHC, specifically geographical accessibility. Prior to examining their role, it is important to elaborate on the notion of UHC and how it is measured. UHC is an all-encompassing concept and is defined by the WHO as "all people receiving the health services they need, including health initiatives designed to promote better health, prevent illness, and to provide treatment, rehabilitation, and palliative care of sufficient quality to be effective while at the same time ensuring that the use of these services does not expose the user to financial hardship" [24, p.7]. It is one of the dominant goals within the current public health agenda as a means to reduce inequities and achieve better outcomes,

solidified by its inclusion in Sustainable Development Goal 3 (SDG 3) [25, 26]. However, its achievement remains an elusive and aspirational target for many countries around the world.

An early framework presented in the 2010 World Health Report [27], represents UHC as consisting of three dimensions; the health services covered, the population coverage and the proportion of costs covered. The aim is for the progressive expansion of services as more resources become available [25, 27]. Since then, the concept of UHC has been expanded, with further emphasis given to quality of services, equity and utilisation according to need. The now predominant conceptualisation of UHC within the SDGs considers it to be composed of two elements: service delivery (every individual obtaining the services that they need); and financial protection (no individual facing financial hardship as a result of paying to seek or receive services) [24, 28-30]. Population coverage is encapsulated within these two elements. However, it is considered that the broad nature of this framing struggles to capture all relevant information on the health system and allows for considerable discrepancies and variation in measuring progress, representing one of the key challenges towards achieving a global consensus on what constitutes the achievement of UHC [31].

Due to its multidimensional imprecise nature, UHC is a challenging concept to measure with its achievement a continuous and changing process [24], depending on a multiplicity of factors. The World Health Report 2013 highlighted that despite the continued global push towards its achievement, that there was a dearth of evidence and lack of agreement on how to measure and monitor progress [32]. Subsequently in 2014, the WHO and World Bank launched a global monitoring framework for UHC framed around service provision and financial coverage [24, 29, 31,

33], seeking to provide some clarity around the uncertainty of measurement, achieve consensus and provide a mechanism for tracking progress and cross-country comparison.

The service delivery component of UHC is particularly challenging to measure due to the broad scope of health services and the necessity to track accessibility, need, quality and utilisation. In the monitoring framework, service provision is divided into 4 categories, three of which are disease focused and just one focusing on service capacity and access [33]. There is no mention of geographical equity or physical access within the framework, so fundamental to reducing inequities and ultimately achieving UHC [27]. We would argue that equitable geographical distribution across all types and levels of service are crucial to the achievement of UHC and a prerequisite to the other indicators (more on geographic accessibility below).

Non-State Non-Profit Health Providers in SSA

Health systems are defined by the World Health Organisation (WHO) as "all organisations, people and actions whose primary intent is to promote, restore or maintain health" [34, p.2] and in most countries they are composed of a complex mix of public and private providers. Private or non-state providers (NSPs) is a heterogeneous group, referring to those providers which work outside the direct control or oversight of the state and include both for-profit (such as private hospitals, practitioners, pharmacies, healers) and non-profit providers (such as non-governmental organisations (NGOs), faith-based providers) [35-37], with the focus of this research on the latter. It should be noted that this distinction between the public and particularly the non-profit, non-state sector is less clear in reality. For example, some NSPs receive state subsidies for services, government employees can be found working within the non-state sector, and NSP facilities can be acting as a district or regional referral facility within the public system [38]. In SSA, non-state non-

profit providers form an integral part of the health landscape existing alongside, or in place of, the public system [39], providing services across all income and population groups.

There has been a tendency for health system strengthening and UHC efforts to mainly focus on the ability and obligation of the public sector to achieve these goals. However, since the 1980s, there has been increasing recognition, that due to the scarcity of resources and the enormous challenges faced, the public sector is unable to achieve this alone and there has been a renewed focus on involving NSPs [6]. This has developed in conjunction with international pressure for intensified collaboration and structured engagement with the private sector towards improved service delivery and public health goals [4, 5, 40]. Although the benefits of public-private partnerships are not unanimously agreed upon, with reduced government responsibility, challenges in monitoring accountability and fragmentation of services having been cited as some downsides of NSP involvement [36, 39] - they *are* involved, and there are a wide variety of ways in which the public and private sector interact and engage [41]. It is also posited that NSPs are particularly prevalent in fragile or conflict states where the public sector is weak [36], emerging during times of crisis - such as in Uganda under Idi Amin [42]. The increased recognition of the role of NSPs has been acknowledged by the WHO, who have called for increased partnerships towards the achievement of UHC and health systems strengthening, articulating a need for further research in this area [6, 43].

FBNPs in SSA

Faith-based non-profit providers are present in almost half of the countries in SSA [44], constituting a significant proportion of the non-state, non-profit health system. The classification of a FBNP is complex and mired in a lack of terminological specificity. A wide variety of different terms are used

in the literature, such as faith-based organisation (FBO), faith-based or inspired health providers, religious-oriented health providers and mission hospital to name a few. These represent the complexity and diversity of the sector [7, 45]. Different types of classification have been used according to level, type or strength of religious affiliation - but FBNPs are usually categorised according to whether they self-identify as religious or faith-oriented [46]. None of these terms or typologies have proved wholly satisfactory. The distinctions between faith-based and secular organisations are often indistinct and changeable and a religious framing is loaded in some contexts. However, for the purposes of this review the term 'FBNP' has been chosen to emphasise the self-identified faith-based dimension as distinct from other non-profit providers, to accentuate the separation from the private for-profit sector, and to distinguish between health service providers and other types of FBO.

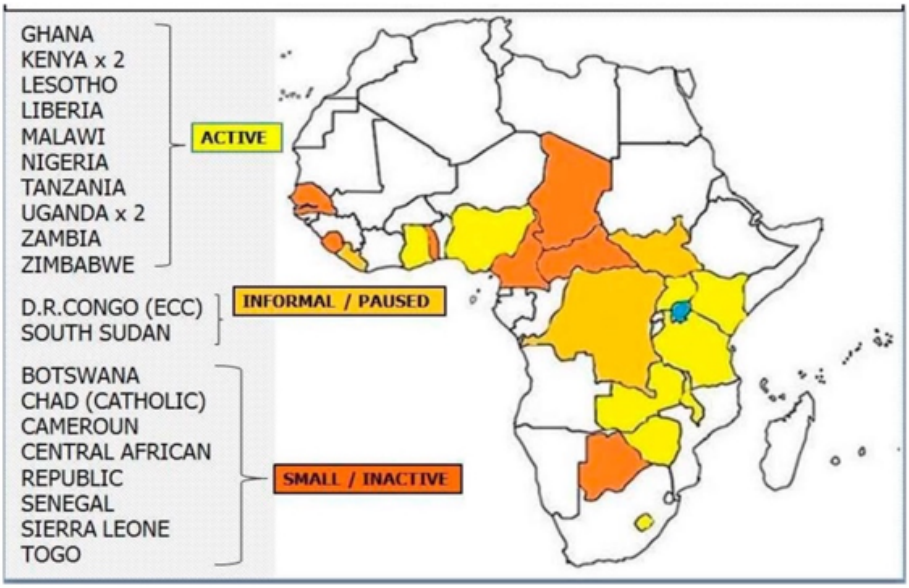
The FBNP 'sector' in SSA includes a multiplicity of religious belief systems as well as types of health providers (adding to the above-mentioned classification confusion). Across SSA, both Christian and Islamic health providers exist alongside secular and traditional systems, with Christianity dominating the FBNP sector in the region. The literature on FBNPs in SSA reflects this, largely documenting and assessing formal Christian and Anglophone activities [1, 14, 47]. Within Christianity alone there are a wide variety of denominational affiliations represented within the provision of health services. These providers take a range of forms, from less visible informal community or congregational initiatives to single non-networked health facilities, to large umbrella coordinating networks and faith-oriented NGOs [9]. The focus of this review is mostly on formal Christian FBNP facilities and coordinating networks as there is a scarcity of literature on other varieties.

Despite specific contextual influences on development and with a hesitation around casting generalisations, Christian FBNPs across SSA have shared elements of historical evolution. Emerging out of the missionary model which developed corridors and carved routes into rural areas creating patterns of settlement and a structure and presence for services to come, termed 'path dependency' [48], FBNPs originally positioned themselves and provided services beyond the colonial population and administrative boundaries [7]. Underlined by religious values and a moral obligation, FBNPs focused on outreach to the poor and underserved, promoting the idea of UHC before it was a priority on the global stage [2, 9, 49, 50]. It is noted that additional motivations and justifications for this work have been posited, including proselytization and acting as agents of or serving colonial powers but a full analysis of these perspectives is beyond the scope of this review. Since then, weathering global and national changes as well as international development and health trends, FBNPs have demonstrated considerable resilience and continue to remain present as part of many national health systems often supplementing and substituting for the public system in time of crisis [3].

Within Africa, many Christian FBNPs operate under Christian Health Associations (CHAs). These are loose networks (coordinating organisations) with a shared religious identity, acting as a coordinated platform for engaging with government, and enabling collaboration and networking amongst members [44]. They also provide technical, management, research and training support to their members [7] and are themselves part of a regional network for cross-country learning, support and policy advocacy – the Africa Christian Health Associations Platform (ACHAP). Evolving from colonial missionary services, the premise of providing services in areas where the government sector was not present or strong, formed the core competency and identity of the CHAs in SSA [9] and provided a reason for forming these associations in the first place (rather than remaining as

unaffiliated individual facilities). It enabled them to remain relevant, sustaining their presence through the period of transition to independence and formed the basis of their relationship with newly established national governments [51].

Figure 1: Christian Health Associations in SSA



Source: Dimmock et al. (2017)

Founded from the 1950s onwards, these CHA networks remain present, influential and integrated within the national system in 23 of the 54 African countries today [44]. Within these 23 countries, current estimates of FBNPs contribution to national health services are said to range from 5-50% [1, 7, 52]. These reports are somewhat problematic, with questions raised around conflicting reports, unreliable data sources, self-reports and clear challenges around the elements used to measure contribution, for example number of facilities versus number of beds versus number of health workers [9, 53]. (CHAG report that they provide 35-40% of national patient care with 5.5% of the infrastructure [54], but in most other countries the basis of the estimates are not reported). This is in addition to the considerable challenge of separating out the contribution of FBNPs when they are integrated into national systems [1]. A systemic review across low- and middle-income countries (LMICs) found that estimates were lower than previously thought [55], while Olivier and Wodon [56] found that historical estimates (based on little or unsubstantiated evidence) had become engrained over time, highlighting a clear need for more contextualised research to substantiate the figures.

FBNPs Contribution to UHC

We noted earlier that the concept of UHC is composed of financial coverage and service provision for the entire population, emphasising the notion of universality but at the same time acknowledging the need for a concerted effort on the poor and marginalised. Geographical accessibility plays a central role in achieving these goals and closely aligns with the core ethos behind FBNPs. The role of FBNPs [1, 2], their contribution towards the achievement of UHC, and their particular value in weak and under-resourced health systems [3] is increasingly being recognised. However, the form that this role has taken (and therefore their perceived contribution to UHC), has changed over time. Having historically marketed themselves as filling gaps in government services in rural areas, the issue of geographic access and coverage was crucial to their ability to leverage resources and a driver of state engagement. However now, with changing social, political, economic, population and epidemiological changes, increasing urbanisation in previously rural areas and an expanding urban poor across SSA, their contribution to UHC is being questioned [9]. Beyond the aforementioned disputes around market share, FBNPs (and the umbrellas of CHAs) need to reposition themselves, or more importantly explicitly highlight their 'comparative advantage' and contributions to both national health issues and the overarching global health trend of the achievement of UHC if they are to remain viable [3, 7, 9]. Despite a perceived comparative advantage being considered to be fundamental to their sustained existence, there are considerable gaps in the literature regarding this and existing evidence is somewhat contradictory and fragmented [8, 9][2].

[2] In considering and discussing FBNPs, it is important to note the issue of generalisability. Although there are clear similarities, it is recognised that significant variation does exist between countries in terms of national context, history and relationship with the government sector [50]. There are also variations within the development of different

The following section considers the literature that does exist on the contribution of FBNPs towards the achievement of UHC. This is examined through the previously mentioned two core elements of UHC – financial coverage and service provision.

Financing

Although not the primary focus of this research, it is difficult to consider UHC without some mention of financing, financial coverage and equity. This is crucial to the achievement of UHC and mechanisms towards achieving it are widely discussed, with an entire World Health Report (2010) dedicated to the issue [27]. Essential to the ability of FBNPs to reach the poor, depends on the cost of the health service to the user and these charges are inherently related to their sources of funding. This has changed over time, with decreasing forms of traditional religious funding and challenges in diversifying and leveraging alternative resources from governments and international donors [1, 7]. This challenge around leveraging funding further relates to the ability of FBNPs to demonstrate market share or as posited here, specific value-add towards the achievement of UHC, requiring them to show that they are complementary to and filling gaps in government service delivery [8].

The success of the negotiations between FBNPs or CHAs and their government are highly variable across countries. For example, there are several examples of FBNPs leveraging financial government support through integration in national health insurance schemes (NHIS) (such as

Christian denominations from the older missionaries to the more modern movements across the region. As highlighted by the literature, more nuanced country and religion and denomination affiliated focused research is required.

CHAG in Ghana) or forming service level agreements for the provision of certain services (such as the Christian Health Association of Malawi, CHAM) [57]. However, it is worth noting that there are also clear disadvantages of being integrated into government systems. This can result in becoming subject to some of the same issues that plague public providers, such as delays in financial reimbursement or lack of efficiency [54, 58], which can remove some of their unique comparative value in areas such as efficiency and quality.

As a result of these operational challenges, most FBNPs in SSA maintain some level of user fee charge (although research on this issue is difficult with limited access to financial information [9]). User fee charges can contradict the original ethos of FBNPs to serve the poor, with cost cited as a significant reason for not seeking or utilising health services [27]. Although user fees do clearly need to remain accessible if FBNPs are to maintain the premise on which they were founded (this is a noted generalisation based on literature analysis), it is recognised that in constrained circumstances FBNPs also require funds to operate and provide quality services. Some facilities and organisations claim that they exempt certain categories of users from fees or cross-subsidise services through a 'paupers fund' or 'Robin Hood pricing' but the literature does not show this to be widely or systematically implemented and research on the issue is scarce [8, 59, 60].

The issue of financing is a sensitive one and dominant in discussions surrounding UHC. If FBNPs want to make a claim of outreach to the poor then there is a need for them to provide evidence and release data in order to substantiate these claims. One study, examining FBNP's service reach found that, in contrast to assertions, outreach to the poor is slightly less than to other population groups and that they do not service the poor any more than public providers do [12] but further investigation must be done.

Service Provision

As previously mentioned, service provision relates to not only the physical location of the facility but also to the distribution of high quality and effective service levels as well as to the type of service, health worker, equipment and supplies. Staffing is critical to the achievement of UHC and in a number of SSA countries, FBNPs have had a longstanding role in contributing towards addressing this issue, training and capacitating human resources. In some cases, these processes have become formalised, resulting in partnership with the government [61] thereby increasing numbers within the system and contributing to UHC in that way. For example in Uganda, faith-based hospitals were found to train 60% of national nursing cadres [7]. However, the issue of staffing relates not only to number but also the equitable distribution of all cadres. Challenges around the distribution and retention of health workers in remote areas is a global issue [62, 63]. There is conflicting evidence on the success of recruiting and retaining a health workforce within FBNP facilities. Some suggest that FBNP networks and religious commitment increase the intrinsic motivation and retention of staff [3, 64] while others posit that CHAs struggle to compete in terms of salaries, that workers move to the public sector due to financial incentives and that the perceived rural catchment areas of FBNPs are an employment disincentive [44, 51, 65, 66]. This highlights the benefits of parity between the sectors (which has occurred in some countries such as Ghana) and for coordination in order to address the issue and achieve UHC [67].

It is also worth noting that the previously mentioned global framework for monitoring UHC [31, 33] uses physician numbers as a UHC indicator, currently not counting other cadres such as nurses or community health workers. These other cadres are arguably more important for achieving UHC, especially given the emphasis on primary health care (PHC) within the global health agenda. This

means that by using these frameworks, the contribution of FBNPs may not be measured (especially given that they often have a high proportion of highly skilled non-physician cadres [54]).

The level of facility, type of service provided and availability of essential services and supplies all impact on the provision of quality health care. FBNPs in SSA tend to provide a full range of medical services across primary and secondary care [7], ranging from informal community care to large specialist and teaching hospitals. FBNPs have traditionally been considered strong in their involvement in PHC, due to close community and congregational links [9] – although in terms of service profile in SSA they have focused mainly on formal hospital-based care [7]. As became evident in assessing the provision of HIV/AIDS services, it is widely noted that the less formal contribution of faith-based entities including FBNPs (through linked congregations and community initiatives) are poorly estimated [1, 8, 68]. These 'intangible' services also need to be mapped [68] especially in light of the expansion of government PHC services in many countries which may result in duplications.

Quality of services is frequently not captured in the measurement of UHC and is excluded from the global framework [33] but is a crucial aspect [9]. A number of studies have examined comparative quality of FBNP services in SSA with just a few discussed here. The measurement of quality is challenging but can be divided into technical and perceived quality. *Technical* quality (relating to clinical or health outcomes) is a more robust, measure but evidence amongst FBNPs is sparse and variable with just a few studies examining it in relation to maternal care. Vogel et al. [52] compared obstetric care in Uganda, Kenya and Democratic Republic of Congo (DRC) and found that FBNP and government facility's had comparable levels of care (although it should be noted that FBNPs were grouped with other NGOs). In contrast, two other literature reviews found that maternal services

amongst FBNPs were of a higher quality [69] than government due to more resources, flexibility in staffing, funding and training and medicines [70]. These studies reflect some of the inconclusive findings in the literature on the contribution of FBNPs towards the quality aspect of UHC.

Related to issues of technical quality and health outcomes are some of the concerns around engagement with faith-oriented providers. Hesitancies are frequently framed around and controversies stem from issues such as family planning [1, 71]. Some FBNP providers do not support the promotion of 'modern' family planning methods which are considered the most effective in conventional biomedicine, although there is considerable variation in approaches within the Christian (and other faith) denominations [72]. There is not space to explore this issue in detail within this review but it is important to note that it can potentially impact on issues of quality in relation to UHC, given that reproductive care and access to a modern family planning method is one of the key tracer indicators within the UHC measurement framework [33].

The majority of research on FBNPs in SSA has focused on *perceived* quality. This can be assessed through levels of satisfaction with anecdotal and empirical evidence suggesting that satisfaction is generally found to be higher amongst FBNPs than public providers [59, 73]. More commonly, perceived quality is explored through user assessments, which although they have limitations, are important as they link to another aspect of UHC - utilisation. A perceived higher level of quality has been highlighted as one of the reasons patients choose to go to FBNPs over other providers [9]. Others have posited that it is this perceived level of quality in relation to cost that is the key driver of utilisation, with users in Burkina Faso stating that this perception of value-for-money influenced their choice [74]. In Ghana perceived quality of care was a bigger factor in deciding to use FBNP providers than religion [75], and users in South Africa emphasised the quality of care, staff-patient

relationship and patient centred care as most important [76]. Linking to the previous argument, this perception of quality has been attributed to the religious commitment of the health workers with reports that the care provided is more compassionate [7]. The literature on the issue of perceived quality link in to considerations of utilisation, both important aspects in the achievement of UHC. However, the literature is also inconclusive, highlighting the need for further research on the contribution of FBNPs.

Discussions on quality and staffing are further linked to those on governance and efficiency amongst FBNPs. Questions have been raised around FBNP's lack of leadership and other technical skills such as those required to manage facilities, raise funds or document work [77], which in turn links to issues of accountability and transparency [3]. Although FBNPs have different structures of governance to the public and for-profit sectors, we suggest that evidence of such challenges can be found across all public and private providers.

Geographic Accessibility

Geographical accessibility is a core foundation of an effective resilient health system, is the first step and is essential to the operationalisation and achievement of UHC [10, 11, 78], preceding all measures of range, quality and utilisation of services. As highlighted, physical distribution of services is of particular pertinence to FBNPs. Provision of services to the underserved in rural areas, providing services where the government has not and filling gaps to redress inequities, is central to discussions around their contribution to UHC. Geographical accessibility, already existing and having a presence in areas not served by government is one of the reasons often cited to engage with NSPs [4].

In relation to FBNPs, this argument is generally accepted as true, historically (although not necessarily demonstrated by evidence), and this premise was the foundation of the CHAs' collaborative relationships with their national governments. Today, it has been suggested that this focus is shifting in the context of ongoing urbanisation and the increased reach and focus of government services towards the marginalised [9, 54]. However, beyond the anecdotal, there is little substantial evidence showing this change or the current urban-rural, rich-poor, geographical distribution of FBNPs. As will be discussed in the next section, much work on geographic accessibility and the physical location of services has not focused on FBNPs specifically but rather on the health system as a whole with FBNPs either not counted (as operating outside government activities [1]), or grouped invisibly within other private provider data. As no comprehensive database exists, and due to the scarcity of literature on the issue, there have been numerous calls for the mapping of religious entities [7, 8, 13]. Some of the results of these calls can be seen in Table 1.

Despite a gradual increase in research, this review highlights that FBNPs' contribution to UHC is under-researched, and there is a lack of substantive evidence with no definitive answers and often conflicting findings raising more questions. Despite being fundamental to both the achievement of UHC and the historical focus of FBNPs, research on geographic accessibility is particularly lacking. This is perhaps reflective of the highlighted data challenges in LMIC contexts as well as technical capacity within FBNPs (particularly umbrella CHAs) to collect data from their individual facilities, as well as changes in affiliation, particularly with the use of paper-based systems.

Table 1: Selection of studies on FBNPs and service provision aspect of UHC in SSA

Aspect of Service Provision	References	Details – Type of Mapping
Geographic Accessibility / Distribution	Coulombe & Wodon, 2012	GIS mapping of the geographic location of CHAG facilities (Ghana) - against district poverty levels and distribution of Catholics.
	Olivier et al., 2012b	Assessment of whether faith-inspired institutions reach the poor more than other providers – based on household surveys.
	De Gruchy et al., 2006 / Olivier et al., 2012a	GIS and descriptive participatory mapping used to map faith-based facility and community health assets in Zambia and Lesotho - first time WHO engaged on FBNPs in Africa.
	Blevins et al., 2012	Community health asset mapping in Mukuru settlement, Kenya - combining participatory and GIS mapping.
Services	Olivier & Wodon, 2012b	Estimation of market share of FBNPs in SSA - using facility and household survey data.
	Olivier et al., 2014	Assessment of market share, reach to the poor and quality of performance of faith-inspired providers in Ghana - using administrative, household survey and qualitative data.
	Blevins & Griswold, 2014	Overview of contribution of faith-based providers to the provision of HIV services in Kenya.
	Blevins et al., 2017	Assessment of the percentage of HIV services provided by faith-based providers in Kenya.
	Olivier et al., 2015	Review published literature and empirical evidence on role of FBNPs in SSA – focusing on magnitude, reach, cost, satisfaction.
	Schmid et al., 2008	Review and case studies examining FBNPs contribution to health services in SSA – coverage, role, activities, capacity, satisfaction, human resources.
Human Resources	Tabatabai et al., 2013	Assessment of internal health worker migration between public and faith-based providers.
	Todd et al., 2009	Mapping the geographic distribution of personnel (nurses and midwives) to support antenatal care in FBOs in Tanzania to develop a HR-GIS database.
	Dieleman & Hilhorst, 2009] / Dieleman, Hilhorst & Utrera, 2012	Case studies of approaches to address HRH crises among FBOs. Lessons from analysis of these practices.
Quality	Vogel et al., 2012	Review of obstetric care capacity of NGOs, FBOs and government institutions in Uganda, Kenya and DRC.
	Gill & Carlough, 2008	Review of literature on maternity care provided by FBOs and in mission hospitals.
	Gemignani et al., 2012 / Gemignani et al., 2014	Assessment of why individuals choose to seek care in faith-inspired facilities in Burkina Faso.
	Widmer et al., 2011	Systematic review assessing FBOs role in maternal and newborn health care in SSA – services, quality and satisfaction.
	Olivier et al., 2012c	Review of satisfaction with services provided by faith-inspired providers in SSA.
	Shojo et al., 2012	Assessment of patient satisfaction with faith-inspired services in Ghana and reasons for choosing them.

Mapping FBNPs

Geographic accessibility can be researched and assessed through the process of 'mapping'. In the broader context of public health this is considered important as it can provide insights into equity,

access, service provision, need and utilisation and can be used for effective evidence-based planning, resource prioritisation and overall health systems management [11, 17, 18]. There have been repeated calls for the mapping of FBNPs over the last decade – a call which was renewed this year by the World Council of Churches (WCC) calling for a new mapping study of Christian health services [16]. Mapping can provide a basis for showing the scope of FBNP work and demonstrating relevance through empirical quantitative research [15]. Mapping can serve to separate FBNPs out from other public and private providers, allowing for deliberate engagement with partners [47] and literally 'putting them on the map' [13, 14]. Mapping has strategic uses at both a national health system and a network CHA level (or other faith coordinating bodies such as the National Catholic Health Service desks). Maps can be used to visually present information which can then be used to assess spatial gaps or duplications in services and for enhanced coordination within CHA networks and with government [8].

The term mapping refers to "both the process and result of making [health assets] visible" [68, p.26]. It covers a range of methods from hard geographic or geospatial mapping, to evidence and literature reviews, to 'soft' interpretative participatory mapping [14, 79]. One of the most widely used methods is the production and analysis of geospatial maps using GIS software and GPS data points, a methodology originating in the geographic and environmental sciences. Geospatial mapping is increasingly being used by specialists and laymen alike, and offers great potential in public health to provide visual representations of the spatial organisation of the health system and distribution of services [87], providing insights into complex data sets or public health problems to researchers and policy makers in ways that traditional data formats cannot [88]. Multiple data layers provide opportunities for more advanced analysis and contextualisation of information.

Despite its widespread potential in health systems planning and management, there remains a bias in the public health literature towards disease specific mapping [89, 90].

Geospatial mapping methodology has been widely used in high-income countries where geolocations and address information is widely and publicly available - but is generally under-utilised in resource-poor environments [17, 91, 92]. The increased availability and versatility of open-source GIS software, reduced cost of GPS devices and widespread use of smartphones (which can be used to identify GPS coordinates) has made this more feasible. However, impediments to this methodology in low-resource settings have been noted, including poor data access and quality (unavailable, outdated, incomplete or unreliable address information), lack of technical capacity and the necessity to rely on hardware and the internet to utilise the GIS software. Furthermore, the output of such studies is often too sophisticated and not practical for operationalisation in resource-constrained, digitally underdeveloped and data poor contexts [93, 94].

Much of the work on mapping health systems in LMICs has been carried out by international organisations or national governments. One of the most prominent of these has been WHO's Service Availability Mapping (SAM) which in 2009 was replaced by the Service Availability and Readiness Assessment (SARA) [10, 95]. These collect information on the physical location of health services as well as details such as number of health workers, utilisation and availability of medicines, designed to monitor and plan health services and produce reliable data for increased accountability and cross-country comparison. They also track key indicators such as family planning, HIV services and child health to assess service readiness. One of the most useful aspects of the SAM/SARA approach is that they contribute towards a country master facility list, which aims to capture all public and private facilities and their GPS location, filling important data gaps and which

can be used for further research (although in reality often only capture information for select districts). However, a disadvantage is that these studies are conducted infrequently so the data is soon out of date. Furthermore, as is frequently noted with other data sets and research, FBNPs were *not* specifically cited and commonly grouped with other public or private providers, a limitation acknowledged by the WHO in 2010 with faith categories now included [13, 14].

A handful of geographical mapping studies have been carried out in SSA focusing predominately on FBNPs (see Table 2). These are usually formulated from a variety of data sets including those gathered by the WHO, national governments and from research-related data collection exercises. They are usually useful for examining a particular geographical area or aspect of service delivery in depth (such as human resources in Tanzania [67] or HIV service provision [96] in Kenya) but tend to be disparate and based on limited data. They do not provide enough information for an assessment of FBNPs contribution towards UHC or to the overall health system. Furthermore, most of these mapping studies have tended to focus on one snapshot of time, not examining the development of the health system of the evolution of public-private provider relationships. Lastly, the data gathered or used in these studies is often not made accessible or open-source and therefore cannot be utilised or updated by FBNPs themselves.

Table 2: Examples of geospatial mapping of FBNPs in SSA

Type of mapping	Reference	Country	What is mapped	Details
Geospatial (GIS) mapping	Coulombe & Wodon, 2012	Ghana	CHAG facilities	Mapped the location of CHAG facilities against district poverty levels and the distribution of Catholics – using mainly household survey data. Found that facility locations correlated more closely with the proportion of Catholics in the population than poverty levels. On a national level, relationship between poverty and distribution of CHAG facilities is weak (based on beds) as they do not have facilities in many poor districts.
	Todd et al., 2009	Tanzania	FBO human resources	Mapped the geographical distribution of FBO facilities and their human resources supporting antenatal care (nurses and midwives) in one district. This was in order to develop a human resource GIS database for national planning and the relationship between faith-based and public sectors.
	Interfaith Health Program	Kenya	Faith-based facilities and HIV/AIDS services	Created online interactive geospatial (Google) maps showing the location of faith-based facilities providing HIV/AIDS services – broken down on a county level. Facilities were identified using the Kenya Master Facility List (government database), so largely formal registered facilities identified) and detailed information on services from the Kenya Health Information System.
	WHO SAMS (2004-2010) / SARA (2010 – Present) Reports	Multiple	All facilities	GIS mapping of all public and private facilities combined with health services information such as number of health workers, availability of medicines and utilisation, for planning purposes and cross-country comparison. Aligns with global UHC and SDG indicators. Since 2010, faith providers should now be included and as their own category.
	Noor et al., 2009	Kenya	All facilities	Developed maps to show disparity in geographic access amongst public facilities. Mentioned faith-based facilities in the facility database used but when the geospatial maps were developed did not separate out facility or other non-profit (NGO) providers from the public sector.
Participatory mapping plus geospatial (GIS)	De Gruchy et al., 2006 / Olivier et al., 2012a	Zambia, Lesotho	FBNP HIV/AIDS services	Used GIS combined with descriptive participatory mapping to map formal, informal / community and 'intangible' faith-based health assets. Participatory mapping including community perceptions of the assets. to map faith-based facility and community health assets. It reflected the importance of community faith entities in the response to HIV/AIDS. This was the first time WHO engaged on FBNPs in Africa.
	Blevins et al., 2012	Kenya	Community health assets	Used mixed methods (community based participatory research with GIS mapping) to conduct community health asset mapping in Mukuru informal settlement, Nairobi and how to mobilise them for HIV prevention.

Table 2 highlights that the mapping studies that have been carried out on FBNPs in SSA, tend to focus on a limited number of countries and exclude many with large FBNP sectors. This includes

those in fragile or conflict states which are considered important as NSPs are often particularly strong and prevalent in these contexts [36]. This lack of information became evident during the recent Ebola epidemic in West Africa where serious knowledge gaps on the location, role and capabilities of the full range of actors, including local and national FBNPs were highlighted, resulting in significant delays in effective collaboration and mobilisation of networks [98, 99]. Furthermore, as with the FBNP literature more generally, there is a bias towards formal Christian and Anglophone FBNPs and countries [14].

Beyond hard geographic mapping, other forms of soft interpretative mapping have been used to gather information on FBNPs [79]. This ranges from evidence mapping [100], literature landscaping or scoping, to participatory mapping [14]. One significant study combined participatory mapping (assessing informal faith-based local or community assets and perceptions of them) with GIS mapping to locate both formal and informal religious health assets involved in HIV/AIDS care and treatment services in Lesotho and Zambia [68, 80]. This form of mapping provides an opportunity to contextualise maps and document relationships, focusing on informal FBNPs which are often excluded from geographic maps. The form of mapping chosen is impacted by the objective of the research.

Conclusion

This review sought to bring together literature on the role of FBNPs in SSA health systems and their contribution towards the achievement of UHC, focusing particularly on the aspect of geographic accessibility. It is clear that FBNPs have had a long-standing and substantial role in the provision of health services and are significant amongst non-state, non-profit health providers in the region. Many work in collaboration with national governments (usually coordinated through CHAs),

supplementing services and are increasingly being recognised as important partners on the global stage. However, it is also apparent that many aspects of their historical and current influence, impact and reach are still unknown.

As recognition of their role has increased, statements have been made and repeated about the contribution of FBNPs, particularly around geographic position and market share. However, this review reiterates previous findings that these claims are largely unsubstantiated and are not supported by a sufficient body of empirical evidence. While limited, some research has examined their particular strengths or perceived comparative advantages, around issues such as quality and staffing, but the results are not always clear with contrasting and conflicting findings. These challenges are perhaps compounded by the continued lack of clarity and imperfect measures for assessing progress towards the achievement of the multidimensional concept of UHC, adding to the difficulties in assessing FBNPs contribution towards it.

In order to try and substantiate and quantify the position of FBNPs there have been repeated calls for specific 'mapping' of FBNP health assets over the last 10 years. This is in recognition of them not being included in many global or national registers, either excluded entirely or grouped with other types of provider. This is a feature that also occurs in the research on aspects of UHC with FBNPs frequently assessed alongside the public sector or other non-state, non-profit providers, resulting in unclear and indistinct findings, resulting in difficulty evaluating contribution. Mapping can entail scoping the literature, interpretative participatory mapping and hard geospatial mapping, with the focus of this review and research on the latter. This review demonstrates that despite these repeated calls, limited mapping work has been done specifically on FBNPs, and that which has been

done, are focused on a limited number of largely Anglophone countries and on mostly Christian providers, focused on particular aspects of health service delivery and at specific moments in time.

Geospatial mapping has great potential for health systems planning and management, both at a national as well as on an organisational scale but has not been strongly utilised for this purpose in SSA generally or amongst FBNPs. Despite being fundamental to their engagement with national and international partners, very little is known about the spatial distribution of FBNPs and how this has been shaped by the changing social, political and economic context around them and their relationships with the public sector. There is increasing recognition that their footprint has changed over time but no research shows this visually – and geospatial mapping is an appropriate methodology to do this.

It is apparent that there are significant gaps in the literature around all aspects of FBNPs, with a need for more nuanced, focused and empirical research. Given the historical importance of geography to FBNPs and the critical importance of physical accessibility in the achievement of UHC, this is an important area to focus on. Utilising GIS technology, and conducting a spatial-temporal analysis of FBNPs development in one country would provide insights into their historical contextual development and assess whether currently held perceptions of their contribution hold true.

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Part C: Journal Article

Intended Journal: *International Journal for Equity in Health*

Towards Universal Health Coverage: Mapping the Development of the Faith-Based Non-Profit Sector in the Ghanaian Health System

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Abstract

Background: Faith-based non-profit (FBNP) providers have had a long-standing role as non-state, non-profit providers in Ghana. They have historically been considered to be important in addressing the inequitable geographical distribution of health services and towards the achievement of universal health coverage (UHC), but in changing contexts, this contribution is being questioned. In response, there have been repeated calls for 'mapping' of such faith-based health assets.

Methods: A historically-focused mixed-methods study was conducted, collecting qualitative and quantitative data and combining geospatial mapping with varied documentary resources (secondary and primary, current and archival). Geospatial maps were developed, providing a visual representation of changes in the spatial footprint of the Ghanaian FBNP health sector.

Results: The geospatial maps show that FBNPs were originally located in rural remote areas of the country but that this service footprint has evolved over time, in line with changing social, political and economic contexts.

[1] Instructions for authors are in Appendix E. Authors' contribution and information are excluded. For the purpose of this thesis, the student is the sole and first author of the work.

Conclusion: FBNPs have had a long-standing role in the provision of health services and remain a valuable asset within national health systems in Ghana and sub-Saharan Africa more broadly. Collaboration between the public sector and such non-state providers, drawing on the comparative strengths and resources of FBNPs and focusing on whole system strengthening, is essential for the achievement of UHC.

Keywords: *faith-based providers, Ghana, universal health coverage, GIS, map, public-private partnership, non-state providers, health system, history*

Background

Health systems are defined by the World Health Organisation (WHO) as "all organisations, people and actions whose primary intent is to promote, restore or maintain health" [1, p.2]. Present-day systems are the result of decades of change having been strongly shaped by historical social, political and economic events [2]. As inherently social institutions, people are the central component with changing relationships and power dynamics between the various actors (both within and outside the system) also strongly influencing their composition [3]. A historical lens provides the opportunity to examine why a health system has evolved to its current state, what factors have been important in change [4], how to predict and prevent similar (unintended) consequences in the future and what this might mean for better understanding the complex adaptations of the current system. Some of these system changes are reflected in and can be traced through the physical representation and geographic distribution of the health infrastructure.

In many low- and middle-income countries (LMICs), the continued inequitable geographical distribution of the health system is a significant hindrance to the achievement of universal health

coverage (UHC) and the goal of quality accessible services to all [5]. The concept of access is multifaceted but physical location is fundamental, influencing aspects of utilisation and quality and is frequently referred to as a significant barrier to seeking and utilising services [6-8].

In order to address these ongoing public health challenges, there has been increasing global recognition of the necessity and value of leveraging private or non-state providers (NSPs)[2] that already constitute part of the national health system [9-11]. In many sub-Saharan African (SSA) countries, significant amongst these NSPs are faith-based non-profit (FBNP) providers[3] who have had a longstanding role in service delivery and the achievement of public health goals. The form they take and relationship they have with the government varies [12] and has changed over time but many are closely affiliated with or an integral part of the national health system. In many cases, the foundation of this relationship was on the basis of the FBNPs providing services to the poor and marginalised and reaching where the government did not [13], with their focus being on addressing the issue of geographic access and the provision of health services for all, even before the concept of UHC was popularised [14, 15].

Despite the longstanding role of FBNP providers, their relationship with the government and their integration into the national health system, there is a distinct lack of robust evidence on their contribution, their historical development, relationship with the public sector, contribution to UHC and strengthening of overall systems [16, 17]. The research that has been conducted to test the validity of the suppositions around impact, has highlighted missing information gaps and resulted in

[2] NSPs are those that operate outside the direct control or oversight of the government and include both for- and non-profit providers.

[3] The classification of a FBNP is one in which there is terminological discord. In this article, the term FBNP refers to non-state, non-profit health providers who self-identify as being driven by religious values.

further unanswered questions [16, 18], particularly in the context of increased urbanisation and changing population dynamics occurring across SSA.

In relation to FBNPs working towards UHC, a lack of empirical evidence – in particular on their geographical presence - has led to repeated calls for the 'mapping' of religious health assets [17, 18]. Frequently excluded from provider registers, it has been argued that mapping is required to understand their contribution and to 'put them on the map' [19, 20], to increase the empirical evidence base [21], and enable strategic engagement with partners [22]. These calls for mapping continue, with the most recent coming from the World Council of Churches (WCC), which in late 2017 called for an international programme to map Christian health services [23].

In this article we report on a study which mapped FBNPs in Ghana, utilising geospatial mapping technology to explore FBNPs contribution to UHC over time, focusing on geographic access.

Country Context: The Ghanaian Health System

The Ghanaian health system architecture reflects historical changes within the country and provides important contextual background to this research. Since achieving independence from colonial Britain in 1957, Ghana has experienced significant political, economic and social upheaval. The population has increased from 6.7 million in 1960 to 24.7 million in 2010, with a rapid increase in urbanisation [24, 25]. Since 2005, economic growth has averaged over 7% a year, with middle income status achieved in 2010 [26]. Although this rapid growth and urban transition has been accompanied by poverty reduction and improved infrastructure, it has also been accompanied by an increase in inequality [26]. Significant discrepancies in wealth are evident between the largely rural North and the urban South, which are also differentiated along religious, cultural and

topographical lines. These transitions have inevitably been accompanied by significant changes in the health outcomes of the population and an epidemiological transition towards a double burden of disease, with the rise in the incidence of non-communicables, alongside existing infectious diseases, resulting in complex public health challenges [24, 27, 28].

The period preceding the achievement of political and economic stability (1957-1992) was characterised by frequent political regime change and instability, impacting on the functioning and composition of the entire public sector. Despite subsequent political changes, the current structure of the public health system (which itself has its origins in the colonial health system) is largely reflective of the changes that were made following the democratic elections of 1992 [29]. The Ministry of Health (MOH) has strategic oversight and financial responsibility for policy development. The Ghana Health Service (GHS), created in 1996, acts as an (semi) autonomous agency under the MOH, responsible for policy implementation and as the main provider of health services. The public sector is supplemented by a substantial proportion of NSPs (private for-profits and private not-for-profits). Despite the progress and development within the country, the health system has been described as inefficient and inequitable, with ongoing financing and human resource crises [24, 27, 30-32].

Figure 1: Summary of Ghanaian historical context and key health system events

Alignment to Figure 5	**Year / Timeline**	**Socio-Political Context**	**Key Health System Events** (as related to FBNPs)
Up to 1949	Up to 1844	Pre-colonial era	Little medical missionary work.
	1844	Bond of 1844: Traditional chiefs sign Bond allowing British Government to rule.	
	1844-1914	- Period of strong British colonial administration. - Colonial structure: Gold Coast colony, Ashanti (interior), Northern Territories Protectorate	- Colonial health system and infrastructure established serving largely European populations in coastal (colonial) areas. - Significant increase in Christian missionary activities especially into the interior but largely focused on education and evangelism.

	1914-1945	World War I, Great Depression and World War II	
1950-1969	1952	Kwame Nkrumah becomes Prime Minister but shares power with British governor.	- Maude Commission: Recommends support of the mission health sector. - Throughout the 1950s, significant growth in mission hospitals.
	1956		Agreement around 'agency' hospitals – those run by missions but supported by government.
	1957	**Independence: Gold Coast becomes the independent state of Ghana**	
	1960	- Nkrumah becomes President (1960-1966) - Period following independence characterised by massive political and economic instability.	Nkrumah government has a strong focus on social development and welfare state.
	1962		Maude Commission into policy.
	1967		**CHAG established**
1970-1989	1975	Continued considerable economic and political instability.	Adibo Commission: Confirms importance of mission hospitals and recommends government pays salaries in CHAG facilities.
	1978		PHC strategy formed (influenced by Alma Ata).
	1981	Jerry Rawlings takes power through a military coup.	
	1985		User fees reintroduced
	1987-1989	Period of structural adjustment	
1990-2009	1992	- Democratic constitution passed. - Rawlings wins election with National Democratic Congress (NDC) party	
	1996	NDC/Rawlings re-elected (presidency 1981-2001)	GHS established
	1999		CHPS launched
	2000	John Kufour of the New Patriotic Party (NPP) wins election (presidency 2001-2009)	
	2003		**CHAG-MOH MOU signed**
	2004		- NHIS introduced - CHAG received immediate NHIS accreditation.
	2005		National roll-out of CHPS
	2006		Addendum to CHAG-MOH MOU
	2008	John Atta Mills of NDC wins election (presidency 2009-2012)	
2010 onwards	2010	Ghana classified as a middle income country	
	2011	John Mahama of NDC wins election (presidency 2012-2016)	
	2016	Nana Afuko-Addo of NPP wins election (presidency 2017-present)	

Source: author. This table provides a brief context of the political, social and economic history of Ghana as well as significant events in the development of the public-private health system. A detailed history and analysis of the development of the national health system is reported in a forthcoming article by Olivier and Kwamie.

Towards UHC

The global movement towards the achievement of UHC has been sporadic and uneven but has been on the national Ghanaian health radar and political agenda even prior to it gaining

prominence on the global stage, and is a key driver of health policy and strategy within Ghana [32]. Driven by socialist ideals, the provision of free health services to all was a high priority of the post-independence Nkrumah government and their aspirational welfare state [29, 33]. However, this aspiration and attainability was lost in the following period of political instability and economic decline (1966–1981). The incoming Rawlings government, faced with this domestic challenge and both influenced and handicapped by the global policy of structural adjustment and 'rolling back the state', reduced spending on health and in 1985 re-introduced user fees ('cash and carry'), negatively impacting on access to and utilisation of services and the health of the population [29, 34].[4] However, since the achievement of stability with the democratic elections in 1992 and the subsequent afore mentioned restructuring of the health system, two concerted and complementary efforts have been made towards achieving UHC and specifically increasing access to healthcare [31].

To address the issue of financial coverage, the government introduced the National Health Insurance Scheme (NHIS) in 2004. This was on the back of an election promise, made in light of increasing resistance to the 'cash and carry' system and in line with the international focus on the necessity of mandatory pre-payment mechanisms in order to achieve UHC [35]. We will not repeat the heated debate on NHIS in the broader literature [31, 36], which has been both applauded (for being innovative, progressive and pro-poor), and denounced (for not achieving these objectives [34, 37]) and beset by significant financial and operational difficulties [36].

In addition, in order to address the geographic service inequities within the country, the government has also rolled-out the Community-Based Health Planning and Service (CHPS)

[4] Detailed histories can be found in Arhinful [33] and Bohmig [29].

programme. This is specifically intended to increase access to services in remote areas, reorienting focus towards primary health care (PHC) in the community [38]. CHPS zones were created, with some having a physical structure (CHPS compounds) for the provision of services and staffed by salaried community health nurses, while other zones had no such physical structure. Following successful pilot studies in the Upper East region in the 1990s, the programme was rolled-out nationally from 2005 in order to address the needs of marginalised urban communities [39], with rapid expansion in recent years. Despite this effort, physical accessibility and geographic inequity remain an issue in the country [40].

The Role of FBNPs

The FBNP sector in Ghana, as in other SSA countries, has largely evolved from colonial-era Christian missionary origins. Today, this sector consists of a number of providers of varying religious backgrounds including faith-oriented non-governmental organisations (NGOs), non-networked facilities, informal faith-based initiatives and the Ahmadiyya Muslim Mission (AMM), amongst others. However, it is historically and currently dominated by mainstream Christian health facilities networked under the Christian Health Association of Ghana (CHAG) [41].

Similar to the other 22 Christian Health Associations (CHAs) present across SSA, CHAG is a network of mainstream Christian denominations [42]. Established in 1967, in a period of national upheaval, the original objectives set out by the founding members aimed to improve service coordination and to act as a consolidated platform for dialogue with the government [17, 42] - objectives which still apply. It is understood that a key founding focus was to provide services to marginalised, rural and most in need communities, although actual motivations are not clearly defined in the historical literature. However, CHAG have continued to maintain the ethos of the founding missionaries, with

one of their current core values being to provide services to the poor and marginalised. CHAG have a long-standing, formalised and robust relationship with the government, solidified through the outcomes of the Adibo Commission in 1975, working collaboratively but autonomously. They are a recognised agency of the MOH (in a similar but more limited fashion to GHS), with facilities receiving partial support and having signed a Memorandum of Understanding (MOU) with the MOH in 2003 detailing the relationship (2006 addendum) [41, 43]. FBNPs networked by CHAG are integrated with the public sector, submitting data to district health information software (DHIS) [44] and were put on the 'fast track' for NHIS accreditation. Due to this formalised integration and their long-standing role they are considered one of the most robust CHAs in SSA [42]. Currently, CHAG report that they have a membership of 282 facilities and 18 training institutions across all 10 regions of the country and constitute 25 different 'churches' (Christian denominational groups). They remain a significant player in the Ghanaian health system and self-report that their network provides 35-40% of the health care in the country with just 5.5% of the infrastructure [45]. (As with the other CHAs, these estimates of market share are contested [16, 41, 46, 47].)

Today, CHAG seeks to maintain both the ethos and functions on which it was founded but in a very different national context [45]. With the changing relationship with the public sector and as CHAG itself has grown to include more members, questions have been raised around their role, value-add and comparative advantage [16]. Some studies have examined aspects of FBNP contribution in Ghana [41, 48, 49] but these have tended to focus on one snapshot of time, and on varied comparative aspects. There has been little historical focus on the evolution of the relationship between CHAG and the government and whether they did and still do contribute towards UHC and health systems strengthening.

Methods

This study seeks to address the question: 'How have faith-based non-profit providers contributed to the historical development of the Ghanaian health system towards UHC – with a focus on geographic availability and distribution?' Framed as Health Policy and Systems Research (HPSR) and utilising an associated interdisciplinary approach, a flexible mixed-methods strategy was conducted which drew on multiple forms of data and combining extensive synthesis of literature, documentary and archival research with geospatial mapping. The research was conducted in three phases with reiterative data analysis, synthesis and triangulation throughout.

In Phase 1, a scoping literature review was undertaken focusing on three main areas; the historical development and current status of FBNPs in SSA, the contribution of FBNPs to UHC, and geospatial mapping of FBNPs in SSA (as described in part B). Only 7 studies were found explicitly conducting research on *geospatial* mapping of health-focused FBNPs in SSA, reflecting the scarcity of literature on this issue. This review formed the foundation for the more intense focus on Ghana in this article. Peer-reviewed and grey literature as well as secondary and archival documents were collated and thematically organised around the three mentioned focus areas (FBNPs in SSA, FBNPs contribution to UHC, geospatial mapping of FBNPs in SSA). A number of relevant organisational websites were also identified and searched including those maintained by CHAG and the GHS.

Phase 2 of this research involved geospatial mapping. This is a methodology originating in geography but is increasingly being used within the field of public health. It remains under-utilised in resource-poor settings such as SSA [50, 51], partly due to methodological challenges including poor data access and quality, lack of technical capacity and the necessity to rely on hardware [52, 53], although it is becoming more feasible with the increased availability of open-source geographic

information system (GIS) software. Much GIS mapping work in SSA (including Ghana) has tended to focus on disease trends [54] but visual representations of the health system can also provide insights into access, service provision and utilisation to be used for planning and management [55-59]. Despite the repeated calls for mapping of FBNP assets outlined in the background section of this paper, very little work has been carried out in this area. There is a tendency for FBNP data to either be excluded from national data sets or grouped with other public or private providers. The work which has been done on FBNP providers tends to focus on narrow geographical areas, service aspects and on one point in time using limited data (as discussed in part B). Just one immediately relevant study has been carried out on FBNPs in Ghana, which will be referred to in the results section [49].

The data collection for this phase involved the gathering and synthesising of a variety of quantitative and qualitative data in order to build as accurate a master list of health facilities as possible. The foundational data source for building this master list was a geo-referenced list of public and private facilities (also including directorates, teaching and research institutions) which was gathered by and bought from the Centre for Remote Sensing and Geographic Information Services (CERSGIS) based at the University of Ghana. This was first collated in 2008 with periodic updates occurring, until 2015. This CERSGIS database consisted of 2803 data points (having removed 21 clear duplicates). 111 items classified as health directorates were also removed from the database. This list was cross-checked and discrepancies reconciled with primary data collated in 2005 for the WHO Service Availability Mapping (SAM) report [60][5], a web resource of health facilities maintained by GHS [61] and other documents. As the focus of this study was on FBNPs and

[5] The geospatial data collated for the SAM report is intended to be publicly accessible but was not and as such was requested from and provided by the Department of Information, Evidence and Research, at the WHO in Geneva.

with CHAG being the dominant service provider within this sector, the database was supplemented with a 2017 list from CHAG, consisting of 300 member facilities. 117 of these 300 were not included or identifiable in the CERSGIS database. These facilities without GPS locations were geo-referenced manually by matching facility, town or village names on Google Maps or through Google searches and included within the master database. It should be noted that some of these are approximate, but considered adequate for the visualisation purposes of this research. It was not possible to geo-reference 14 of the CHAG facilities (data kept for non-mapping reference purposes but excluded from the master database). The final verified list consisted of 2795 data points composed of public and private (for- and not-for-profit) facilities, teaching and research institutions.

Due to the historical nature of this study (and the desire to show change in the health system over time), it was important to gather information on the establishment dates of FBNP facilities. Given the constraints of the research process, this could only include current CHAG members (that is, not inclusive of the small number of 'other' FBNP providers in Ghana)[6]. Establishment data were acquired for 224 of the 300 members – with this information gathered from CHAG Head Office, as well as the National Catholic Health Service (NCHS), and the Salvation Army's own national databases – and supplemented by internet, literature and archival searching. There were considerable discrepancies which were resolved or validated as far as possible through cross-checking during the final phase of the research (contextualisation). The acquisition of data on the establishment dates of public facilities were more challenging to gather and was not done systematically due to time constraints and as the primary focus of the research was on FBNPs. However, some data were gathered through internet and literature searching. Attempts were also

[6] Information on the Ahmadiyya Muslim Mission healthcare is scarce and little reliable or substantial data was found to be available on the establishment, location or numbers of facilities within Ghana.

made to collate information on the date that facilities became a member of CHAG but unfortunately remained too incomplete to report here with confidence (this will be pursued later). Information was obtained from CHAG for 189 of the facilities, but as 152 of these were listed as joining between 2000-2017 there was a time bias in the data that could not be reconciled.

The next stage of the mapping phase involved the creation of the maps. Data points were plotted using global positioning system (GPS) coordinates in a variety of presentations with appropriate base maps chosen and developed. QGIS™ software was used, chosen over other options such as ArcGIS™, because it is free and open-source and therefore more accessible to stakeholders (for future utilisation). The advantage of GIS software (over for example Google Maps) is that multiple data sets can be combined and displayed as independent layers enabling simultaneous visual assessments of the data. Technical challenges and limitations are noted in the results section.

Phase 3 of the research involved the synthesis of primary materials in order to contextualise the maps. Visual trends and patterns were assessed against reported events and the digital maps were compared against historic paper-based maps. These materials included organisational annual reports, archival materials, paper-based maps, key informant transcripts acquired for the primary study[7], and historical documents found in CHAG and NCHS archives during a research fieldwork trip in February 2017.

Processes to ensure and maintain rigour were applied throughout the research. This included multiple methods of design and data collection, a clear account of all steps taken throughout the

[7] This research project is a sub-study within a broader WHO - Alliance for Health Policy and Systems Research (AHPSR) funded project conducted by researchers at the University of Cape Town (UCT) and the University of Ghana examining the historical relationship between the Ghana public health system and non-state non-profit providers.

process, constant data analysis and synthesis, triangulation (cross-verification) of all data and findings, and peer and supervisor debriefing and support [4]. The researchers conducting the primary study from which some data were drawn also took appropriate steps to maintain rigour, including cross team analysis and member checking (participant validation) of interview transcripts.

Ethical standards were maintained throughout the research, complying with international, national and institutional requirements. Although considered minimal risk, ethical approval was obtained from the University of Cape Town's (UCT) Human Research Ethics Committee (HREC) (Reference 303/2017). The study also operated under the existing ethical considerations of the primary study, approval for which has been obtained from the WHO Research Ethics Committee, GHS Ethical Review Committee and UCT HREC (annually updated, 2015-2018). In addition, permission (not a formal requirement) was obtained from GHS, Ghana Department of Health and CHAG for this sub-study.

Results

In this results section, we have merged primary geospatial mapping results with integrated secondary literature as the most appropriate way to express the contextualised maps.

The Public-Private Health System Today

The current distribution of all health facilities in Ghana continues to be geographically inequitable, as represented in Figure 2a. As detailed in the methods section this map is representative of the health system in 2015 with CHAG details as of 2017.[8]

[8] Applicable across all of the maps, regional and district boundaries (now increased to 216) have changed over time but by using GPS data rather than address details this is not considered to be a significant issue for this research.

Figure 2a: The Current Public-Private Health System

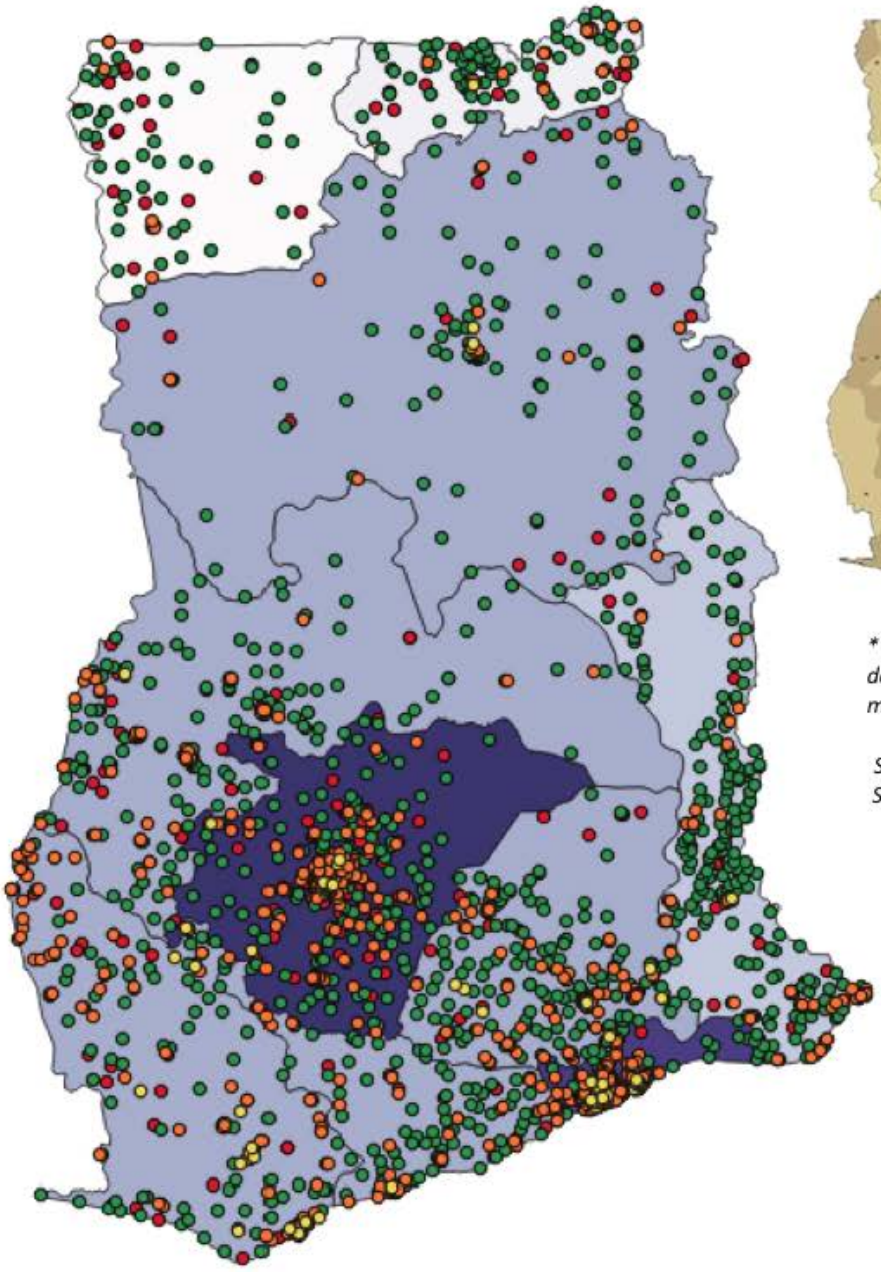
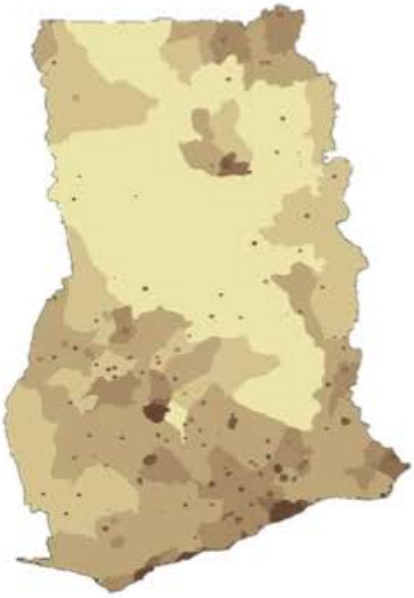


Figure 2b: 2010 Population Density



** Shading represents population density with darkest areas being the most populated*

Source: Center for International Earth Science Information Network (CIESIN), Columbia University

Key

- CHAG
- Government
- Private
- Quasi
- Islamic

Base: 2010 Regional Population Figures (darkest indicating most populated)

** Includes clinics, health centres, hospitals. Excludes CHPS, research institutions, training institutions.*

Source: Author

CHAG and government facilities currently have similar distribution patterns across the country and these largely correlate with regional population density (further detailed in Figure 2b). Although the population is lower in the Northern and Upper regions, it is clear that people who are living in those areas remain underserved and need to travel considerable distances to access health care. Combined with the lack of infrastructure and transport systems typical in rural areas this is likely to be a disincentive to accessing and utilising care. This visual representation corresponds with literature which states that unequal geographical distribution and regional disparities remain a significant issue in Ghana [24, 40]. It also reinforces the findings of the 2007 SAM report that health facilities (and associated human resources and infrastructure such as piped water) are unequally distributed with Northern regions underserved [60].

Figure 2a also highlights that 'other private' facilities are not evenly distributed. The CERSGIS database from which these figures were drawn does not differentiate between for- and not-for-profit providers in this category. However, one assessment of the Ghanaian health system (based on 2009 data), estimated that approximately half of all facilities are privately owned [24]. Within that, 73% are classified as private-for-profit (making up 36% of the total health system) with the remainder of the private category composed of quasi-public[9], CHAG and Islamic providers. Based on this, it is estimated that the majority of providers categorised as private in Figure 2a are for-profit providers (with the exception of a few NGOs).

Private providers (considered largely for-profit) are mostly concentrated in the cities and urban hubs [62], particularly in the Greater Accra region and around the city of Kumasi (Ashanti region).

[9] Quasi-public facilities are institutions owned by government establishments in service industries such as mining and manufacturing as well as educational, military and law enforcement agencies. They are subsidised but not operated by the government. They predominantly serve their target populations but use has been encouraged in times of crisis such as during physician strikes.

Although Kumasi is also served by a number of government and CHAG facilities, conversely, analysis (our own) shows that currently just 3% of CHAG and 5% of government total national facilities are located in the Greater Accra region (supported by Oboudi's findings of just 3 CHAG facilities in Greater Accra in 1999 [63]). This finding could be attributed to two characteristics of the Ghanaian historical health system context. Firstly, the low number of FBNPs in the Greater Accra region is likely representative of their historical placement and development, consciously not present in colonial areas such as Accra (as will be discussed in the following section). Secondly, it potentially signifies the success of strategic government efforts to increase geographic access, reflecting concerted health infrastructure development away from the historically well-served (colonial) areas. However, the limited number of public sector and CHAG facilities in the Greater Accra region, does raise the question of what happens to the urban poor or those unable to pay for private health care in this region (further analysed in the discussion).[10]

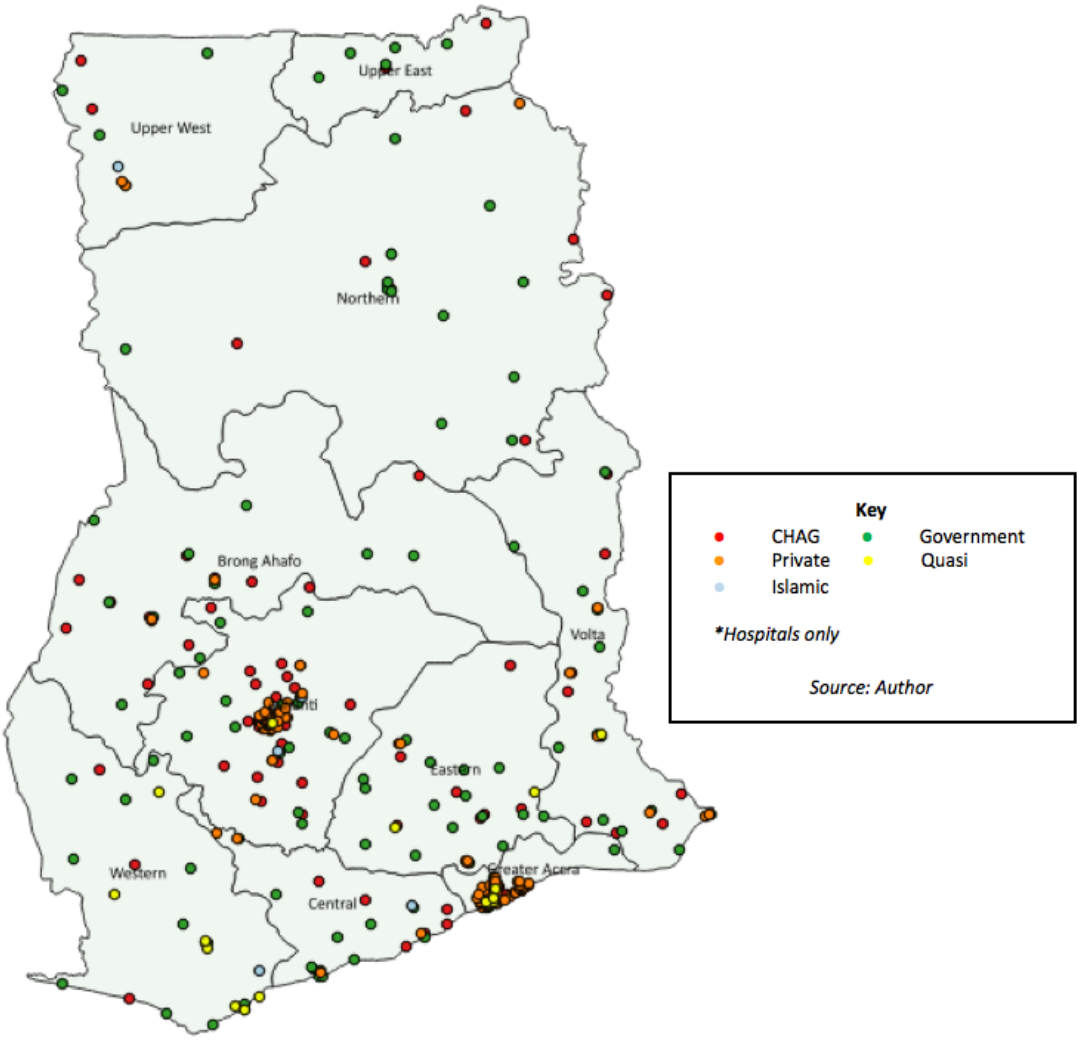
In assessing UHC, the level of care must also be considered. Figure 3 shows that hospitals (high-level facilities) are sparser in the Upper and Northern regions of the country. Private hospitals providers are particularly predominant in the urban areas of Accra and Kumasi [64]. These findings reiterate those on the entire health system (Figure 2). However, it is also noticeable that differing slightly from the whole system findings, that CHAG and government hospitals are mostly not located geographically adjacent to one another (other than around Kumasi) and this is especially evident in the Northern and Upper regions. It should also be noted that some of these CHAG hospitals are 'district designated'.[11] Data on the available service package across facilities was not gathered but it is a potential area of further exploration when assessing UHC and in relation to

[10] These images have been reduced in clarity for purposes of thesis examination.

[11] District designated hospitals are the first referral hospital and provide higher levels of clinic care at the district level. They serve populations of approximately 100,000-200,000 people in a clearly defined geographic area [65].

CHAG, considering specialisations that they are known for such as orthopaedic and eye care [43, 66].

Figure 3: Current Distribution of Hospitals



1957: Health System at Independence

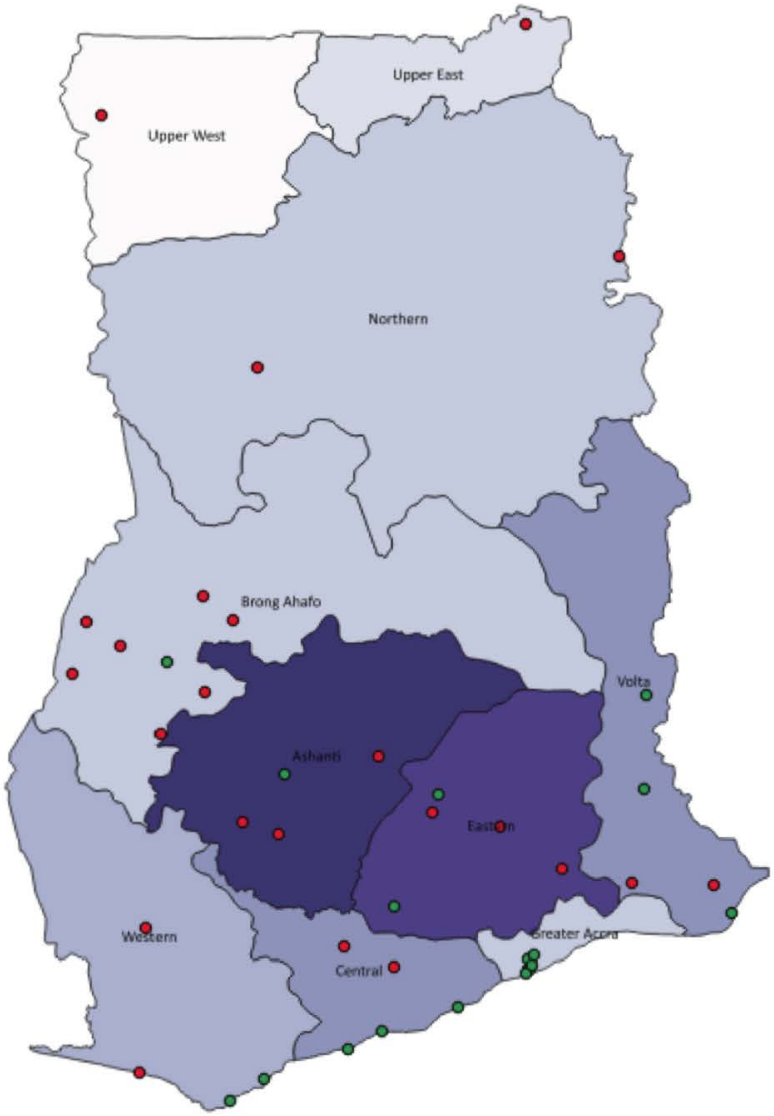
Figure 4a shows the distribution of hospitals (only) established at the time of independence, up to and including the year 1957 against the 1960 regional populations (earliest available – drawn from the 1960 census data). Of the 23 FBNP hospitals plotted, 17 are Catholic, representative of early missionary denominations and their long-standing dominance within the FBNP sector [41]. As detailed in the methodology, establishment data for government facilities was harder to find and

was not systematically gathered but the data available for older government hospitals were used. Classification is according to their current status in terms of ownership (CHAG versus government) and facility type (clinic versus hospital) and it is acknowledged that some of these have changed over time[12].

The colonial period was marked by significant development in the Southern and Coastal regions (the Gold Coast), with little attention focused on the resource-poor northern territories (see Figure 4b for colonial boundaries). This was reflected in a highly segregated health system serving the needs of the colony [29, 33]. These areas of concentrated socio-economic development, have left a long-lasting legacy, still evident today [67], as shown in Figure 2a. The literature suggests that missionary health work followed the paths carved by earlier missionaries who were more focused on proselytization and education but who created patterns of settlement ('path dependency' [68]). Mission facilities consciously expanded beyond colonial administrative boundaries (as represented in Figure 4b as the Gold Coast Colony), reaching out and providing services in rural and marginalised areas where government facilities were not present (20160905 CHAG, unpublished interview transcript) [45]. Although it was difficult to verify the location of government facilities at this point in time, Figure 4a corroborates these findings, showing hospitals in the Northern and Upper regions as only operated by FBNPs (missions) and government hospitals mostly situated along the coastline, with some in Ashanti and one in Brong Ahafo region (20160907 retired MOH leadership, unpublished interview transcript).

[12] This point is applicable across all of the maps and is a recognised limitation of the study with challenges in showing changes in ownership and type of facility, as well as the exclusion of facilities that have subsequently closed.

Figure 4a: Hospitals (government and CHAG) in 1957



Key

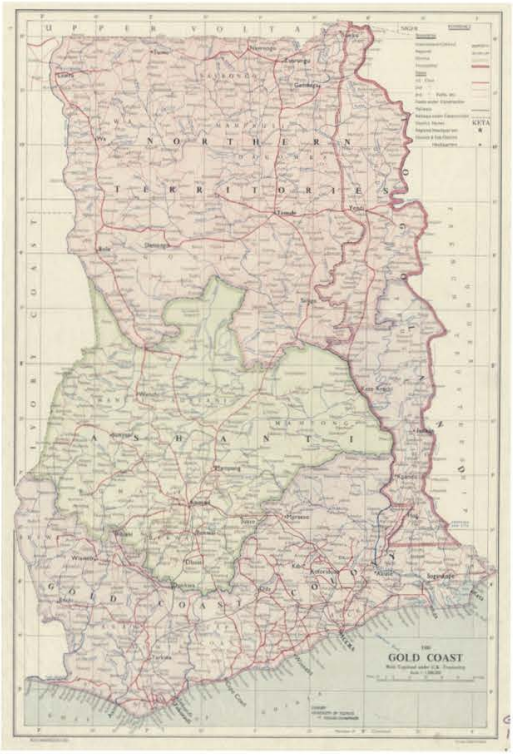
● CHAG ● Government

Base: 1960 Population Figures

** Hospitals only*

Source: Author

Figure 4b: The Gold Coast under UK Trusteeship in 1955



Source: Gold Coast Survey Department, Accra (1955)

The Evolution of FBNPs

Figure 5 provides a simple representation of the evolution of FBNPs over time, based on establishment data (darkest dots representing the oldest facilities).[13] This is based on current CHAG members and does not include other FBNPs that exist, as these are not as prevalent and due to challenges in ascertaining data.

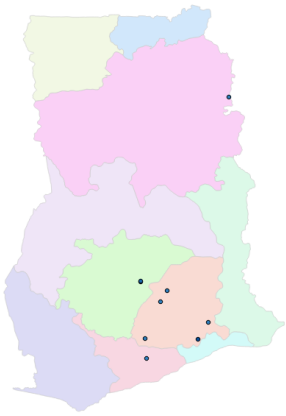
The literature documents a rapid increase in the number of both government and missionary services in the immediate pre-independence period [29, 33]. This proliferation of FBNPs is supported by Figure 5 with 31 FBNP facilities established between 1950 and 1959. Many of these were in areas further away from colonial boundaries. It is possible that it was associated with the 1952 Maude Commission which supported the enlistment of missions in the provision of health [33]. Other suggestions include that it could have been as a result of the pre-independence economic upturn or positioning in preparation for independence, recognising the impending increased unification of the country. The latter end of this decade also marked the advent of 'agency' hospitals. These were largely located in rural areas, where construction was paid for by government, but otherwise owned and run by the churches [43, 69]. Examples include Bawku Presbyterian Hospital in the Upper East region (established 1955) and St Joseph's Catholic Hospital in the Upper West region (converted from a clinic to a hospital in the 1950s).

The map also shows that there appears to be another significant increase in FBNP facilities during the 1980s (46 FBNPs established). This was an unstable period with tough conditions in the country (20160907 retired MOH leadership, unpublished interview transcript). It was the era of structural adjustment and health user fees were reintroduced in 1985 [34]. It has been suggested that in

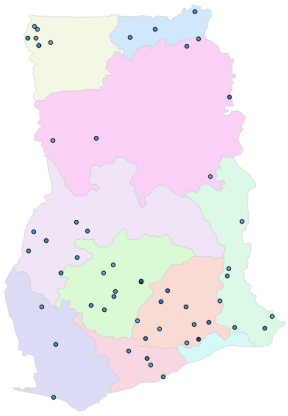
[13] Establishment data is available for 224 of the 300 CHAG member facilities.

times of crisis and when the public system is weak (particularly in fragile and conflict states), that NSPs emerge and become more prevalent [70] and the increase during the period could be attributed to this trend. Globally, this period is affiliated with a focus on 'rolling back the state' [71] thereby promoting the private sector, as well as a surge in international development aid (to both government and non-state actors) which may have benefitted FBNP providers. Another suggestion posited here is that the increase could also be linked to the 1975 Adibo Commission. This investigated the role of mission health services and marked the commencement of *formal* collaboration between faith-based providers and the MOH, with facilities receiving partial support for salaries and supplies and in turn filling gaps in the national system [41, 43].

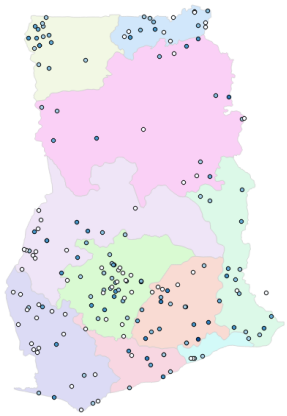
Figure 5: Evolution of FBNPs



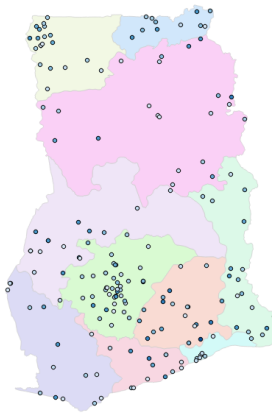
Up to 1949



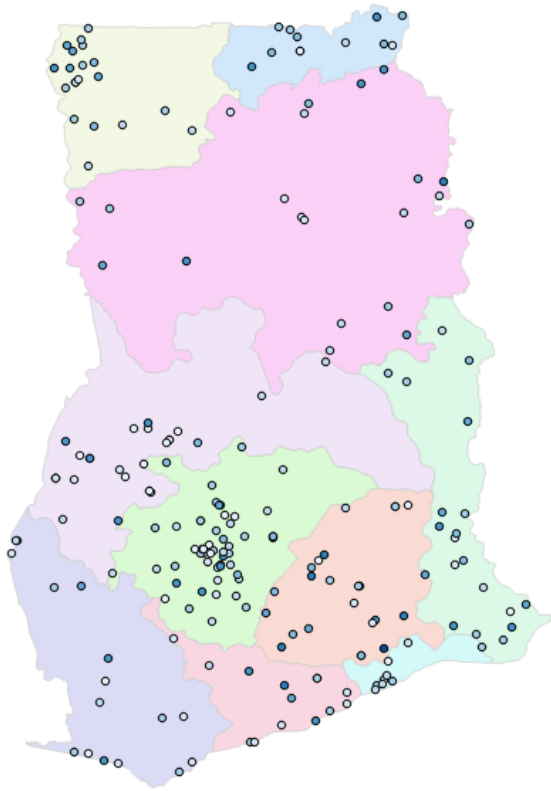
1950-1969



1970-1989



1990-2009



Right: 2010 onwards

Key

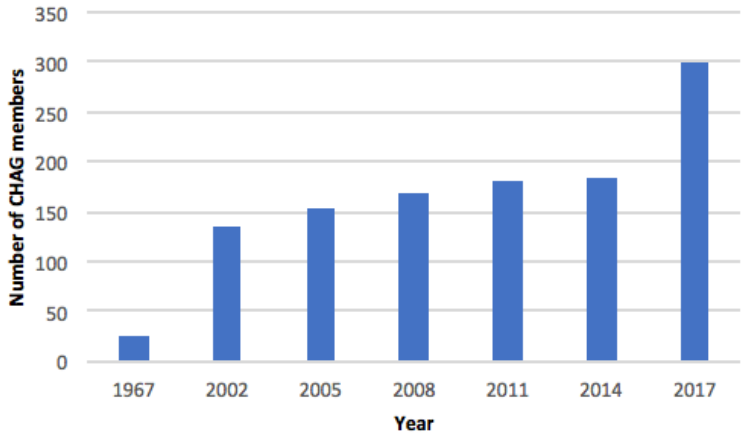
Shows CHAG facilities only.
Darkest marks represent the oldest facilities (become lighter in each map).

Source: Author

How has CHAG Changed?

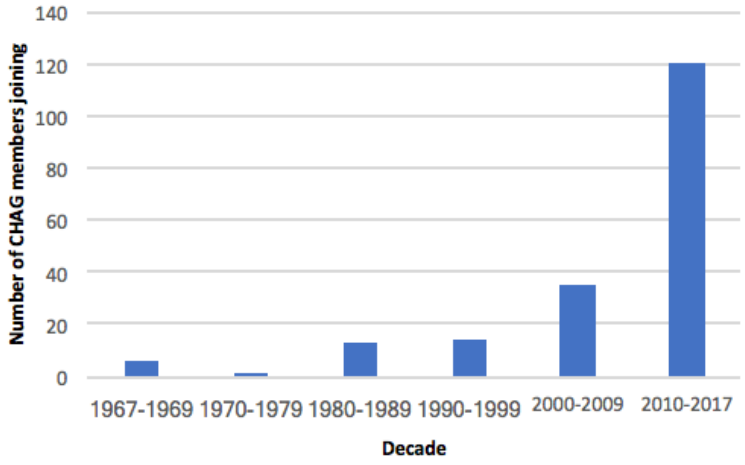
As stated, the FBNPs that are examined in Figure 5 are all currently members of CHAG (2017) however, they have not always been. In some cases there are significant time lags (decades), between the establishment date of the facility and the date that they became a member of CHAG. This is applicable even for some of the facilities owned and run by the founding denominations (despite indications that they should have become CHAG members immediately), but there is no clear explanation for why this is the case and reflects data limitations. Therefore, it would have been useful to carry out the same temporal mapping exercise visualising and contextualising changes in CHAG membership. Unfortunately, membership data were only available for 189 of the 300 CHAG members with 152 of those joining since the year 2000 (displayed in Figure 6). Due to

Figure 6a: CHAG membership numbers from annual reports and self report



Source: Author, based on CHAG data

Figure 6b: Year members joined CHAG from self report



Source: Author, based on CHAG data

this lack of information from early years, there is considered to be too much bias in the data and it was not suitable for mapping analysis.

Despite this, an interesting trend is noted in the later data with a rapid increase in membership in 2015. CHAG state that they had a 2-year membership freeze resulting in many facilities becoming members at the same time (in 2015) (CHAG, personal communication, 19th July 2017). However, even accounting for this, an increase of approximately 120 facilities on a base of 180 over this period is huge. It is not clear what the cause of this is - when the 120 are analysed, there are no clear trends in denomination or geography. It is also not related to a proliferation of new facilities as at least half of them were established prior to 2013, with a number dating back to the 1960s. It is suggested that it could relate to CHAG's fast-track accreditation of the NHIS or conversely, increased sectoral solidarity in facing the financial reimbursement challenges around NHIS [45] - but there are no conclusive answers.

Do CHAG Serve the Marginalised Today?

Figure 7 plots current CHAG facilities against recent population (Figure 7a) and poverty (Figure 7b) figures by region. Population distribution and poverty are linked - highly populated urban areas in Ghana have lower levels of poverty than more sparsely populated rural areas [26] and this is evident in the two base maps. These maps seek to further assess this dynamic in relation to CHAG facilities.

Figure 7a: CHAG facilities against population figures

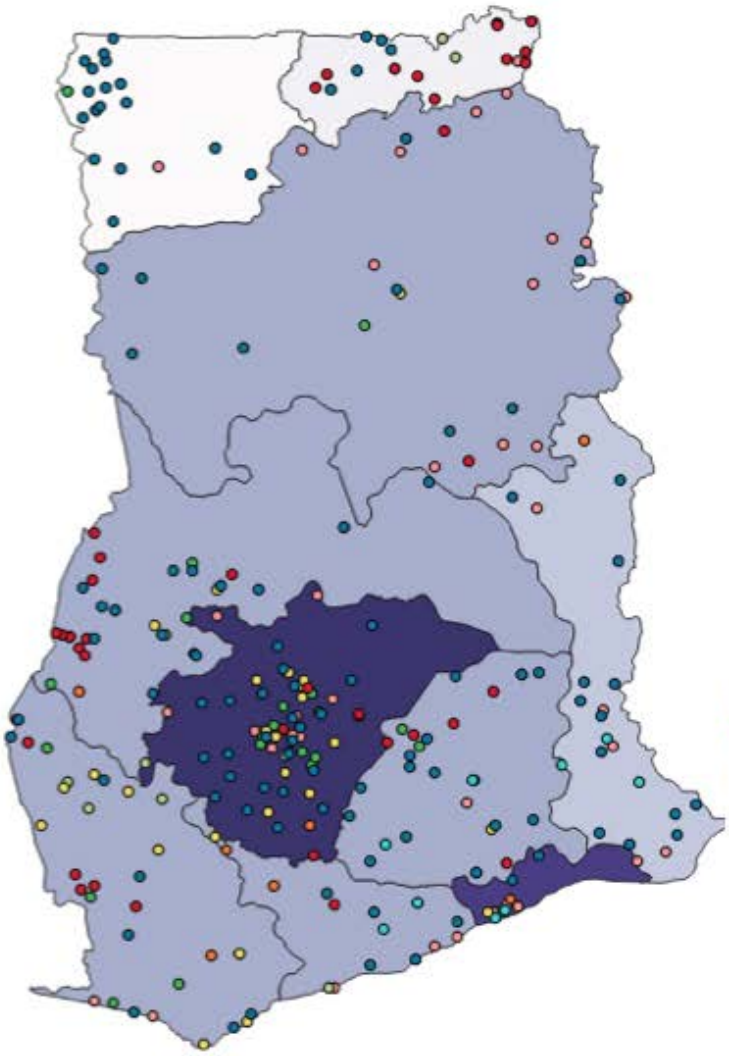
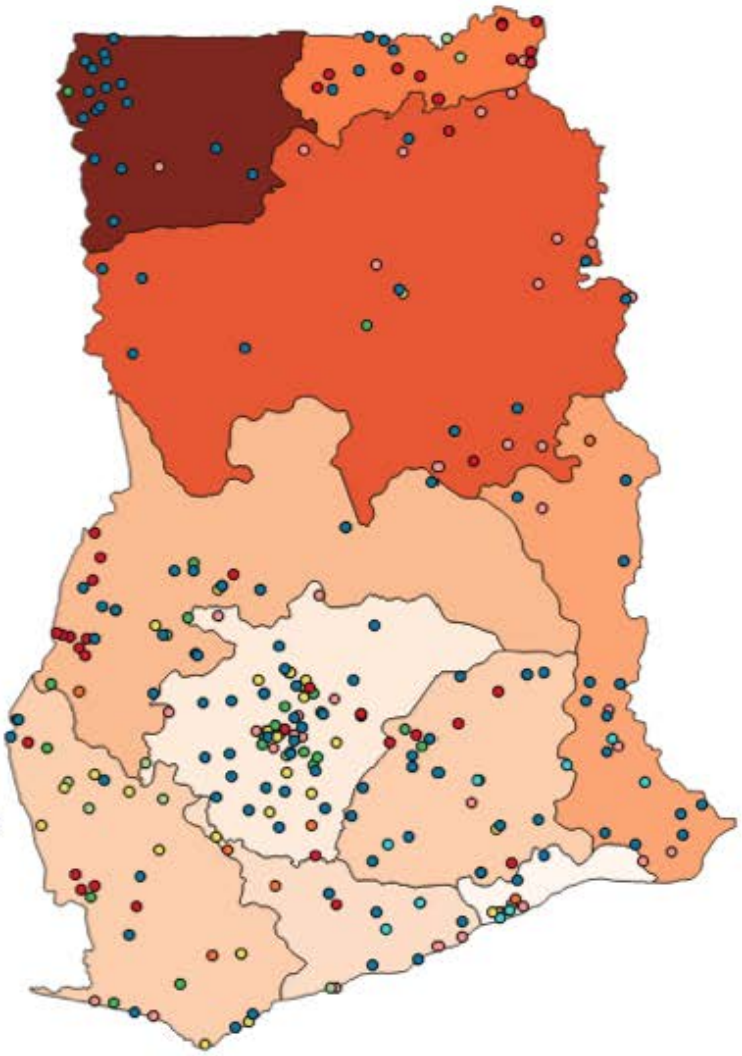


Figure 7b: CHAG facilities against poverty incidence



Key

Catholic	Pentecost	Presbyterian	Methodist
Anglican	SDA	Salvation Army	Other

Figure 7a Base: 2010 Population Figures

** Shading represents population figures with darkest areas being the most populated*

Figure 7b Base: 2010 Poverty Incidence

** Shading represents poverty incidence with darkest areas being those with the highest incidence*

Source: Author

Figure 7a shows that if regional population numbers are taken as a measure of urbanisation, CHAG does not appear to serve more rural than urban populations. Although present in the Northern rural areas, their distribution, much like government facilities, is aligned with population figures (as shown in Figure 2b). A recent article by CHAG (current and former Executive Directors) has acknowledged this rural-urban shift [45] (explored in more detail in the discussion below). This finding is supported by Figure 7b which plots the presence of CHAG facilities against regional poverty incidence (essentially the inverse of the population density). The map shows that there is no evidence that CHAG has significantly more facilities in more poverty-stricken areas than it does to more wealthy areas. These findings are further confirmed when examined at a district level (sub-regional), with CHAG not present in many poorer districts [49], such as Banda and Kintampo South in Brong Ahafo region, Sissala West in Upper West region and limited presence in the Gonja districts in Northern region (some of the poorest in the country) [25]. The government and CHAG both appear to serve (or not serve) the poor and rural areas to the same extent.

These findings are supported by the literature which has shown that CHAG facilities are primarily situated in urban areas [43] and when assessed on geo-location, do not disproportionately serve the poor [41]. In a mapping study, Coulombe and Wodon [49] found that CHAG facility locations correspond more closely with the number of Catholics in the population rather than the degree of poverty, (although this itself has been influenced by the historical presence of missionaries - explored in more detail in the discussion). However, it is important to note that this study (and that conducted by Coulombe and Wodon) is examining poverty levels on a regional (or district) scale rather than at a household or individual level, thereby limiting the assumptions that can be made (as it does not track actual service provision against individual or household poverty status, but rather compares regional poverty levels and geo-location of facilities). However, the findings have

been reinforced by statements in the key informant interviews which support the idea that CHAG is no longer in rural or poor areas and that CHAG's focus should rather be on the quality of care that it provides rather than location (20160907 former CHAG, unpublished interview transcript; 20160907 retired MOH leadership, unpublished interview transcript). These findings suggest there are no conclusive answers on whether CHAG facilities serve the poorest individuals – at least not that can be found through this type of study.

Denominational Differences

When examining the distribution of CHAG, in addition to the temporal geographical representation, it is useful to assess the denominational split. As a founding member, CHAG has always been predominantly made up of Catholic facilities (through history, estimated between 40-60% of CHAG[14]), followed by Presbyterian facilities which are now the next largest denominational group [41]. Figure 7 shows that Catholics currently have the most facilities and the greatest reach (123 of the 300 member facilities or institutions). They have a strong presence in the Upper West region, an area historically neglected by the government, representative of their early mission work and considered likely resulting from expansion and outreach from the afore mentioned agency hospital (St Joseph's Catholic Hospital). The pattern is similar for Presbyterian facilities in the Upper East region (Bawku Presbyterian Hospital). Without contextualisation, this clustering could be seen as rural poverty being the priority of these organisations but is considered more likely that it is linked to the patterns of exploration and settlement ('path dependency') of early missionary work (although this itself is a circular argument as this early missionary work targeted rural populations). Another pattern that is evident from the maps is that the Seventh Day Adventists (SDA), with many

[14] This estimate is based on limited figures due to the previously mentioned lack of CHAG membership data available. A 2003 CHAG Annual Report shows that 67.5% of total facilities and training institutions were Catholic and the latest figures show that they make up 41% of CHAG members.

recently established facilities, are largely predominant in urban areas (particularly around Kumasi) and have a minimal presence North of the Ashanti region. This shows important denominational differences even within the FBNP and CHAG clustering.

Discussion and Findings

This research has focused on assessing the historical and present spatial development of FBNPs within the Ghanaian health system in relation to facilities provided by the government and other private sector, seeking to contribute to the growing body of research on the topic and answer questions that remain around their contribution to health services in SSA. Taking a systems perspective and viewing the health system holistically, the results demonstrate that there are areas of the country, particularly in the North, which despite concerted efforts to address geographical inequalities by both FBNP and the public sector, are still not having their (local) health needs met by either public or private providers due to a lack of facilities. A legacy of the development associated with the colonial period, this North-South divide has been a long-standing issue, but the health system must continue to be oriented to address it if Ghana hopes to improve access and achieve UHC by 2030 as outlined in the Sustainable Development Goals (SDGs).

As a particular type of NSP, FBNPs, largely coordinated under the umbrella of CHAG, have had a significant long-standing role in seeking to address this fundamental aspect of UHC. The historical analysis clearly shows that, in line with the work of the early missionaries and the founding focus of CHAG (framed as a founding mission but not clearly defined in the historical literature), they *did* originally spatially complement the government system, providing services in rural underserved areas and contributing towards improved geographic access. However, as the context around them has changed – with the geographical expansion of the public sector, FBNP funding patterns shifting

away from traditional sources, and increasing urbanisation around the historically rural areas where mission facilities were located - this dynamic is now less apparent. Examination of the current location of government infrastructure demonstrates that these facilities are now also located in the more rural areas of the country and in some cases, appear to have been established where CHAG member facilities are also present. It is recognised that the health system is strongly oriented towards the development of the public sector and conversely, it could be viewed that the establishment of government facilities in these areas once predominantly served by CHAG, is in fact, complementary and supplementary to CHAG (rather than the reverse), contributing to strengthening the overall system.

In making this claim and in order to assess its validity, it is important to examine the health system more closely. When assessing the distribution of different levels of care, the spatial positioning of government and CHAG hospitals (higher level facilities) reflects less overlap, with hospitals generally not situated within the same immediate geographic area (other than around the city of Kumasi). Many of these hospitals have been present for decades demonstrating considerable resilience and suggesting some degree of coordination between providers. Although the literature alone does not indicate definitively when or exactly how this occurs, the 1975 Adibo Commission report and the more recent 2003 MOU between CHAG and the MOH are considered to be structured platforms which facilitate this engagement. This collaboration is also highlighted by the fact that a number of CHAG hospitals are district designated. Although the afore-mentioned pattern of geographic inequities also exist around this level of care, this more nuanced analysis demonstrates that FBNPs do continue to contribute to improved geographic access to higher levels of care (and therefore UHC) and that the initial assumptions of the findings may not be so clear cut.

At the other end of the spectrum, this mapping exercise has not visualised or included the distribution of CHPS zones (or compounds). However, given CHAG's historical focus on improved geographic access for rural and marginalised communities and as CHPS is the government strategy to address this issue it is important to mention it here. Although not considered a duplication of services due to its small-scale community focus (often with no associated health infrastructure), the increasing national coverage of the programme means that it is inevitably present in areas where CHAG member facilities exist. Having been largely excluded from early roll-out of the programme, CHAG are now coordinating with the government on CHPS [45] and in order to enhance the effectiveness of the programme this collaboration and systems integration is encouraged.

In examining the evolution of FBNP providers in Ghana, it is worth considering the impact of the overall FBNP presence. It has been posited that those once rural areas where facilities were located, proceeded to urbanise and develop – often *because* of the presence of Christian churches and communities and their associated health and education services (and presumably transport links), thereby attracting people and ultimately government services, which resulted in more rapid development in these areas [45]. As one interviewee stated "Battor Catholic Hospital made up what Battor is, so CHAG is the community" (20160906/7 MOH, interview transcript). Alternatively, it has been suggested that missionaries located themselves in areas where there were already local populations or which had favourable conditions (for example, situated at high altitude away from malaria) and as such were always likely hubs for growth regardless of their presence. There is not a clear 'cause and effect' answer but it is likely that missionary presence had an impact on the communities around them and in turn, have had a role in shaping the current day health system. This trend of infrastructure and community development around historic missionary locations is

particularly noticeable in the denominational breakdown with clusters of smaller facilities present around some of the earliest and long-standing FBNP hospitals.

As with many SSA countries, the configuration of the population in Ghana has shifted and the results indicate that the infrastructure of the public health system has broadly adjusted to align with the current population distribution. However, one clear exception to this rule is the Greater Accra region where both CHAG and the government have a limited presence. FBNP's limited presence is likely a result of the aforementioned conscious expansion beyond colonial boundaries. The reason for the paucity of government services is less clear, but may be a result of strategic government efforts to increase access to health services across other areas of the country. Rapid in-migration to this region (the second most populated) has resulted in unsystematic expansion since the 1980s [24, 72]. This has brought with it an increasing urban poor with limited access to public health facilities but who at the same time are particularly susceptible to the associated environmental health concerns of informal settlements such as poor water and sanitation facilities (as demonstrated by having the most cases in the 2014-2015 cholera outbreak [73]). The finer details of this urban analysis are outside the scope of this study. However, provision of services to meet the needs of the urban poor in this region, is suggested could be a potential area of future collaboration between CHAG and the government. This may take a different form to historical collaborations due to denominational differences. As highlighted in the maps, the few CHAG members currently present in this area are mostly the smaller denominations sometimes operating just one facility in the country, highlighting the necessity for CHAG's coordinating role to promote effective coverage. In addition, some of the newer member denominations such as the SDAs, have focused their expansion in urban areas, mostly around Kumasi, and may have potential to do the same in Greater Accra to meet the needs of the burgeoning urban poor.

The CHAG Secretariat have had a notably strong, long-standing collaborative relationship with the MOH [42], engaging effectively through successive governments, weathering periods of significant national turmoil and health system shocks. It is recognised that the findings on geographic coverage may influence perceptions of CHAG's role but it is asserted through the findings of this research that this does not negate the value of their contribution towards UHC or role in the health system. Drawing on global recommendations around the importance of involving NSPs in health systems strengthening efforts, and given their integration within the system, the government should continue to capitalise on and leverage CHAG's existing strengths and infrastructure. As the epidemiological transition towards non-communicable diseases occurs in the country, and in considering the service package required to achieve UHC, other areas that CHAG have pockets of specialisation in such as orthopaedics, eye care, and mental health services could also be drawn upon. Furthermore, their congregational linkages into communities could be used to enhance community care and increase access to those who remain underserved. Viewing the health system holistically (through such geospatial maps) and continued collaboration through coordinated policy processes would avoid duplication and fragmentation of services (in terms of geographic access).

More broadly, this research has demonstrated that the historical social, political and economic context of a country has a significant impact on the health system of today. Changing relationships between public-private partners significantly impact on the provision and spatial footprint of facilities. From an HPSR methodological perspective, this innovative use of GIS software has demonstrated the wider applicability of geospatial mapping technology and that when contextualised appropriately (a key feature of the HPSR field), it can be used to examine these historical aspects of health system development, expanding beyond its traditional uses.

Furthermore, these mapping techniques enable visualisation of multiple data sets in a variety of formats which can be adapted according to stakeholder needs – and can be a powerful tool for enhancing intersectoral stakeholder engagement. In the context of the CHAs this can provide valuable insights into the distribution of their network members which traditional data formats cannot. On a national level, especially if continually updated and if the private sector is categorised appropriately, it is a useful tool for nuanced analysis of the complex web of providers within the health system, with potential to assist decision making and enrich health systems analysis.

Study Limitations and Challenges

The limitations of this study are in two key areas – challenges around the availability and accuracy of data, and limitations in terms of the scope of the research. The mixed methods approach used, involving the synthesis of a wide range of data sources, allowed for more rounded findings but as mentioned, resulted in significant data discrepancies. Cleaning and verification to resolve these issues are an expected part of the research process and although not a limitation, are noted as a challenge. Relatedly, although the use of secondary data sources for geospatial mapping is appropriate for this kind of small-scale study, the quality of the mapping relied on the accuracy and availability of the data. Adequate for the purposes of this historically-focused descriptive research, it emphasises the benefits of such data being open-source and the importance of keeping databases current.

As described in the results, this research highlighted fundamental data gaps, impacting on the comprehensiveness of the analysis. If available, these would not only contribute to the research but more importantly would help to define CHAG's composition and contribution and ability to reassess their position within the health system. This reflects the importance of data if FBNPs and CHAs are

to remain viable and relevant in an ever more technological and results driven environment, and in the context of national governments increasingly utilising these approaches. This was poignantly acknowledged by one participant in the research stating, "we know that we are contributing, even if we can't show it […] and we need to document our activities better" (20160909 CHAG board member, unpublished interview transcript).

The focus of this study was on the spatial distribution of FBNPs. As noted in the results, there are limitations around this geospatial approach when assessing factors such as poverty and assessing the nuances of the individual and household population that facilities serve. Furthermore, it is recognised that a limitation of this focus on spatial distribution is that other aspects of UHC were not considered in detail. The methodology described could be utilised in the context of FBNPs to assess geographical placement in combination with service quality, health outcomes, specialisations, human resources, and fiscal aspects, moving the discussion beyond the historical focus on geographical distribution towards other areas of potential comparative advantage.

Lastly, it is noted that this research focused on formal Christian FBNPs in Ghana (grouped under CHAG), largely due to the availability of data. The cost-effective methodology used in this research could be further enhanced by combining it with other forms of mapping, such as participatory, in order to examine providers of other faiths (in Ghana, Islamic), informal networks and in contexts outside of SSA. Research gaps and questions remain in these areas and could benefit from multi-source mapping approaches to build the evidence and knowledge base where literature is particularly sparse.

Conclusions

This research demonstrates the long-standing role, resilience and adaptability of FBNPs in Ghana and their contribution towards the achievement of UHC. It substantiates, where previous data and empirical evidence were lacking, their historical and continuing role in the provision of services. The findings on the evolution of CHAG members and their stimulus for joining CHAG is not conclusive, but as indicated, there are clear spikes indicating periods of strength and suggesting that member institutions seemingly joining CHAG when they saw an increase in their political and strategic value in relation to the government or at times of crisis. Although context specific, FBNPs across SSA are considered to have followed similar paths of development and as such, patterns may be drawn. However, as emphasised throughout this research, in order to substantiate their role and demonstrate their continued relevance in the provision of health services, it is essential that the CHAs (and other FBNPs) maintain substantive data records.

The historical analysis demonstrates that the past clearly *does* have an impact on the spatial footprint of the present-day health system. Population changes, topography, economic fluctuations and concentrated areas of infrastructural expansion, all impact on the development of the health system. The centrality of people and the changing relationship and power dynamics between actors both within and outside the system are also significant. Addressing the legacy (and potential inequities) of the past requires a sustained, concerted and coordinated effort across all providers in the health system. Across countries, recognising and addressing the impact of these broader contextual factors, as well as the (sometimes unintended) consequences of past health systems strategies, may provide valuable lessons for current day systems management and future planning.

This historical research also indicates that the health system in Ghana has long been composed of a mixture of public and private providers, a situation that is unlikely to change. Although the ultimate responsibility of addressing inequities and improving the health outcomes of the population is considered to remain with the state, engaging with the full range of existing NSPs is necessary in order to build a strong and effective health system. A collaborative approach towards health systems planning and management, between the government and NSPs, utilising accessible open-source data would enable greater understanding of the full range and scope of services within the country. The generation and use of geospatial maps to visualise such data is one tool for identifying gaps and duplications in order to reduce fragmentation and maximise resources, enhancing this kind of holistic health system analysis.

A resilient health system is one which can provide consistent everyday health services and withstand complex emergency situations. The path to accomplishing this is through the achievement of UHC, ensuring that quality effective health services are both financially and physically accessible for all and as such equipped to deal with any future and emerging health issues or shocks. This research has highlighted that the issue of UHC is complex and multi-levelled. To supplement and add depth to this macro level mapping approach, a meso facility level assessment of service users is required to assess provision of services to the poor. Overall this research emphasises that the achievement of UHC is about *whole* systems cooperation and collaboration. In the face of the evolving health challenges of the future, capitalising on the comparative strengths and resources offered by FBNPs and other NSPs should be encouraged if national governments in SSA want to achieve UHC and ultimately improve health outcomes amongst their populations.

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Appendices

Appendix A: Sub-study (Thesis) Research Brief for Distribution to Stakeholders

Alliance for Health Policy and Systems Research

RESEARCH INFORMATION BRIEF

Mapping the Development of the Private Not-for-Profit Health System in Ghana

A sub-study of

Systems Integration towards UHC: Strengthening the collaborative relationship between faith-based non-profit providers and the Ghanaian public health system

While there are broad assumptions that collaboration between different sectors would support health systems strengthening, there is a dearth of systematic evidence on the effects of such relationship-building on the health system: its evolution or what strategies need to be put in place.

There is a particular cluster of faith-based non-profit (FBNP) providers who tend to operate in loose networks of health facilities, the collaborative relationship and approach between FBNPs and state actors have been distinct in LMIC contexts due to their shared goals of outreach to the poor and achieving universal health coverage (UHC). There is still a lack of evidence available on whether mechanisms to incorporate and involve FBNPs within the health system have been successful or not – whether they have in fact strengthened the relationship or the system, whether they have improved reach and access within the national system or ultimately supported the goal of reaching UHC.

This research project will undertake a *geographic mapping* of the development of the private not-for-profit health sector in Ghana (in particular the Christian Health Association of Ghana, CHAG, which dominates this sector in Ghana). This study will seek to show the evolution of CHAG facilities in relation to the public health system (for example, showing the location of main facilities, regional differences, or how the health system has developed since independence in the 1950s).

Utilising available data, the study will provide a profile of the spatial distribution of facilities across the country. Currently no such map exists, resulting in challenges in assessing accessibility and availability of services across the country, key aspects towards achieving universal health coverage and supporting health system development. Further analysis will be applied to these maps, in consultation with stakeholders.

This project is a sub-study of a broader WHO-AHPSR funded project *"Systems integration towards universal health coverage: Strengthening the collaborative relationship between faith-based non-profit providers and the Ghanaian public health system"*. This examines the historical relationship between the Ghana public health system and non-state non-profit providers (mainly faith-based facilities under the umbrella of the Christian Health Association of Ghana (CHAG)). This sub-study will contribute to this broader study, and will also be put towards an MPH degree thesis project (at UCT).

The maps produced by this research project will be shared with stakeholders (CHAG and GHS), and if agreed on by stakeholders will be made publicly available.

Timeline

February-March 2017: Data collection

March-June 2017: Analysis, mapping and further data collection

July-September 2017: Write up, followed by dissemination

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For more information please contact:

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http://www.who.int/alliance-hpsr/en/ http://www.publichealth.uct.ac.za/ http://www.chag.org.gh/ www.irhap.uct.ac.za http://www.ghanahealthservice.org/

Appendix B: Primary Study Research Brief

Alliance for Health Policy and Systems Research

UNIVERSITY OF GHANA

INFORMATION BRIEF

Systems integration towards universal health coverage:

Strengthening the collaborative relationship between faith-based non-profit providers and the Ghanaian public health system

While there are broad assumptions that collaboration between different sectors would support health systems strengthening, there is a dearth of systematic evidence on the effects of such relationship-building on the health system: its evolution or what strategies need to be put in place. One of the main challenges is the diversity of non-state actors in LMIC settings, each requiring a different approach for regulation and alignment with national priorities and systems functioning.

There is a particular cluster of faith-based non-profit (FBNP) providers who tend to operate in loose networks of health facilities with a shared religious identity, non-profit status, and an overt intent to provide 'quality healthcare to the rural poor' – usually with governance connections to a local religious group. The collaborative relationship and approach between FBNPs and their state actors has been distinct from that of other non-state actors in most LMIC contexts. Because of shared goals (increased outreach of health services to the poor and ultimately UHC), FBNPs have usually been seen to have a more natural 'fit' with the state-run system.

In each country where such FBNPs are present in a significant quantity, a similar set of interventions or mechanisms have been attempted over a number of years as part of a broader intervention to strengthen the relationship between FBNPs and the state system - effectively to 'align' them with the state priorities and functioning – and the stated purpose of such efforts is usually UHC, based on the assumption that FBNPs should be serving the poor often in mainly rural areas. However, there is still a lack of evidence available on whether such intervention strategies have been successful or not - whether they have in fact strengthened the relationship or the system, whether they have improved reach and access within the national system or ultimately supported the goal of reaching UHC.

Question: *In which respects has the relationship between faith-based non-profit providers and the Ghanaian government been strengthened (and in which respects undermined) through the series of health systems interventions and mechanisms attempted over the last fifty years? If so, how has this been achieved? Can this be said to have strengthened the system towards UHC in Ghana?*

Hypotheses: *Improved collaboration between FBNPs and the state would result in improved services within the FBNPs and would extend the reach of the national system to under-served populations.*

Approach: Described as a 'historical realist-style case study'

Hypotheses driving the approach:

- Health systems are complex adaptive systems that are influenced by multiple factors (social/cultural, political, economic, and other) as they change – but the contribution of multiple factors to good health and 'plausible pathways' can be identified.
- Causal/explanatory links can be made between systems interventions, the state of this relationship, and its influence on UHC.
- The factors that should prove to be important to the successful implementation of these (and other such) interventions intended to improve integration of systems towards UHC are likely to include: power differences & flows between stakeholders; trust & relational factors; historical roles & responsibilities; organisational cultures & clashes; financial, human resource & informational limitations
- An interdisciplinary approach is required to understand complex systems change over time.
- Looking at any one of these strategies in isolation or over a shorter period of time would not adequately uncover such interactions - or the greater impact on UHC.

Timeline

Phase 1: January 2016 – December 2016 - Historical case narrative study

Phase 2: January 2016 – June 2017 - Case study (fieldwork including archival searches, key informant interviews)

Phase 3: July 2017-December 2017 - Cross-case analysis and followup

Phase 4: Jan2018-May2018 - Writeup and consultation

Primary Investigators	Key Partners and Advisors
Dr. Jill Olivier (University of Cape Town) Dr. Aku Kwamie (University of Ghana)	Christian Health Association of Ghana, Mr Peter Yeboah (CHAG) Prof. Irene Agyepong (GHS & UG) Prof. Lucy Gilson (UCT)

For more information please contact:

Dr. Jill Olivier: Senior Lecturer & Research Coordinator, University of Cape Town, Health Policy and Systems Division, School of Public Health and Family Medicine, Anzio Road, Observatory, 7925, South Africa jill.olivier@uct.ac.za Tel: +27 (0) 21 4066489

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http://www.who.int/alliance-hpsr/en/ http://www.publichealth.uct.ac.za/ http://sph.ug.edu.gh/ http://www.chag.org.gh/ www.irhap.uct.ac.za

Appendix C: UCT Ethics Approval Letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: sumayah.ariefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

05 July 2017

HREC REF: 303/2017

Dr J Olivier
School of Public Health & family Medicine
Falmouth Building

Dear Dr Olivier

PROJECT TITLE: MAPPING THE DEVELOPMENT OF THE PRIVATE NOT-FOR PROFIT HEALTH SECTOR IN THE GHANAIAN HEALTH SYSTEM (MPH-candidate-A Grieve)

Thank you for your response letter dated 01 June 2017, addressing the issues raised by the Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 July 2018.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student, A Grieve will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

Yours sincerely

Signed

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical

Appendix D: Portion of Final Collated Database

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	**ID**	**Region**	**District**	**Facility Name**	**Type**	**Simplified Type**	**Town**	**Ownership**	**Latitude**	**Longitude**	**Alternative Name**	**Denomination**	**CHAG 2017**	**Establishment Decade**	**1957**	**Joined CHAG**	**Catholic Diocese**	**Staff**	**Beds**	**Website / References**
2	2721	Western	Shama Ahanta East	Effia Nkwanta Regional Hospital	Regional Hospital	Hospital	Sekondi	Government	4.92482	-1.74458		Government		1930	Yes					http://citifmonline.com/2016/09/10/effia-nkwanta-hospital-appeals-to-govt-for-new-regional-hospital/
3	1297	Greater Accra	Ga East	Achimota Hospital	Hospital	Hospital	Atomic	Government	5.62922	-0.21476		Government		1930	Yes					
4	905	Central	Cape Coast Metropolitan	Cape Coast Metropolitan Hospital	Metropolitan Hospital	Hospital	Bakano	Government	5.10247	-1.25902		Government		1930	Yes					http://www.ecthghana.org/about-us/ / http://uaps2011.princeton.edu/papers/110346
5	2524	Volta	South Tongu	Dabala Health Centre	Health Centre	Health Centre	Dabala	Government	5.98588	0.67646		Government		1930	Yes					
6	2701	Western	Nzema East	Essiama Health Centre	Health Centre	Health Centre	Essiama	Government	4.93579	-2.35504		Government		1930	Yes					
7	2389	Volta	Keta	Keta Government Hospital	Municipal Hospital	Hospital	Keta	Government	5.88784	0.98164		Government		1930	Yes					Gold Coast Report 1935
8	950	Central	Komenda-Edina-Eguafo-Abirem Municipal	Elmina Urban Health Centre	Health Centre	Health Centre	Elmina	Government	5.09873	-1.3483		Government		1930	Yes					
9	772	Central	Asikuma-Odoben-Brakwa	Our Lady of Grace Hospital	Hospital	Hospital	Breman Asikuma	CHAG	5.58063	-0.99655		Catholic	Yes	1940	Yes		Cape Coast			
10	1192	Eastern	Manya Krobo	St Martins Hospital	Hospital	Hospital	Agormanya	CHAG	6.14498	-0.01469	St Martin's de Porres Hospital	Catholic	Yes	1940	Yes		Koforidua			http://nchsgh.org/health-concern-2/
11	1173	Eastern	Kwahu West	Holy Family Hospital	District Hospital	Hospital	Nkawkaw	CHAG	6.47555	-0.77237		Catholic	Yes	1940	Yes		Koforidua			http://nchsgh.org/health-concern-2/
12	1086	Eastern	Birim South	Catholic Clinic & Maternity Home	Clinic	Health Centre	Akim Swedru	CHAG	5.88958	-1.01654		Catholic	Yes	1940	Yes		Koforidua			http://nchsgh.org/health-concern-2/
13	1158	Eastern	Kwahu South	St. Joseph Maternity Home	Maternity Home	Health Centre	Kwawu Tafo	CHAG	6.65174	-0.66607	St Joseph Clinic & Maternity Home	Catholic	Yes	1940	Yes		Koforidua			http://nchsgh.org/health-concern-2/
14	1799	Northern	Saboba-Chereponi	Saboba Medical Centre	Hospital	Hospital	Saboba	CHAG	9.70965	0.31924		Other	Yes	1940	Yes	1980			80	http://www.sabobamedicalcentre.net/about_the_medicalcentre.html /
15	1576	Greater Accra	Accra Metropolitan	Korle-Bu Nurses Training College	Training Institution	Training	Korle-Bu	Government	5.54027	-0.23095		Government		1940	Yes					Govindaraj
16	2335	Volta	Hohoe	Hohoe Government Hospital	District Hospital	Hospital	Hohoe	Government	7.15849	0.47239		Government		1940	Yes				178	https://www.electives.net/hospital/4954/preview
17	521	Ashanti	Kumasi Metropolitan	Kumasi Nurses/Midwifery Training School	Training Institution	Training	Kumasi	Government	6.4148	-1.37507		Government		1940	Yes					
18	1287	Greater Accra	Accra Metropolitan	37 Military Hospital	Psychiatric	Hospital	37	Quasi	5.58704	-0.18391		Quasi		1940	Yes				400	http://www.electives.net/hospital/5617/prev
19	623	Brong Ahafo	Jaman South	St. Mary's Hospital	Hospital	Hospital	Drobo	CHAG	7.58599	-2.78549		Catholic	Yes	1950	Yes		Sunyani			
20	755	Brong Ahafo	Techiman	Holy Family Hospital	Hospital	Hospital	Techiman	CHAG	7.59193	-1.93944		Catholic	Yes	1950	Yes		Techiman			http://www.holyfamilyhospitaltechiman.com/index.php?op=news_detail&newsId=7
21	2831	Western	Wassa-Amenfi West	Asankragwa Catholic Hospital	Hospital	Hospital	Asankragwa	CHAG	5.80149	-2.43225	Fr. Thomas Alan Rooney Memorial Hospital	Catholic	Yes	1950	Yes		Sekondi-Takoradi			
22	1880	Northern	West Gonja	Damongo Hospital	District Hospital	Hospital	Damongo	CHAG	9.06302	-1.79872	West Gonja Hospital	Catholic	Yes	1950	Yes		Damongo			Atim 1998 / Rasheed 2009
23	561	Brong Ahafo	Asutifi	St. Elizabeth Hospital	Hospital	Hospital	Hwidiem	CHAG	6.93279	-2.35805		Catholic	Yes	1950	Yes		Goaso	167	111	http://goasodiocese.org/2016-01-07-09-04-40/institutions/132-st-elizabeth-catholic-hospital / www.sech-gh.org/brief-history
24	2138	Upper West	Jirapa	St. Joseph's Hospital	District Hospital	Hospital	Jirapa	CHAG	10.53334	-2.69916		Catholic	Yes	1950	Yes		Wa			http://nchsgh.org/institutions/training-schools/jirapa-nurses-training-college/ / Hawkins 1997 / Rasheed 2009 / Arhinful (2003)
25	2700	Western	Nzema East	Eikwe Catholic Hospital	Hospital	Hospital	Eikwe	CHAG	4.96539	-2.46978	St Martin de Porres Hospital	Catholic	Yes	1950	Yes		Sekondi-Takoradi	200	175	www.eikwe-hospital.org
26	2034	Upper East	Builsa	Wiaga Clinic	Health Centre	Health Centre	Wiaga	CHAG	10.65505	-1.25675	St Lucas Health Centre	Catholic	Yes	1950	Yes		Navrongo-Bolgatanga			
27	586	Brong Ahafo	Berekum	Holy Family Hospital	Hospital	Hospital	Berekum	CHAG	7.44325	-2.58806		Catholic	Yes	1950	Yes		Sunyani		210	www.holyfamilyhospitaltechiman.com
28	2893	Upper West	Jirapa	St Joseph's Midwifery Training School	Training Institution	Training	Jirapa	CHAG	10.53334	-2.69916		Catholic	Yes	1950	Yes		Wa			http://nchsgh.org/institutions/training-schools/jirapa-midwifery-training-school/
29	875	Central	Assin North Municipal	St. Francis Xavier Hospital	District Hospital	Hospital	Foso	CHAG	5.6996	-1.28136		Catholic	Yes	1950	Yes		Cape Coast		138	http://sistershospitallers.org/centres/st-francis-xavier-hospital/ / http://sistershospitallers.org/wp-content/uploads/2016/09/Annual_Report_2015.pdf
30	288	Ashanti	Amansie Central	St. Peters' Hospital	Hospital	Hospital	Jacobu	CHAG	6.34331	-1.66669		Catholic	Yes	1950	Yes		Obuasi			
31	729	Brong Ahafo	Tano North	St. John of God Hospital	Hospital	Hospital	Duayaw Nkwanta	CHAG	7.17559	-2.0967		Catholic	Yes	1950	Yes		Goaso		150	http://goasodiocese.org/2016-01-07-09-04-40/institutions/130-st-john-of-god-hospital / www.stjohnofgodhospital.com

Appendix E: Journal Style Guide

Aims and scope

International Journal for Equity in Health presents evidence relevant to the search for, and attainment of, equity in health across and within countries. The journal publishes research which improves the understanding of issues that influence the health of populations. This includes the discussion of political, policy-related, economic, social and health services-related influences, particularly with regard to systematic differences in distributions of one or more aspects of health in population groups defined demographically, geographically, or socially.

Article-processing charges

Open access publishing is not without costs. *International Journal for Equity in Health* therefore levies an article-processing charge of £1420.00/$2220.00/€1810.00 for each article accepted for publication.

If the corresponding author's institution participates in our open access membership program, some or all of the publication cost may be covered (more details available on the membership page). We routinely waive charges for authors from low-income countries. For other countries, article-processing charge waivers or discounts are granted on a case-by-case basis to authors with insufficient funds. Authors can request a waiver or discount during the submission process. For further details, see our article-processing charge page.

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Research

Criteria

Research papers should adhere to the STROBE guidelines according to the study's design.

International Journal for Equity in Health encourages authors of qualitative papers to use the RATS framework when preparing their manuscript for submission.

Preparing your manuscript

The information below details the section headings that you should include in your manuscript and what information should be within each section.

Please note that your manuscript must include a 'Declarations' section including all of the subheadings (please see below for more information).

Title page

The title page should:

present a title that includes, if appropriate, the study design e.g.:

"A versus B in the treatment of C: a randomized controlled trial", "X is a risk factor for Y: a case control study", "What is the impact of factor X on subject Y: A systematic review"

or for non-clinical or non-research studies a description of what the article reports

list the full names, institutional addresses and email addresses for all authors

if a collaboration group should be listed as an author, please list the Group name as an author. If you would like the names of the individual members of the Group to be searchable through their individual PubMed records, please include this information in the “Acknowledgements” section in accordance with the instructions below

indicate the corresponding author

Abstract

The Abstract should not exceed 350 words. Please minimize the use of abbreviations and do not cite references in the abstract. Reports of randomized controlled trials should follow the CONSORT extension for abstracts. The abstract must include the following separate sections:

- **Background:** the context and purpose of the study
- **Methods:** how the study was performed and statistical tests used
- **Results:** the main findings
- **Conclusions:** brief summary and potential implications

- **Trial registration:** If your article reports the results of a health care intervention on human participants, it must be registered in an appropriate registry and the registration number and date of registration should be in stated in this section. If it was not registered prospectively (before enrollment of the first participant), you should include the words 'retrospectively registered'. See our editorial policies for more information on trial registration

Keywords: Three to ten keywords representing the main content of the article.

Background: The Background section should explain the background to the study, its aims, a summary of the existing literature and why this study was necessary or its contribution to the field.

Methods
The methods section should include:

- the aim, design and setting of the study
- the characteristics of participants or description of materials
- a clear description of all processes, interventions and comparisons. Generic drug names should generally be used. When proprietary brands are used in research, include the brand names in parentheses
- the type of statistical analysis used, including a power calculation if appropriate

Results
This should include the findings of the study including, if appropriate, results of statistical analysis which must be included either in the text or as tables and figures.

Discussion
This section should discuss the implications of the findings in context of existing research and highlight limitations of the study.

Conclusions
This should state clearly the main conclusions and provide an explanation of the importance and relevance of the study reported.

List of abbreviations
If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided.

Declarations
All manuscripts must contain the following sections under the heading 'Declarations':

- Ethics approval and consent to participate
- Consent for publication
- Availability of data and material
- Competing interests
- Funding
- Authors' contributions
- Acknowledgements
- Authors' information (optional)

Please see below for details on the information to be included in these sections.
If any of the sections are not relevant to your manuscript, please include the heading and write 'Not applicable' for that section.

Ethics approval and consent to participate
Manuscripts reporting studies involving human participants, human data or human tissue must:

- include a statement on ethics approval and consent (even where the need for approval was waived)
- include the name of the ethics committee that approved the study and the committee's reference number if appropriate

Studies involving animals must include a statement on ethics approval.

See our editorial policies for more information.
If your manuscript does not report on or involve the use of any animal or human data or tissue, please state "Not applicable" in this section.

Consent for publication
If your manuscript contains any individual person's data in any form (including individual details, images or videos), consent for publication must be obtained from that person, or in the case of children, their parent or legal guardian. All presentations of case reports must have consent for publication.
You can use your institutional consent form or our consent form if you prefer. You should not send the form to us on submission, but we may request to see a copy at any stage (including after publication).
See our editorial policies for more information on consent for publication.
If your manuscript does not contain data from any individual person, please state "Not applicable" in this section.

Availability of data and materials
All manuscripts must include an 'Availability of data and materials' statement. Data availability statements should include information on where data supporting the results reported in the article can be found including, where applicable, hyperlinks to publicly archived datasets analysed or generated during the study. By data we mean the minimal dataset that would be necessary to interpret, replicate and build upon the findings reported in the article. We recognise it is not always possible to share research data publicly, for instance when individual privacy could be compromised, and in such instances data availability should still be stated in the manuscript along with any conditions for access.
Data availability statements can take one of the following forms (or a combination of more than one if required for multiple datasets):

- The datasets generated and/or analysed during the current study are available in the [NAME] repository, [PERSISTENT WEB LINK TO DATASETS]
- The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.
- All data generated or analysed during this study are included in this published article [and its supplementary information files].
- The datasets generated and/or analysed during the current study are not publicly available due [REASON WHY DATA ARE NOT PUBLIC] but are available from the corresponding author on reasonable request.
- Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.
- The data that support the findings of this study are available from [third party name] but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of [third party name].
- Not applicable. If your manuscript does not contain any data, please state 'Not applicable' in this section.

More examples of template data availability statements, which include examples of openly available and restricted access datasets, are available here.

BioMed Central also requires that authors cite any publicly available data on which the conclusions of the paper rely in the manuscript. Data citations should include a persistent identifier (such as a DOI) and should ideally be included in the reference list. Citations of datasets, when they appear in the reference list, should include the minimum information recommended by DataCite and follow journal style. Dataset identifiers including DOIs should be expressed as full URLs. For example:
Hao Z, AghaKouchak A, Nakhjiri N, Farahmand A. Global integrated drought monitoring and prediction system (GIDMaPS) data sets. figshare. 2014. http://dx.doi.org/10.6084/m9.figshare.853801
With the corresponding text in the Availability of data and materials statement:
The datasets generated during and/or analysed during the current study are available in the [NAME] repository, [PERSISTENT WEB LINK TO DATASETS].[Reference number]

Competing interests
All financial and non-financial competing interests must be declared in this section.

See our editorial policies for a full explanation of competing interests. If you are unsure whether you or any of your co-authors have a competing interest please contact the editorial office.
Please use the authors initials to refer to each author's competing interests in this section.
If you do not have any competing interests, please state "The authors declare that they have no competing interests" in this section.

Funding
All sources of funding for the research reported should be declared. The role of the funding body in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript should be declared.

Authors' contributions
The individual contributions of authors to the manuscript should be specified in this section. Guidance and criteria for authorship can be found in our editorial policies.
Please use initials to refer to each author's contribution in this section, for example: "FC analyzed and interpreted the patient data regarding the hematological disease and the transplant. RH performed the histological examination of the kidney, and was a major contributor in writing the manuscript. All authors read and approved the final manuscript."

Acknowledgements
Please acknowledge anyone who contributed towards the article who does not meet the criteria for authorship including anyone who provided professional writing services or materials.
Authors should obtain permission to acknowledge from all those mentioned in the Acknowledgements section.
See our editorial policies for a full explanation of acknowledgements and authorship criteria.
If you do not have anyone to acknowledge, please write "Not applicable" in this section.
Group authorship (for manuscripts involving a collaboration group): if you would like the names of the individual members of a collaboration Group to be searchable through their individual PubMed records, please ensure that the title of the collaboration Group is included on the title page and in the submission system and also include collaborating author names as the last paragraph of the “Acknowledgements” section. Please add authors in the format First Name, Middle initial(s) (optional), Last Name. You can add institution or country information for each author if you wish, but this should be consistent across all authors.
Please note that individual names may not be present in the PubMed record at the time a published article is initially included in PubMed as it takes PubMed additional time to code this information.

Authors' information
This section is optional.
You may choose to use this section to include any relevant information about the author(s) that may aid the reader's interpretation of the article, and understand the standpoint of the author(s). This may include details about the authors' qualifications, current positions they hold at institutions or societies, or any other relevant background information. Please refer to authors using their initials. Note this section should not be used to describe any competing interests.

Endnotes
Endnotes should be designated within the text using a superscript lowercase letter and all notes (along with their corresponding letter) should be included in the Endnotes section. Please format this section in a paragraph rather than a list.

References
All references, including URLs, must be numbered consecutively, in square brackets, in the order in which they are cited in the text, followed by any in tables or legends. The reference numbers must be finalized and the reference list fully formatted before submission.
Examples of the BioMed Central reference style are shown below. Please ensure that the reference style is followed precisely.
See our editorial policies for author guidance on good citation practice.

Web links and URLs: All web links and URLs, including links to the authors' own websites, should be given a reference number and included in the reference list rather than within the text of the manuscript. They should be provided in full, including both the title of the site and the URL, as well as the date the site was accessed, in the following format: The

Mouse Tumor Biology Database. http://tumor.informatics.jax.org/mtbwi/index.do. Accessed 20 May 2013. If an author or group of authors can clearly be associated with a web link (e.g. for blogs) they should be included in the reference.

Example reference style:

Article within a journal

Smith JJ. The world of science. Am J Sci. 1999;36:234-5.

Article within a journal (no page numbers)

Rohrmann S, Overvad K, Bueno-de-Mesquita HB, Jakobsen MU, Egeberg R, Tjønneland A, et al. Meat consumption and mortality - results from the European Prospective Investigation into Cancer and Nutrition. BMC Med. 2013;11:63.

Article within a journal by DOI

Slifka MK, Whitton JL. Clinical implications of dysregulated cytokine production. Dig J Mol Med. 2000; doi:10.1007/s801090000086.

Article within a journal supplement

Frumin AM, Nussbaum J, Esposito M. Functional asplenia: demonstration of splenic activity by bone marrow scan. Blood 1979;59 Suppl 1:26-32.

Book chapter, or an article within a book

Wyllie AH, Kerr JFR, Currie AR. Cell death: the significance of apoptosis. In: Bourne GH, Danielli JF, Jeon KW, editors. International review of cytology. London: Academic; 1980. p. 251-306.

OnlineFirst chapter in a series (without a volume designation but with a DOI)

Saito Y, Hyuga H. Rate equation approaches to amplification of enantiomeric excess and chiral symmetry breaking. Top Curr Chem. 2007. doi:10.1007/128_2006_108.

Complete book, authored

Blenkinsopp A, Paxton P. Symptoms in the pharmacy: a guide to the management of common illness. 3rd ed. Oxford: Blackwell Science; 1998.

Online document

Doe J. Title of subordinate document. In: The dictionary of substances and their effects. Royal Society of Chemistry. 1999. http://www.rsc.org/dose/title of subordinate document. Accessed 15 Jan 1999.

Online database

Healthwise Knowledgebase. US Pharmacopeia, Rockville. 1998. http://www.healthwise.org. Accessed 21 Sept 1998.

Supplementary material/private homepage

Doe J. Title of supplementary material. 2000. http://www.privatehomepage.com. Accessed 22 Feb 2000.

University site

Doe, J: Title of preprint. http://www.uni-heidelberg.de/mydata.html (1999). Accessed 25 Dec 1999.

FTP site

Doe, J: Trivial HTTP, RFC2169. ftp://ftp.isi.edu/in-notes/rfc2169.txt (1999). Accessed 12 Nov 1999.

Organization site

ISSN International Centre: The ISSN register. http://www.issn.org (2006). Accessed 20 Feb 2007.

Dataset with persistent identifier

Zheng L-Y, Guo X-S, He B, Sun L-J, Peng Y, Dong S-S, et al. Genome data from sweet and grain sorghum (Sorghum bicolor). GigaScience Database. 2011. http://dx.doi.org/10.5524/100012.

Figures, tables additional files

See General formatting guidelines for information on how to format figures, tables and additional files.

Preparing your manuscript

This section provides general style and formatting information only. Formatting guidelines for specific article types can be found below.

- Annotated bibliography
- Commentary
- Letter to the Editor
- Research
- Review

- Study protocol
- Systematic review

General formatting guidelines

- Preparing main manuscript text
- Preparing illustrations and figures
- Preparing tables
- Preparing additional files

Preparing main manuscript text

Quick points:

- Use double line spacing
- Include line and page numbering
- Use SI units: Please ensure that all special characters used are embedded in the text, otherwise they will be lost during conversion to PDF
- Do not use page breaks in your manuscript

File formats

The following word processor file formats are acceptable for the main manuscript document:

- Microsoft word (DOC, DOCX)
- Rich text format (RTF)
- TeX/LaTeX (use BioMed Central's TeX template)

Please note: editable files are required for processing in production. If your manuscript contains any non-editable files (such as PDFs) you will be required to re-submit an editable file when you submit your revised manuscript, or after editorial acceptance in case no revision is necessary.

Note that figures must be submitted as separate image files, not as part of the submitted manuscript file. For more information, see Preparing figures below.

Additional information for TeX/LaTeX users

Please use BioMed Central's TeX template and BibTeX stylefile if you use TeX format. Submit your references using either a bib or bbl file. When submitting TeX submissions, please submit both your TeX file and your bib/bbl file as manuscript files. Please also convert your TeX file into a PDF (please do not use a DIV file) and submit this PDF as a supplementary file with the name 'Reference PDF'. This PDF will be used by our production team as a reference point to check the layout of the article as the author intended. Please also note that all figures must be coded at the end of the TeX file and not inline.

The Editorial Manager system checks for any errors in the Tex files. If an error is present then the system PDF will display LaTex code and highlight and explain the error in a section beginning with an exclamation mark (!).

All relevant editable source files must be uploaded during the submission process. Failing to submit these source files will cause unnecessary delays in the production process.

TeX templates
BioMedCentral_article (ZIP format) - preferred template
Springer article svjour3 (ZIP format)
birkjour (Birkhäuser, ZIP format)
article (part of the standard TeX distribution)
amsart (part of the standard TeX distribution)

Style and language

For editors and reviewers to accurately assess the work presented in your manuscript you need to ensure the English language is of sufficient quality to be understood. If you need help with writing in English you should consider:

- Visiting the English language tutorial which covers the common mistakes when writing in English.
- Asking a colleague who is a native English speaker to review your manuscript for clarity.
- Using a professional language editing service where editors will improve the English to ensure that your meaning is clear and identify problems that require your review. Two such services are provided by our affiliates Nature Research Editing Service and American Journal Experts.

Please note that the use of a language editing service is not a requirement for publication in the journal and does not imply or guarantee that the article will be selected for peer review or accepted.

Data and materials

For all journals, BioMed Central strongly encourages all datasets on which the conclusions of the manuscript rely to be either deposited in publicly available repositories (where available and appropriate) or presented in the main paper or additional supporting files, in machine-readable format (such as spread sheets rather than PDFs) whenever possible. Please see the list of recommended repositories in our editorial policies.

For some journals, deposition of the data on which the conclusions of the manuscript rely is an absolute requirement. Please check the Instructions for Authors for the relevant journal and article type for journal specific policies.

For all manuscripts, information about data availability should be detailed in an 'Availability of data and materials' section. For more information on the content of this section, please see the Declarations section of the relevant journal's Instruction for Authors. For more information on BioMed Centrals policies on data availability, please see our [editorial policies].

Formatting the 'Availability of data and materials' section of your manuscript

The following format for the 'Availability of data and materials section of your manuscript should be used:

"The dataset(s) supporting the conclusions of this article is(are) available in the [repository name] repository, [unique persistent identifier and hyperlink to dataset(s) in http:// format]."

The following format is required when data are included as additional files:

"The dataset(s) supporting the conclusions of this article is(are) included within the article (and its additional file(s))."

BioMed Central endorses the Force 11 Data Citation Principles and requires that all publicly available datasets be fully referenced in the reference list with an accession number or unique identifier such as a DOI.

For databases, this section should state the web/ftp address at which the database is available and any restrictions to its use by non-academics.

For software, this section should include:

- Project name: e.g. My bioinformatics project
- Project home page: e.g. http://sourceforge.net/projects/mged
- Archived version: DOI or unique identifier of archived software or code in repository (e.g. enodo)
- Operating system(s): e.g. Platform independent
- Programming language: e.g. Java
- Other requirements: e.g. Java 1.3.1 or higher, Tomcat 4.0 or higher
- License: e.g. GNU GPL, FreeBSD etc.
- Any restrictions to use by non-academics: e.g. licence needed

Information on available repositories for other types of scientific data, including clinical data, can be found in our editorial policies.

References

See our editorial policies for author guidance on good citation practice.

All references, including URLs, must be numbered consecutively, in square brackets, in the order in which they are cited in the text, followed by any in tables or legends. The reference numbers must be finalized and the reference list fully formatted before submission. For further information including example references please read our reference preparation guidelines.

What should be cited?
Only articles, clinical trial registration records and abstracts that have been published or are in press, or are available through public e-print/preprint servers, may be cited.

Unpublished abstracts, unpublished data and personal communications should not be included in the reference list, but may be included in the text and referred to as "unpublished observations" or "personal communications" giving the names of the involved researchers. Obtaining permission to quote personal communications and unpublished data from the cited colleagues is the responsibility of the author. Footnotes are not allowed, but endnotes are permitted. Journal abbreviations follow Index Medicus/MEDLINE.

Any in press articles cited within the references and necessary for the reviewers' assessment of the manuscript should be made available if requested by the editorial office.

How to format your references
Examples of the BioMed Central reference style are shown below. Please ensure that the reference style is followed precisely; if the references are not in the correct style, they may need to be retyped and carefully proofread.

Preparing figures
When preparing figures, please follow the formatting instructions below.

- Figures should be provided as separate files, not embedded in the main manuscript file.
- Each figure of a manuscript should be submitted as a single file that fits on a single page in portrait format.
- Tables should NOT be submitted as figures but should be included in the main manuscript file.
- Multi-panel figures (those with parts a, b, c, d etc.) should be submitted as a single composite file that contains all parts of the figure.
- Figures should be numbered in the order they are first mentioned in the text, and uploaded in this order.
- Figures should be uploaded in the correct orientation.
- Figure titles (max 15 words) and legends (max 300 words) should be provided in the main manuscript, not in the graphic file.
- Figure keys should be incorporated into the graphic, not into the legend of the figure.
- Each figure should be closely cropped to minimize the amount of white space surrounding the illustration. Cropping figures improves accuracy when placing the figure in combination with other elements when the accepted manuscript is prepared for publication on our site. For more information on individual figure file formats, see our detailed instructions.
- Individual figure files should not exceed 10 MB. If a suitable format is chosen, this file size is adequate for extremely high quality figures.
- **Please note that it is the responsibility of the author(s) to obtain permission from the copyright holder to reproduce figures (or tables) that have previously been published elsewhere.** In order for all figures to be open access, authors must have permission from the rights holder if they wish to include images that have been published elsewhere in non open access journals. Permission should be indicated in the figure legend, and the original source included in the reference list.

Figure file types
We accept the following file formats for figures:

- EPS (suitable for diagrams and/or images)
- PDF (suitable for diagrams and/or images)
- Microsoft Word (suitable for diagrams and/or images, figures must be a single page)
- PowerPoint (suitable for diagrams and/or images, figures must be a single page)

- TIFF (suitable for images)
- JPEG (suitable for photographic images, less suitable for graphical images)
- PNG (suitable for images)
- BMP (suitable for images)
- CDX (ChemDraw - suitable for molecular structures)

For information and suggestions of suitable file formats for specific figure types, please see our author academy.

Figure size and resolution

Figures are resized during publication of the final full text and PDF versions to conform to the BioMed Central standard dimensions, which are detailed below.

Figures on the web:

- width of 600 pixels (standard), 1200 pixels (high resolution).

Figures in the final PDF version:

- width of 85 mm for half page width figure
- width of 170 mm for full page width figure
- maximum height of 225 mm for figure and legend
- image resolution of approximately 300 dpi (dots per inch) at the final size

Figures should be designed such that all information, including text, is legible at these dimensions. All lines should be wider than 0.25 pt when constrained to standard figure widths. All fonts must be embedded.

Figure file compression

- Vector figures should if possible be submitted as PDF files, which are usually more compact than EPS files.
- TIFF files should be saved with LZW compression, which is lossless (decreases file size without decreasing quality) in order to minimize upload time.
- JPEG files should be saved at maximum quality.
- Conversion of images between file types (especially lossy formats such as JPEG) should be kept to a minimum to avoid degradation of quality.

If you have any questions or are experiencing a problem with figures, please contact the customer service team at info@biomedcentral.com.

Preparing tables

When preparing tables, please follow the formatting instructions below.

- Tables should be numbered and cited in the text in sequence using Arabic numerals (i.e. Table 1, Table 2 etc.).
- Tables less than one A4 or Letter page in length can be placed in the appropriate location within the manuscript.
- Tables larger than one A4 or Letter page in length can be placed at the end of the document text file. Please cite and indicate where the table should appear at the relevant location in the text file so that the table can be added in the correct place during production.
- Larger datasets, or tables too wide for A4 or Letter landscape page can be uploaded as additional files. Please see [below] for more information.
- Tabular data provided as additional files can be uploaded as an Excel spreadsheet (.xls) or comma separated values (.csv). Please use the standard file extensions.
- Table titles (max 15 words) should be included above the table, and legends (max 300 words) should be included underneath the table.
- Tables should not be embedded as figures or spreadsheet files, but should be formatted using 'Table object' function in your word processing program.
- Color and shading may not be used. Parts of the table can be highlighted using superscript, numbering, lettering, symbols or bold text, the meaning of which should be explained in a table legend.
- Commas should not be used to indicate numerical values.

If you have any questions or are experiencing a problem with tables, please contact the customer service team at info@biomedcentral.com.

Preparing additional files

As the length and quantity of data is not restricted for many article types, authors can provide datasets, tables, movies, or other information as additional files.

All Additional files will be published along with the accepted article. Do not include files such as patient consent forms, certificates of language editing, or revised versions of the main manuscript document with tracked changes. Such files, if requested, should be sent by email to the journal's editorial email address, quoting the manuscript reference number. Please do not send patient consent forms unless requested.

Results that would otherwise be indicated as "data not shown" should be included as additional files. Since many web links and URLs rapidly become broken, BioMed Central requires that supporting data are included as additional files, or deposited in a recognized repository. Please do not link to data on a personal/departmental website. Do not include any individual participant details. The maximum file size for additional files is 20 MB each, and files will be virus-scanned on submission. Each additional file should be cited in sequence within the main body of text.

If additional material is provided, please list the following information in a separate section of the manuscript text:

- File name (e.g. Additional file 1)
- File format including the correct file extension for example .pdf, .xls, .txt, .pptx (including name and a URL of an appropriate viewer if format is unusual)
- Title of data
- Description of data

Additional files should be named "Additional file 1" and so on and should be referenced explicitly by file name within the body of the article, e.g. 'An additional movie file shows this in more detail [see Additional file 1]'.

For further guidance on how to use Additional files or recommendations on how to present particular types of data or information, please see How to use additional files.