UNIVERSITY OF CAPE COAST

PERFORMANCE OF MATERNAL AND CHILD HEALTH DATA IN ROUTINE HEALTH INFORMATION SYSTEM AMONG HEALTHCARE FACILITIES IN CAPE COAST METROPOLIS, GHANA

OBED UWUMBORNYI LASIM

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BY

OBED UWUMBORNYI LASIM

Thesis submitted to the Department of Health, Physical Education and Recreation of the Faculty of Science and Technology Education of College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for award of Doctor of Philosophy Degree in Health Promotion (Maternal and Child Health Promotion)

JULY 2022

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Signature…… Date……..

Name: Obed Uwumbornyi Lasim

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature…… Date……

Name: Dr. Daniel Apaak

Co-supervisor's Signature…… Date…….

Name: Dr. Edward Wilson Ansah

ABSTRACT

This study assessed the performance of Routine Health Information System (RHIS) as well as identified the technical, organisational, and behavioural factors affecting maternal and child health (MCH) data quality (DQ) and information use (IU) in the Cape Coast Metropolis (CCM). Descriptive quantitative cross-sectional case study design was used. The survey involved thirteen purposively sample healthcare facilities (HCFs), and 278 healthcare professionals (HCPs). Eight MCH indicators were assessed for data accuracy, completeness, timeliness, and consistency. Data was collected using two pre-existing instruments. Pearson correlation coefficient, percentages, and verification factors (VFs) were estimated. The VFs for data accuracy between registers and forms, registers and District Health Information System (DHIS2) database, and forms and DHIS2 were, 102.1%, 102.4%, and 100.1% respectively. Data were 95.4% complete in DHIS2, 87.2% submitted on time, and 93% consistent over time. RHIS processes were 63.7% functional, and 27.9% of the management functions were met. Indices measuring technical and behavioural factors were weak. Self-efficacy was moderately positively associated with: perceived promotion of culture of information (COI), $r(265) = .36, p < .0001$; activities for COI, $r(265) = .33, p < .0001$; and supportive management, $r(265) = .29, p < .0001$. The level of MCH DQ were within the threshold recommended by WHO, but the level of IU was weak. MCH processes, and organisational factors fared averagely. Managers of HCFs should strengthen MCH performance by building the capacities of HCPs involved in MCH activities.

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DEDICATION

To my lovely family: Mrs. Jemima Lasim, Joel-Steele, John-Goodwyn, and Keren-Gladys

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LIST OF ACRONYMS

ANC1	Antenatal Clinic (first visit)
ANC4	Antenatal Clinic (fourth visit)
CCM	Cape Coast Metropolis
CCMA	Cape Coast Metropolitan Assembly
CCMHD	Cape Coast Metropolitan Health Directorate
CHAG	Christian Health Association of Ghana
CHIM	Centre for Health Information Management
DHIMS2	District Health Information Management System (version II)
DHIS2	District Health Information System (version II)
CHPS	Community-Based Health Planning and Services
GHS	Ghana Health Service
GSS	Ghana Statistical Service
HCFs	Health Care Facilities
HCPs	Health Care Professionals
HIS	Health Information System
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HSs	Health Systems
IPT1	Intermittent Preventive Treatment (first dose)
LMICs	Low-and-Middle-Income Countries
MAT	Management Assessment Tool
MCH	Maternal and Child Health
OBAT	Organisational and Behavioural Assessment Tool
Penta1	Pentavalent Vaccine (first dose)

Penta3	Pentavalent vaccine (third dose)
PNC	Postnatal Care
PRISM	Performance of Routine Information System Management
RHIS	Routine Health Information System
SDGs	Sustainable Development Goals
SOP	Standard Operating Procedure
Td2+	Tetanus–Diphtheria (2 or more doses of the vaccine)
WHO	World Health Organisation

CHAPTER ONE

INTRODUCTION

Healthcare professionals (HCPs) routinely collect large amount of data. Reports indicate that small portions of this are used in the management of health at the facility, district, regional and national levels. To better manage the delivery of health services at all levels, proper data management becomes paramount. This study focuses on assessing the performance of maternal and child health (MCH) data in routine health information system (RHIS) in the Cape Coast Metropolis (CCM), Ghana. The aim is to have an understanding of MCH/RHIS performance at the health facility level in the CCM. The procedures, tools and factors related to MCH data collection, analysis, use as well as flow of information are explored, so as to offer suggestions to improve the systems of routine data collection, analysis and use. The study also identifies the factors that affect the performance of MCH data in RHIS and information use.

Background to the Study

A health system (HS), refers to a network of all the organisation or institutions, people and actions with the primary objective of promoting, restoring or maintaining health (World Health Organisation [WHO], 2007). It is organized at various levels, including: the peripheral (known as primary/community), the intermediate (district and regional), and the central (national) levels (Ghana Health Service [GHS], (2016). The continuous progress towards national health priorities and the attainment of United

Nations Sustainable Development Goals (SDGs) depends on a strong HS. Hitherto, HS strengthening was more focused on disease specific health response. However, in the wake of complex global health environments, many national health systems are putting the spotlight on more comprehensive strengthening mechanisms than focusing on only disease specific health response. Hence, strengthening the HS becomes a priority for many national and global health agenda to improve health outcomes.

The WHO recommends a framework for health systems' strengthening. The framework describes HS with six core components, also referred to as "building blocks" including: health service workforce; health service delivery; health financing; medical products, vaccines, and technologies; governance and leadership; and health information (WHO, 2007). These building blocks either individually or synergistically contribute significantly to the strengthening of any HS. For instance, building blocks such as health workforce and financing provide the key input components for the HS while the immediate output components are derived from service delivery and access to essential products and technology. Likewise, health information system (HIS), and leadership/governance provide the basis for the overall policy and regulation of all the other HS blocks. While each pillar is important in improving HS and ultimately health outcomes, quality information generated from HIS remains the fulcrum of the overall health systems' improvement. Besides, informed/evidence-based decision making in each of the other five pillars is driven by the amount and quality of data that is generated from the HIS (WHO, 2007).

WHO (2011) defines HIS as an integrated effort to collect, process, report and use health information and knowledge to influence policy making, programme action, and research. A robust HIS can, therefore, support the other five building blocks of the HS and eventually, track the attainment of the health-related SDGs (MEASURE Evaluation, 2017). Perhaps, with availability of timely, reliable and quality data, health service managers are able to track, evaluate and improve performance of HS and thereby make sound evidence-based decisions. Hence, the need for Routine Health Information System (RHIS) is imperative now than ever.

Routine health information system is a system for collecting, analysing, distributing and using data provided at regular intervals at the private and public health facilities as well at other peripheral levels of health delivery system (MEASURE Evaluation, 2017). The data are produced through routine mechanisms to address predictable health information needs (Hotchkiss, Diana & Foreit, 2012), and are used for management of health commodities, planning, detecting outbreaks, and monitoring the overall performance of the HS that further maintains the quality of care (Karuri, Waiganjo, Daniel & Manya, 2014). These data, collected by HCPs as they do their routine duties, give a picture of health status, health services, and health resources (MEASURE Evaluation, 2017). Routine health information systems are critical for planning, monitoring, and managing health services (Bhattacharya et al., 2019) at the peripheral levels as they play a key role in the effective and efficient delivery of health services, decision making and improvement of health programs (Nutley & Reynolds, 2013).

The focal area of an effective RHIS is to generate high quality routine health information to make evidence-based decisions (WHO, 2007). The type of information derived from HIS depends on how frequent the information is generated, whether routine or non-routine. Non-routine data such as nationally representative household surveys (e.g., multiple indicator cluster surveys, and demographic and health surveys), provides information over a long period of time and on ad hoc basis to complement the information turned out routinely (Maina et al., 2017). A distinctive characteristic of RHIS is the provision of data at a frequency and level of disaggregation that is rarely possible through nationally representative household surveys (Amouzou et al., 2013; Maina et al., 2017;). Routine health information systems are a potential source of data to generate health statistics and indicators to track national and subnational progress towards universal health coverage and to inform planning and assessments of progress and performance (Maïga et al., 2019).

Global initiatives such as SDGs and Countdown to 2030 further underscored the role of RHIS in monitoring progress and facilitating course correction (Boerma et al., 2018; United Nations, 2015; Victora et al., 2016). Two major maternal and newborn health initiatives, ending preventable maternal mortality (WHO, 2015), and every newborn action plan (WHO, 2014a), have identified strategies to achieve goals for reduced maternal and newborn mortality by 2030 to a global average of 70 per 100,000 live births and 12 per 1,000 live births, respectively. These initiatives identified priority MCH indicators as triggers for progress, with a goal that RHIS (i.e., facility-based data) will contribute significantly to its monitoring (WHO, 2015; WHO, 2014a). However, RHIS data will only be adequate to track progress towards

the MCH services and other national goals when reporting coverage and data quality are consistently high, timely, complete, as well as aggregated into meaningful internationally agreed upon indicators. Data quality is therefore an essential component of RHIS (WHO, 2008).

Data quality is a multi-dimensional concept (Chen, Hailey, Wang, & Yu, 2014; Smerek, 2015) with no single definition used consistently across organisations (WHO, 2014b). For example, it is defined as "conformance to requirements" (Crosby, 1980, p. 15; Crosby, 1979, p. 17); "*fitness for use*" (Tayi, & Ballou, 1998, p. 54; Wand, & Wang, 1996, p. 22; Wang, & Strong, 1996, p. 6); when the information available fits or meets the intended goals of its users (Chen et al., 2014). Several dimensions of data quality have been identified in the literature, including data completeness, data timeliness, data consistency, data accuracy, data reliability, data precision (Ahanhanzo et al., 2014; Chen et al., 2014; Ndabarora, Chipps, & Uys, 2014; Smerek, 2015). Completeness defines "*a measure of the presence of expected data items in a given dataset or collection*" (Wand, & Wang, 1996, p. 23). Timeliness refers to the measures level at which data is current in relation to a specified time (Cai, & Zhu, 2015). Accuracy describes "*the closeness of data values to the truth or the veracity of the information received*" (Chen et al., 2014, p. 2). Consistency is described as the degree to which data remain the same or identical (Thatipamula, 2013). That is to say, if two or more data are compared, there should be no substantive difference in them (Doku, 2018).

Despite the importance quality health data play in healthcare, it has been found that in practice, RHIS data have a number of limitations such as missing values, bias, and computation errors (WHO, 2008). It is common to

observe that RHIS data generated from the healthcare settings are not used for decision making. Several reasons accounts for the low utilisation of data. These may include poor quality of data, weak analysis of data, lack of an information culture, lack of trained personnel in HIS activities (Yarinbab, & Assefa, 2018). Weak data management, communication and utilisation practices of health facilities are reported mostly in developing countries (Kihuba et al., 2014; Mucee, Kaburi, & Kinyamu 2016; Nisingizwe et al., 2014; Teklegiorgis, Tadesse, Mirutse, & Terefe, 2016). Poor RHIS data utilisation at the health facilities were reported in studies from Kenya (Jeremie, Kaseje, Olayo, & Akinyi, 2014; Kihuba et al., 2014; Mucee et al., 2016). Findings from Cote D'Ivoire using Performance of Routine Information System Management (PRISM) framework indicated a 38% overall utilisation of health information at the facilities (Nutley, Gnassou, Traore, Bosso, & Mullen, 2014). Other studies identified poor data management skills, lack of support from management, infrastructure, and migration of trained workers as factors that reduce the management and use of health information at the health facility level (Jeremie et al., 2014; Mucee et al., 2016; Nisingizwe et al., 2014; Teklegiorgis et al., 2016).

Over the past years, countries and development partners have invested heavily to improve data generation and use through the RHIS (Etamesor, Ottih, Salihu, & Okpani, 2018; Maïga et al., 2019). One of such notable development is the introduction of an online health information management system, District Health Information Management System (DHIMS2). This online system replaced the old paper format of data management that was bedeviled with several challenges, including delays in transmitting data to the

next level, lack of in-built capacity to validate and check errors, absence of harmonising all health information systems, culminating in loss of confidence in information for decision making. Thus, DHIMS2 software is uniquely created for integrated health information management which supports several features of information cycles, including data collection, analysis, reporting, quality checks, and multiple levels of data access. From 2010 onwards, several countries began utilising this web-based DHIS2 platform to manage and visualise routine health data, particularly facility-based data (Bhattacharyya et al., 2016). The GHS, recognising the vital role quality data plays in the management of healthcare systems, acquired the DHIMS2 software in 2007. The software has since been upgraded to District Health Information System (DHIS2) in 2012 and reportedly had more than 10,000 users by the end of 2016 (GHS, 2016).

Several advantages have been reported of the DHIS2 application (Jayatilleke, Ganewatta, Amarakoon, Hewapathirana, & Jayatilleke, 2016; Kiwanuka, Kimaro, & Senyoni, 2015; Manya, & Nielsen, 2016). For example, Dehnavieh et al. (2019) examining the strengths and operational challenges of DHIS2, reviewed literature in combination with meta-synthesis of 20 previous studies from eleven countries. Their findings identified 21 categories of strengths and 18 categories of operational challenges of using DHIS2 software. Dehnavieh et al.'s meta-analysis highlighted some strengths in the technical and functional aspects of DHIS2. The technical capabilities of the system include its ability to analyse data properly, generate reports, provide feedback, as well as visualise data. Proper data management was also identified as some of the functional strengths of the system. They also

identified the following operational challenges and concerns that need attention: inadequate and unstable funding; lack of communication infrastructure; absence of appropriate data for reporting adequate and high-quality data; lack of adequate motivation in professionals to use the systems; issues of human resource capacity in terms of knowledge, abilities, and experience, as well as training users on how to operate the system.

In Ghana, sets of health data are collected and reported on a monthly basis using data collection tools at the health facilities. The primary data at health facilities is mostly paper-based using registers, forms and notebooks. Subsequently, these data are collated and summarised to nationally standard designed forms and finally captured electronically into a DHIS2 database (see Figure 1). Thus, three (3) sources of health information are integrated to form the national health information system, namely; daily data collection tools, monthly health facility summary form, and the electronic database, DHIS2. At the facility level, primary sources of maternal data are captured into the maternal health record book (usually with the client), the antenatal register, delivery register, postnatal register, and the Expanded Programme on Immunisation (EPI) tally booklet that captures data on tetanus–diphtheria immunisation for women, as well as Penta1 and Penta3 immunisation for children (Amoakoh-Coleman et al., 2015). Often, the pregnant mother is assigned a unique identification number during registration and her details, including, biodata, parity, haemoglobin level, administration of tetanus–diphtheria, intermittent preventive treatment in pregnancy (IPT) are captured onto the antenatal register. Moreover, deliveries services are recorded in a delivery register (sometimes labelled Returns on Delivery Book or Labour

room admission and discharge book), and postnatal services recorded in the postnatal registers, with the clients' biodata and other indicators. Data on vaccination are captured into the vaccination tally sheet. At the end of the month, data from these sources at the facilities are collated and summarized-mostly by the midwives and community health nurses onto the monthly midwives returns form and monthly vaccination form. Before entries are made in the DHIS2 database, these summaries are reviewed by the head of the facility or validation team. The introduction of DHIS2 in Ghana has brought a lot improvement in healthcare data management, including accessing the uploaded data in real time at the national and regional health management levels (GHS, 2016).

In spite of its successful roll-up, some challenges have been identified with the DHIS2 in Ghana. These challenges, according to Ghana National Healthcare Quality Strategy Report (Ministry of Health, 2016), include among others, poor data and monitoring systems to support evidence-based decision making and to track performance in priority areas. The report recounts that close to 60% of data from the health facilities especially those from the private facilities that are entered into the DHIS2 software are not done in a timely manner. They further reported that many of the private health facilities do not report their routine data into the DHIS2 software. To overturn this limitation, the Ministry of Health is collaborating with Health Facilities Regulatory Agency (HEFRA) to encourage the private health facilities to employ the services of health information personnel that support improved data collection, entry and abstraction (Ministry of Health, 2016). These efforts are likely to improve health care provision and patients' outcomes such as MCH services.

Maternal health is the health of women during pregnancy, childbirth and the postpartum period (WHO, 2011). Coverage of MCH interventions is among the most commonly used measures to monitor the implementation of health programmes at both national and sub-national levels (Maina et al., 2017). They form part of the indicators for determining the coverage, effectiveness, and efficiency of every healthcare system. Data on MCH determines the health status of the current and future generation and predicts the future public health concerns of families, communities and the overall health system. Maternal and child health data are, therefore, considered vital information that should be collected into RHIS. It is critical that this area get quality and timely data if proper services are to be provided.

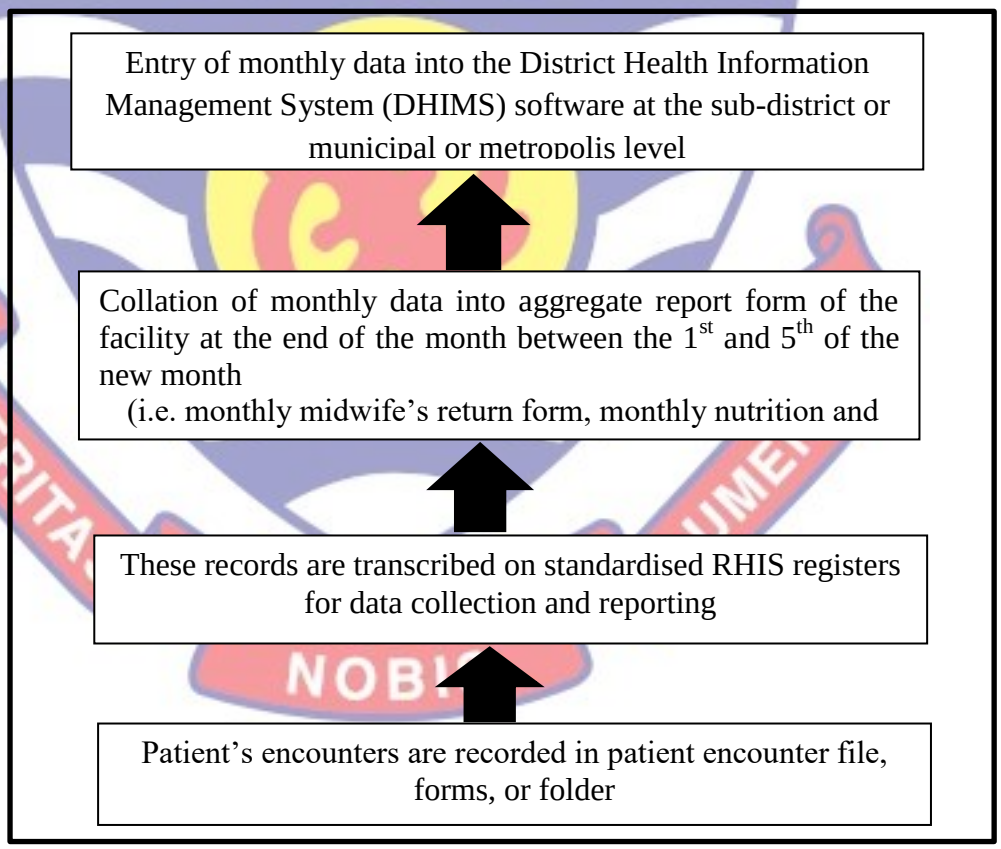

Figure 1: Flow chart of MCH data from folders to the DHIS database

Notwithstanding the critical role RHIS plays in the management of HS at every level, it has repeatedly been reported to be riddled with problems

(Mucee et al., 2016; Nisingizwe et al., 2014; Teklegiorgis et al., 2016). Evidence suggests lack of data quality in the system (Gebrekidan et al., 2012; Tadesse et al., 2014). Not only have the records suffered incompleteness and poor quality, there is also a tendency to over-report the outputs and outcomes. Irregularities in reports generation, data duplication and data inconsistencies, at all levels of healthcare delivery extending from facility's level to district and national level, are commonly observed and reported (Sharma, Rana, Prinja & Kumar, 2016). However, there is no robust analysis to assess the extent of these irregularities in the data in Ghana. Further, a careful look into the DHIMS2 database revealed several components that serve different purpose, including data quality check component for checking the quality of routine data entered into the system. This function allows for various types of quality checks such as validation rule analysis, standard deviation outliers analysis, minimum-maximum outliers analysis, and follow-up analysis. However, the function had not yet been activated and utilised. Besides, given its current form, even if the component is activated, the systems will be unable to determine the accuracy of a value that has been entered into the system. The implication of this development is that there is no means of checking data quality in DHIS2. Perhaps, a way to know how much confidence we could place in the data generated from DHIS2 is to conduct data quality assessment by comparing data from the facility's registers and forms with that of DHI2 database.

Again, a number of studies have assessed the quality of RHISs in low-and-middle-income countries (LMICs) and have identified several organisational, behavioural and technical factors affecting the quality of data

that are generated and subsequently used in planning and making decision in health (Ahanhanzo et al., 2014; Dehnavieh et al., 2019; Hotchkiss et al., 2012; Hoxha, Hung, Irwin, & Grepin, 2020). For instance, at the organisational level, inadequate governance and management, lack of training, supervision and resources, and the failure to promote a culture of data use can hinder the collection and use of high-quality data (Leon et al., 2015; MEASURE Evaluation, 2019). Further, at the behavioural level, poor knowledge of the rationale for RHIS activities, poor motivation, and competency among health workers impede RHIS performance (Leon et al., 2015; MEASURE Evaluation, 2019). Lack of knowledge, skills, and specialised technical infrastructure have also been identified as some of the technical challenges (MEASURE Evaluation, 2019). These challenges often render RHIS data unreliable and irrelevant, impede their usefulness in practice, and contribute to the continued preference for intermittent cross-sectional population-based research as the primary source of data for tracking population health, risk factors, and health service coverage (Wagenaar, Sherr, Fernandes, & Wagenaar, 2016).

Given that strong RHISs that capture, store, manage and transmit health information are necessary for improving the quality of healthcare in LMICs, as well as for tracking progress towards achieving targets such as those outlined in the SDGs (Thomas, Silvestre, Salentine, Reynolds, & Smith, 2016), a greater understanding of the factors that contribute to the effective use of RHIS data is required. This has underpinned this research to assess the performance of MCH data in RHIS, in terms of its quality and information use. Consequently, this research assessed the level of MCH data completeness,

accuracy, timeliness, and consistency in RHIS as well as its associated factors in the CCM.

Statement of the Problem

There has been a surge for data at all levels of healthcare delivery system following the endorsement of *Transforming our world, the 2030 agenda for sustainable development* (Winkler, & Williams, 2017), with its sustainable development goals (SDGs). Particularly for populations with higher risks of disease and mortality, such as, pregnant mothers, infants and children, the demand for high quality data is even more crucial (Alhassan et al., 2019; Gopal, 2019; Guo et al., 2019; Muheirwe, & Nuhu, 2019). This surge places pressure on national monitoring and reporting systems, especially in the LMICs (Farnham, Utzinger, Kulinkina, & Winkler, 2020), consequently, necessitating the need for robust routine health information management practice in the provision of healthcare (WHO, 2017). The purpose of RHIS is to systematically collect quality data to effectively track and manage the needs and health status of the population as well as help decision-makers to plan, allocate resources, and prioritise services that will significantly impact the society (Mucee et al., 2016; Nisingizwe et al., 2014). However, data from the RHIS has often been reported as unreliable and inconsistent in many LMICs (WHO, 2017), which may jeopardise their effectiveness in achieving health targets both at the national and sub-national levels (Ouedraogo, 2018).

Efforts had been made in Ghana to improve the collection and management of health data at the national and sub-national levels. One of such efforts is the introduction of DHIS2 software to collect and collate routine

health data from the peripherals to the national level. Notwithstanding the touted prospects of DHIS2 following its introduction as a game changer in better standardisation of data collection, leading to improvements in data quality, persistent data quality issues still exist (Maïga et al., 2019). Similar efforts had been made over the years to improve the data collection in RHIS. The 2016 annual report of the GHS, for example, reported a number of feats in the area of health information management, including a new health sector reporting portal (the Ministry of Health Information Exchange), developed by Centre for Health Information Management (CHIM); distribution of the third edition of the standard operating procedures (SOP) on health information to all the health facilities across the nation; and DHIS2 e-tracker modules for Tuberculosis, HIV/AIDS antiretroviral treatment and MCH services comprising family planning, delivery, antenatal and postnatal care. Despite these interventions, there still exist issues related to RHIS data management, analysis, quality, and utilisation (Doku, 2018), endangering the usefulness of RHIS to monitor progress in health and development in Ghana.

A major problem of the RHIS in LMICs like Ghana gyrates round nurses who are confronted with managing patients and collecting data in the line of their work. They have multiple tasks including the primary medical duties that may conflict with the time dedicated to the collection of data. They may prioritise patient care over the collection of data. Thus, collection of data may take place several days after the event, and this delay may affect the quality of information produced. Another problem is that stacks of records and tally sheets must be compiled and summarised at the level of the facility and sent to sub-district level. Staff involved in data collection are more often not

trained and may not understand the importance of the data they collect and may even lack the competencies to check the quality of data they generate. This situation could potentially compromise the quality of data in RHIS used for decision making. The WHO (2017) report, for example, suggests that the use of data generated from RHIS is often ignored and the use of data to make evidence-based decisions is still very weak in most LMICs. Also, Nicol, Bradshaw and Dudley (2012) pointed that RHIS data are unreliable and the methods of data collection are not complete.

Additionally, it has been observed that technical infrastructural issues such as poor internet connectivity and unreliable electricity impact the management and use of RHIS (Ndabarora et al., 2014). Ndabarora et al. further identified limited computer availability of reporting sheets, lack of training policies and guidelines, absence of supervision and feedback from senior level, and competences of health workers, as major obstacles to the use of RHIS. Relatedly, lack of registers and forms for outpatient care, antenatal care (ANC), and family planning users were identified by Karengera, Anguyo, Onzima, Katongole and Govule (2016). On the part of HCPs, Manya, and Nielsen (2016) reported challenges in counting from registers and tally sheets, inability to understand the indicators, problems in filling records, and inability to plot graphs to monitor progress and performance, as some technical issues for data quality in RHIS. Other RHIS data quality issues were identified in terms of their completeness, accuracy, and timeliness, resulting in low utilisation of these data in decision making processes (Ahanhanzo et al., 2015; Manya, & Nielsen, 2016; Ndabarora et al., 2014; Nisingizwe et al., 2014). In the case of DHIS2, the data is first collected in paper format (registers and

standardised forms) at the facility level before it is transferred into DHIS2 mostly at the sub-district and district level. This situation presents the possibility for transcribing errors, especially if the data was collected in non-conducive atmosphere.

It is evident from the foregoing that no health data from any source could be considered perfect (WHO, 2017). All data are subject to some quality limitations such as missing values, bias, measurement error, and human errors in data entry and computation (WHO, 2017). Yet, high quality data is needed to monitor and evaluate programs in LMIC striving towards universal health coverage. Data quality assessments should, therefore, be undertaken to understand how much confidence could be placed in such data that are used to assess health sector performance and to understand the relative strengths and weaknesses of the data sources (WHO, 2017). It appears no much attention is paid to this phenomenon especially, in Ghana. For example, by the end of 2012, about twenty-three (23) countries throughout the world, excluding Ghana, applied the PRISM tools to evaluate the performance of their RHIS at different levels and to guide the RHIS strengthening process (Belay, & Lippeveld, 2013). Additionally, data quality evaluation mechanisms have been used by researchers to assess the quality of facility health data (WHO, 2017). Unfortunately, these studies had used fewer data quality attributes (Achampong et al., 2018; Amoako-Coleman et al., 2015; Doku, 2018), and had either considered only the private or the public facilities using either survey or checklist. In addition, these researches failed to identify the determinants of data quality. Further, MEASURE Evaluation (2019) defined RHIS performance in terms of data quality and information use. However,

past researches in this area only focused on one aspect, data quality, without considering information use (Achampong et al., 2018; Amoako-Coleman et al., 2015).

No research in Ghana has specifically focused, to the best of my knowledge, on the performance of MCH data in RHIS, taking into account data quality and information use. MCH data are critical to understanding progress towards achieving SDGs and universal health coverage (Alhassan et al., 2019; Gopal, 2019; Guo et al., 2019; Muheirwe et al., 2019; Rajia, Sabiruzzaman, Islam, Hossain, & Lestrel, 2019). Having recognised the vital role quality data collected on populations where the risk of morbidity and mortality such as pregnant women, new-borns and children is higher, this research evaluates the quality of MCH data in RHIS and information use in CCM, focusing on data quality dimensions proposed by the WHO (WHO, 2014b). Also, technical, organisational, and behavioural issues affecting MCH data quality and information use in RHIS are determined using the PRISM framework.

Purpose of the Study

The purpose of this study was to assess the performance of MCH data in RHIS with the view to establish an understanding on current status of MCH data among healthcare facilities (HCFs) in CCM. This study also sought to identify the technical, organisational, and behavioural factors that contribute to MCH performance.

Objectives of the Study

The following objectives provide a guide for the study:

1. To assess the level of RHIS performance (MCH data quality and information use) in the HCFs at the CCM.
2. To assess the functionality of MCH/RHIS processes in the HCFs at the CCM.
3. To assess the technical, organisational, and behavioural factors of MCH data quality and information use in RHIS in the HCFs at the CCM.
4. To determine how organisational factors (promotion of culture of information, reward system, supportive management, and resources availability) affect behavioural factors (self-efficacy, and motivation).

Significance of the Study

1. Often, data from the RHIS have been reported as unreliable and inconsistent in many LMICs (Ouedraogo, 2018), which may jeopardise their effectiveness in achieving health targets both at the national and sub-national levels. Meanwhile, the demand for high quality data is more crucial for populations with higher risks of disease and mortality, such as, pregnant mothers, infants and children. Therefore, the findings of this research would provide decision makers with information on how much confidence to place in the quality of data they are relying on to make decisions.
2. Managers of healthcare in the CCM will have first-hand information of the identified gaps in data management practices which need to be addressed to have quality data for health service planning and

management. This provides feedback that would influence and shape strategies on data quality processes in RHIS in HCFs at CCM.

3. Practically, this research contributes to the effort of creating conducive RHIS environment for effective and efficient MCH care delivery in the facility.
4. Findings from this study would improve RHIS performance that would support improved health management, enhanced RHIS information use in internal management, and to enhance credibility in reporting to external agencies in order to remove obstacles and improve performance in health data management practices in CCM.
5. The findings could help health administrators and other stakeholders reflect on performance of RHIS in general, as well as identify the factors affecting RHIS performance to inform remedial actions.
6. Results of this study will enable HCPs adapt to a culture of information use in achieving routine activities to maximize the effectiveness and efficiency of the work.
7. Results of this study can also serve as a good starting point to initiate data quality and information use improvement in other RHIS performance.
8. This study provides the foundations of sound monitoring/assessment of MCH indicators and the decisions that can be made from this assessment.

Delimitation

1. The study was delimited to using descriptive case study to assess the status of RHIS performance (MCH data quality and information use), and its determining factors, as well as the functionality of MCH/RHIS processes.
2. Again, the study was delimited to thirteen HCFs providing MCH in the CCMA. The study was further delimited to eight MCH indicators to assess data quality, and did not consider indicators beyond MCH.
3. The study was further delimited to surveying HCPs in CCM providing MCH services. Moreover, only HCPs working one year and above and were present at their facilities during the data collection took part in the study.
4. The research was delimited to identifying the technical, organisational, and behavioural issues from HCPs perspective.

Limitations

I envisage that the results, findings and conclusions of this research may have limited external validity beyond CCM, although very relevant for the Metropolis. Therefore, making generalisation based on the results of this study will be a limitation. In particular, the characteristics and perception of HCPs who answered questions on factors affecting performance of MCH data in RHIS may not be a representation of those of the entire region and nation.

Definition of Terms

Data: Stream of facts representing things or services provided in the HCFs.

Data Accuracy: Data representation (or value) well reflects the true state of the source document. Documentation reflecting the event as it actually happened.

Data Completeness: A measure of the presence of expected data items in a given dataset or collection. Having all required data present.

Data Consistency: It is described as the degree to which data remain the same or identical during a certain time. It describes whether the logical relationship between correlated data is correct and complete.

Data Quality: Data that is complete, accurate, timely, and consistent, or data that correctly represent the real-world construct to which they refer.

Data Timeliness: Data from the healthcare facility transmitted to the next level within a specified time (5th of the ensuring month).

Determinants/Factors: The factors guiding or limiting the performance of MCH/RHIS data.

Health Information System: A set of component and procedures organized with the objective of generating information which will improve health care management decisions at all levels of the health system.

Information: Quality data collected and processed for use.

Maternal and Child Health Data: Unprocessed facts gathered on services provided to mothers and children.

Maternal and Child Health: Health services provided to mothers and children

Organisational factors: It relate to organisational structure, resources, procedures, support services, and culture to develop, manage and improve RHIS processes and performance.

Routine Health Information System: Heath data collected on regular interval on health status and resources.

Technical Determinants: Factors that are related to the specialised know-how and technology to develop, manage and improve RHIS processes and performance.

Verification Factor: A summary indicator that measures the ratio of the number of recounted events from source documents to the number of reported events over the same period.

Organisation of the Study

The study is organised under chapters one, two, three, four, and five. The first chapter gave the background to the study, statement of the problem, purpose of the study, research questions, significance of the study, delimitations, limitations, and definition of terms. Chapter two focuses on review of relevant literature on the research framework. Chapter three deals with the research methods, highlighting the research design, study area, the population, sampling procedure, data collection instruments, data collection procedure, processing and analysis. Whereas the fourth chapter details the results and discussions, chapter five covers the summary, main findings, conclusions, and recommendations.

CHAPTER TWO

LITERATURE REVIEW

The purpose of this study was to assess the performance of MCH data in RHIS with the view to establish an understanding on current status of MCH data, as well as identify the technical, organisational, and behavioural factors that contribute to MCH performance among HCFs in CCM. This chapter therefore reviewed literature relevant to this purpose. In particular, the review examined the definition of data and information, health information, health information systems including its components. In addition, the chapter examined the empirical and theoretical underpinning for this research. Two important frameworks for evaluating RHIS: PRISM, and Routine Data Quality Assessment (RDQA), are also covered in this chapter. Particular emphasis is put on the growing literature on the PRISM framework used in various country and regional contexts, that is, RHIS performance, processes of RHIS, RHIS determinants, RHIS evaluation tools. Based on the theoretical underpinnings, a conceptual framework was developed.

Data, Information and Knowledge

Data, information, and knowledge are terms that are mostly used interchangeably. The debate over the relationship between these three terms continues to evolve as new forms of representation emerge (Daniel, 2018). However, a conceptual difference exists among them. Data are a stream of facts representing things or events that have happened in the real world (Wand, & Wang, 1996). They represent items mostly referred to as data

elements, which have not been interpreted, such as an individual's height (Nelson, 2019). It would be impracticably difficult to interpret the significance of just a value for height. To make meaning and interpret the significance of this value, it would be necessary to add other data elements such as weight, sex, age, overall well-being of the individual (Nelson, 2019). Information on the contrary, is a set of data elements that has been organized and processed such that interpretation and significant meaning can be derived from such data elements (Nelson, 2019). For instance, to calculate the Body Mass Index (BMI), data elements such as weight, height, age and gender can be used. The BMI indicates whether an individual is of normal weight, is underweight, overweight or obese based on some predetermined values. Information is, therefore, data processed into structured form to make it meaningful and useful. Knowledge is produced when information is applied in a specific context. It involves the combination of rules, relationships, ideas, and experience (Wand, & Wang, 1996).

Health Information

Health information refers to data about an individual's medical history, which includes the symptoms, diagnoses, procedures, treatment and outcome (Wyatt, & Sullivan, 2005). Patient history, laboratory results, x-rays, clinical information and progress notes form part of the health information record. Health information can either be viewed individually or as aggregated. It is viewed individually to see how the health of the individual has improved, and viewed as part of a broader set of data to understand how the health of a population has changed and how medical interventions can change health outcomes. It refers to health data structured in a meaningful format, such that

the data can be understood and retrieved, when necessary, regardless of the level of aggregation (Cabitza, & Batini, 2016; Davis, & LaCour, 2014).

Health Information System

It is a system designed to manage health data. It involves the systems that coordinate data that relate to the activities of healthcare providers and health organisations. It also includes systems that collect, store, process, manage and disseminate electronic medical record of a patient and administrative record management of a health facility (Brook, 2019). Information generated from health information systems (HIS) can in turn be used for research to drive policy and evidence-based decision-making, and improve health outcomes and status ultimately (Levin, 2019). Health information systems are the foundation for sound decision-making in healthcare and have the following key functions: data collection, compilation, analysis, dissemination, and use (WHO, 2010). The primary objective of any HIS is to promote the use of information that would support decision-making at all levels (WHO, 2010). However, achieving this objective depends on activities for developing, implementing and maintaining the system (Mimi, 2015). There are basically two types of HIS: patient-based clinical HIS and routine health information systems (Thorseng, 2008).

Increasingly, RHIS are regarded as an important mechanism for health system strengthening (Hotchkiss et al., 2012; Wickremasinghe, Hashmi, Schellenberg, & Avan, 2016), and are central to health services planning and management at the peripheral to the district level. RHIS refers to "any system of data collection, distribution, and use that provides information at regular intervals" (Hotchkiss et al., 2012). Here, data are gathered at regular intervals

in health facilities and organisations at the public, private and community level (Belay, & Lippeveld, 2013). The data provide an overview of the health resources, health status, and health services within a population and represent rich information sources, vital for informing decision-making at all levels of the health system, including resource allocation, day-to-day management, strategy development and policy-making (Leon et al., 2015; Wagenaar et al., 2016). Health care providers collect most of the data often about individual's health status when they perform their routine task (Belay, & Lippeveld, 2013). The WHO (2007) considers RHIS as an integral component of any health care system as it provides the context for effective and efficient data collection, analysis and reporting of health information. They play a significant role in reporting and improving the services at the various levels of the health system (Belay, & Lippeveld, 2013). Their introduction seeks to enhance the administration of health care by constantly gathering information on the provision and use of health services in health facilities.

Robust RHIS is a prerequisite for evidence-based decision making in the HCFs and at the district levels of the healthcare system (Belay, & Lippeveld, 2013). Relevant patient information accessible to healthcare providers help them to align the needs of the patient to available services and treatment. Additionally, program managers are able to access data to direct daily operations, monitor performance, learn from past outcomes and improve performance (Belay, & Lippeveld, 2013). This could possibly lead to proper channeling of limited resources.

Health Information System Components

The framework for health metrics network (HMN) described HIS as consisting two key components, namely: the normative, and implementation components (WHO, 2008). Whereas the implementation component outlines a roadmap for strengthening HIS, the normative component, on the other hand, defines the standards and evaluation criteria relevant to HIS inputs, processes, outputs and outcomes. The normative component, according to the HMN framework, consists of six building blocks, including HIS resources, indicators, data sources, data management, information products, and dissemination and use (WHO, 2008). These building blocks define the key components and requirements for a country's HIS. It sets standards for each of the component as well as describing the data management, transforming data to information, dissemination of these information and its eventual use (WHO, 2008). It determines components that fundamentally constitute a HIS and how these components communicate to generate accurate information for evidence-based decisions leading to better health outcomes (WHO, 2008). These components are put into three groups: inputs, processes and outputs (see Figure 2). Inputs describe the HIS resources, both physical and structural that are required to build a strong HIS; processes define the indicators, data sources, and data management; and outputs describe information products as well as its dissemination and use (WHO, 2008).

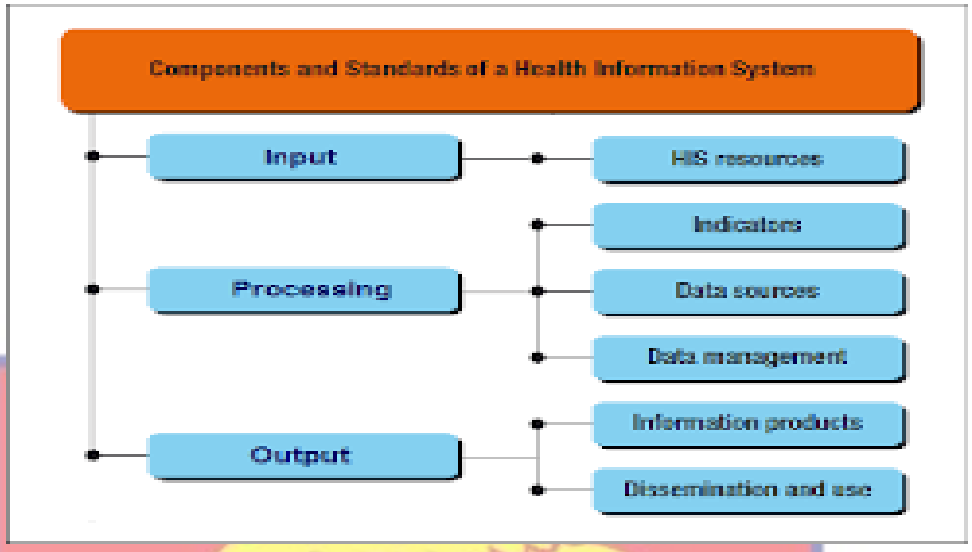

Figure 2: HMN components and standards of a HIS (WHO, 2008)

Health information system resources

Health information systems' resources refer to the regulatory, legislative and planning frameworks needed to ensure optimal operation of the HIS, together with the resources (such as, technical skills, logistics, information and communication technologies) which are prerequisites for the functioning of such a system (WHO, 2008). Health information system resources, thus, focusses on HIS, leadership and coordination; information policies; human and financial resources; and infrastructure, required to ensure a fully functional HIS (WHO, 2008).

HIS leadership and coordination. The development and robustness of any HIS depends largely on the function and interaction of certain key departments and institutions (WHO, 2008) such as health information department of the ministry of health, disease surveillance department, and the statistical departments, whose mandate is to design and support data collection, storage, processing, reporting and dissemination. To have an effective and efficient HIS, there is the need to put in place a team of experts drawn from both health and statistical departments who are responsible for

designing and managing the HIS as well as ensuring dissemination of information across programs and organisations (WHO, 2008).

HIS information policy. It refers to the regulatory and legal framework in which health information is produced, outlining the processes that should be established to ensure a fully functioning HIS as well as mechanisms for ensuring accessibility, exchange, quality and data sharing (WHO, 2008). The regulatory and legal requirements are especially important when it comes to the capacity of HIS to rely on data emanating from private and public health services as well as those coming from non-health sectors (Mimi, 2015). More often, private health facilities are reluctant to submit RHIS to the relevant authorities on statistics of the health status of the people who sought medical treatment from them (Asiimwe, 2016). Therefore, particular attention needs to be paid to these issues to ensure that private HCFs are part of the HIS of the country. The presence of a legal and policy systems in accordance with international standards increases confidence in the credibility of the information generated for decision making and planning (WHO, 2008).

HIS finance and human resources. Health information professionals at the peripheral level are responsible for collecting, recording and analysing data. At the national level, services of other professionals such as the statisticians, epidemiologists, demographers, are needed to ensure accurate analysis and improve data quality (WHO, 2008). Special attention is given to human resources development, including training, targeted capacity development, educational schemes, reward and career growth at all levels to achieve optimal improvement in HIS and consequently, better health outcomes

(WHO, 2008). It is also important to institute appropriate renumeration packages to HIS staff to motivate and reduce attrition (WHO, 2008).

HIS infrastructure. Health information managers should have access to ICT infrastructure including computers, fully integrated web-connected and email services at the facility through to the national level. Information technology can have an effect on improving the quality of the data collected and can increase the timeliness, analysis and use of information (WHO, 2008). There is also the need to equip both the national, regional and district health directorate with communication equipment and transport to assist in the timely collection and compilation of data at the facility level.

Health information system indicators

Indicators refer to measures put in place to monitor improvements in the health profile of a country, in terms of, health determinants, health systems and health status (WHO, 2008). Health determinants indicators refer to the demographic, socio-economic, environment and behavioural risk factors (WHO, 2008). Health systems indicators refer to inputs and associated processes, including organisational policies, human and financial resources, infrastructure, equipment and supplies (WHO, 2008). Also, in the health system are the output indicators that describe availability of information as well as quality of health services. Indicators such as levels of morbidities, mortalities, disabilities and well-being measure health status. These indicators depend largely on the effectiveness and coverage of the interventions and health determinants that may impact health outcomes independently of health service coverage (WHO, 2008). It is important to have a generally well-defined minimum set of core health indicators that are routinely used in the

planning, monitoring and assessment of national programmes (WHO, 2008). The indicators should be reliable, precise, accurate, sensitive and easy to measure (Mimi, 2015).

The information system for healthcare is not confined to the health sector alone. There is a strong link between this system and the other sectors' information systems. Hence, HIS should provide data for different needs, including information on service delivery to individual clients, statistics to support health services planning and management, and indicators for health policy formulation and assessment (WHO, 2008).

Health information system data sources

Data from the HIS are either population-based (created directly from populations) or institution-based (e.g., healthcare services) (WHO, 2008). Population-based sources include population surveys, civil registration and census. Institutional-based sources focus on individual records, health services records, and resources records. An efficient HIS collects data from these sources and transforms it into information that can easily be accessed and used. The choice of the most suitable source of data depends on certain considerations. These include availability of resources (financial, and time), the type of information needed, the human and technical skills necessary to collect, manage and disseminate data (Mimi, 2015).

Health information system data management

The major medium of generating routine health data in most developing countries is paper data recorded and collected through registers, cards, aggregation or reporting forms (WHO, 2008). Data management refers to a set of procedures employed during data collection, storing, analysis and

transmission (WHO, 2008). Accurate and comprehensive data collection is a necessary prerequisite and a basic technique of data management plan (Mimi, 2015). Once data is collected and stored, it must be processed and compiled in such a way that it can easily be compared with information from other sources. This will ensure data is not duplicated, errors are identified and corrected, and increase confidence levels in using the data for decision-making (WHO, 2008).

Information products

This refers to data that has been transformed into information that decision makers can use to improve health care (WHO, 2008). Data are HIS raw products. Not until it is processed to become information, it has little intrinsic value. Information is much more valuable, especially when it is combined with other information and evaluated in terms of the problems of health system (WHO, 2008). The synthesis of evidence becomes more valuable when the information is formatted for presentation and communication to decision makers in a way that changes their view of health issues. Information at this point becomes evidence that decision-makers can use.

Dissemination and usage

Information is used for health service and system management, planning, advocacy and policy development at different levels of the health system (WHO, 2008). Each level has a wide range of users from different technical backgrounds and careers. A key function of HIS is to be able to link data output with its use (Mimi, 2015). Dissemination of information should be planned in accordance with each user's specific characteristics, where the

highest effective information transmission packaging and communication channel should be identified (Mimi, 2015).

Frameworks for Evaluating Routine Health Information Systems

There are different frameworks for evaluating RHIS. Two of such frameworks are discussed below, thus, Routine Data Quality Assessment, and Performance of Routine Health Information System.

Routine data quality assessment

The RDQA tool developed by the MEASURE Evaluation was designed to build data quality capacity and allow self-assessment of data quality in the health programs (MEASURE Evaluation, 2008). The tool provides a platform for evaluating data quality as well as strengthening the reporting and data management systems through the assessment of the various dimensions of data quality and the functional components of the data management system needed to ensure data quality (MEASURE Evaluation, 2015). The primary focus of RDQA tool is to determine the quality of reported data and also evaluate the underlying data management and reporting systems for standard indicators output at the program level. The tool seeks to promote three main activities that are essential to improving data quality: verify the data quality, evaluate the system producing the data, and develop measures to improve data quality verification (MEASURE Evaluation, 2015). It employs both quantitative and qualitative approaches to measure the quality of data in RHIS. The tool which can be used in its original form or modified to meet specific needs of users uses a two-pronged approach to determine data quality with respect to data verification/validation, and system assessment. Data verification employs a quantitative approach in verifying the values reported

against the values in the source documents. The purpose of data verification is to determine whether facilities are collecting and reporting data accurately, completely, and timely (MEASURE Evaluation, 2015). The systems assessment relies on a qualitative method for the evaluation of data management and reporting systems at administrative levels (MEASURE Evaluation, 2015). The purpose of assessing the data management and reporting system is to identify potential threats to data quality posed by the design and implementation of data management and reporting systems (MEASURE Evaluation, 2015).

The RDQA has been used in different countries to evaluate the quality of data in RHIS (Abah, 2012; Ahanhanzo et al., 2015). Abah (2012) used both the approach of data verification and system assessment to measure the quality of HIV data, and reported poor quality data in Nigerian ART clinics largely due to the late data submission from the health facilities and the high staff turnover rate of the facility. Again, consistency of immunisation data was examined using verification approach in Tunisia were reported third dose of Diphtheria-Tetanus-Pertussis (DPT3) values were compared with data found in the registers in the health facilities and districts (Chahed, Bellali, Alaya, Ali, & Mahmoudi, 2013). Large discrepancies were observed in the values of DPT3 found in the registers and summary forms of the facility and the district summaries (Chahed et al., 2013).

Performance of routine health information system

The PRISM framework is one of the most widely used health information system frameworks for evaluation of performance of RHIS. It is an approach to developing, improving and evaluating RHIS (Aqil, Lippeveld,

& Hozumi, 2009). The PRISM framework consists of inputs, processes and outputs which has an effect on the performance of the health system and thus leads to better health outcomes (Aqil et al., 2009). The framework describes performance of information systems using two criteria: improved data quality, and continuous use of information for decision making (Aqil et al., 2009; MEASURE Evaluation, 2019). It hypothesises that improved HIS performance leads to better performance of the health system, which in turn leads to improved overall health status. The major determinants of RHIS performance are categorized as inputs (technical factors, behavioural factors, and organisational factors), and RHIS processes (see Figure 3). The framework argues that the performance of RHIS is influenced by its processes, which are also influenced by the RHIS input. The RHIS processes such as data collection, transmission, analysis, data quality checks, display and feedback are argued to have an effect on performance of the health system (Aqil et al., 2009). The framework also examines the relationship between technical, behavioural and organisational factors on the processes and the performance of RHIS. It provides an opportunity to find out whether the factors act directly or indirectly through behavioural factors or processes or through an interaction with each other to affect the performance of RHIS (Aqil et al., 2009).

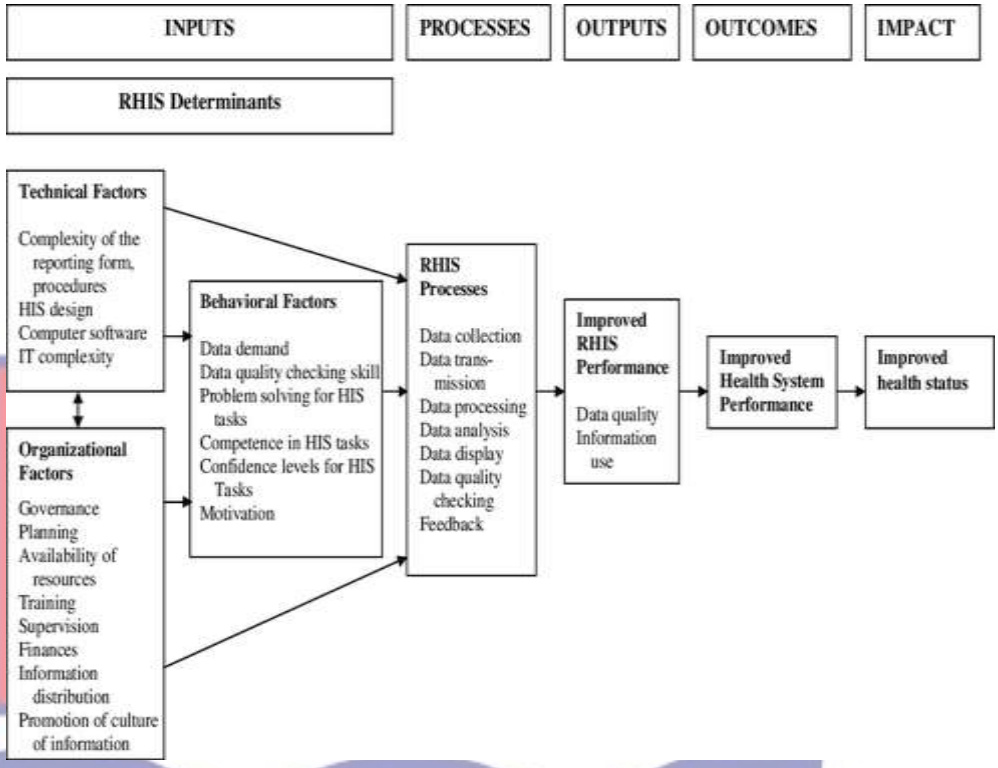

Figure 3: Theoretical framework of PRISM (Aqil et al., 2009)

Performance of routine information system tools

The PRISM framework employs various tools, including the RHIS Overview Tool and Facility/Office Checklist; Performance Diagnostic Tool; Organisational and Behavioural Assessment Tool (OBAT); and Management Assessment Tool (MAT), to assess the RHIS performance output, processes and determinants as well as their relationships. In 2019, the MEASURE Evaluation with the support of United States Agency for International Development (USAID) updated the PRISM tools to include *electronic RHIS performance assessment tool*, and separated the *overview tool* from the facility checklist (MEASURE Evaluation, 2019).

Facility/Office checklist. This checklist measures the availability and status of resources (such as, utilities, equipment, information storage, capacity of communication, and RHIS registers and forms) at the supervisory level required for RHIS implementation. The specific use of the checklist includes:

evaluate and track resource availability over time, take managerial decisions to stock up resources, and develop guidelines to fix resource issues (MEASURE Evaluation, 2019).

RHIS overview tool. This tool examines the technical determinants, such as the structure and design of existing HIS, information flows and the interaction of various information systems. It examines the extent of fragmentation and inefficiencies in the RHIS and helps to address issues of data integration and use. The tool covers three broad area: data collection, information system mapping, and information flow (Aqil et al., 2009). The data collection lists the tools for capturing data (registers, forms, electronic data records) at the facility, how it was introduced and the type of information that is collected. Information system mapping catalogues the information systems and data transmission mechanisms present at the various levels of the health system, how it was introduced and the type of information that is collected (Aqil et al., 2009). Lastly, information flow shows how and when information flows, its overlap, and the burden of information and function across different levels of the health system (MEASURE Evaluation, 2019).

Performance diagnostic tool. The overall level of RHIS performance is measured by this tool - level of data quality, and information usage. The tool quantifies the level of data quality including, completeness, accuracy and timeliness of reporting. It also measures the status of information use in the areas of access to RHIS data, availability of analysed data and use of RHIS data to monitor and plan health services. Issues of data processing and processes for information use are also identified (MEASURE Evaluation, 2019). It also collects technical and organisational factors such as: guidelines

for reporting and defining the indicators; complexities of data collection methods and reporting forms; and the existence of data quality assurance mechanisms, mechanisms for using RHIS data, and for monitoring and feedback (MEASURE Evaluation, 2019).

Electronic RHIS performance assessment tool. This tool looks at the user-friendliness as well as the features of the technology used to generate, process, analyse and use routine health data. The tool aims at analysing an electronic RHIS (eRHIS) used primarily to collect and process aggregate routine health data (MEASURE Evaluation, 2019). It evaluates both system functionality (how well an eRHIS performs the task it was originally designed to perform) and system usability (how well eRHIS can be used by workers to specific task (MEASURE Evaluation, 2019).

Management assessment tool. The purpose of this tool is to take stock of management practices of RHIS and also encourage development of interventions for better management. It evaluates various functions of RHIS management such as governance, planning, training, finance, supervision, and use of tools for performance improvement. It also recognises the ineffective RHIS management functions and set action goals. Lastly, it performs a comparative analysis to appreciate the effect of management function on performance of RHIS, promotion of information culture, and the behavioural factors (MEASURE Evaluation, 2019).

Organisational and behavioural assessment tool. This tool identifies the behavioural and organisational factors affecting performance of RHIS. The purpose of this tool is to determine whether the organisational structures for achieving the desired RHIS performance results are in place. It also

investigates the level of information culture in the organisation, and also identifies upper management's commitment and support to improve an information system. It quantifies the confidence, knowledge, motivation and competencies of health workers to perform RHIS tasks (MEASURE Evaluation, 2019).

Considerable efforts have been made over the past years to promote the use of PRISM tools in different countries (Mimi, 2015). By the end of 2012, twenty-three (23) countries throughout the world applied the PRISM tools to evaluate the performance of their RHIS at different levels and to guide the RHIS strengthening process (Belay, & Lippeveld, 2013). A comprehensive national health institution-based assessment of RHIS was carried out in 13 of these countries. Eighteen of the countries adopted all the four (4) PRISM tools while four (4) countries selectively adapted and applied the tools (Belay, & Lippeveld, 2013). Performance diagnostic tool, for example, was applied in Timor Leste and Rwanda, whilst Mexico applied the organisational and behavioural assessment tool (Belay, & Lippeveld, 2013). Additionally, partnerships have been created in several countries to develop and implement PRISM framework training courses in institution of higher learning such as the universities, including African Centre for Higher Management Studies (CESAG) in Senegal, National School of Statistics and Applied Economics (ENSEA) in Côte d'Ivoire, National Institute of Public Health (INSP) in Mexico, and the University of Pretoria (South Africa). The purpose of these courses is to build capacity and skills in PRISM tools for improvement in the performance of RHIS. Again, Pan American Health Organisation (PAHO) has used the PRISM tools to train individuals in the Eastern Caribbean Countries

(Belay, & Lippeveld, 2013). Other institutions such as John Hopkins University (JHU) incorporated PRISM framework as a key component of the health informatics programme (Belay, & Lippeveld, 2013). Many past researches in assessing performance of RHIS have also used PRISM tools (Abdisa et al., 2022; Boadu, 2015; Mimi, 2015; Murai, Ventura, & Gaite, 2022; Ouedraogo et al., 2019)

RHIS Performance

A routine health information system is an information system that collects data from the community-level health care and clinics, public and private health facilities at regular intervals (Azim et al., 2017). According to Azim et al. this data is generated by healthcare providers as they perform their daily task, and document health status, health services, and health resources. Aqil et al. (2009) described RHIS performance as improvement in the quality of data and continuous use of information. Data quality is therefore an essential component of RHIS (Bhattacharya et al., 2019).

Quality of data refers to data that is "*fit for use*" (Juran & Godfrey, 1999; Tayi & Ballou, 1998; Wand & Wang, 1996; Wang & Strong, 1996), suggesting that the quality of data can be determined by its users (Doku, 2018). It has several dimensions that describe data features that can be measured against established criteria to determine the value of that data (Cabitza, & Batini, 2016). Although no agreement has been reached on data quality dimensions, literature recognises cross-cutting dimensions, such as completeness, timeliness, consistency, accuracy, data reliability, precision (Ahanhanzo et al., 2014; Batini, & Scannapieco, 2016; Chen et al., 2014; Ndabarora et al., 2014; Smerek, 2015). Completeness is "a measure of the

presence of expected data items in a given dataset or collection" (Wand, & Wang, 1996, p. 23). It defines the level at which the data includes items that are important to support the reason for which it was collected. It is assessed by filling all the data elements in the report form, ensuring that there are no gaps in the information from what was intended to be collected and was actually collected (Nektar Data Systems, 2016). Completeness is also concerned with looking at the percentage of reporting facilities in an administrative area. Before data is submitted to the next level or used, issues of incomplete data must be resolved on grounds that all projected data are present (Nektar Data Systems, 2016). Timeliness measures the expected time data should be collected, and the effectiveness of its use (Doku, 2018). Discrepancies between expectation and reality would mostly lead to data not being used effectively. In Ghana, health facilities and the district levels are required to submit their data into the DHIS2 by the 5th and 15th of the ensuing month respectively. Data accuracy is defined as how close data values are to the reality, or the truthfulness of the information provided (Chen et al., 2014). Cabitza and Batini describes it as the level at which data adequately defines the objects of the "real world". It determines whether the data in the dataset is correct and exactly reflects what it should (Nektar Data Systems, 2016). Accuracy is assessed by comparing data in the source document (registers) to the data reported (Aqil et al., 2009). Consistency is described as the degree to which data remain the same or identical (Thatipamula, 2013). That is to say, if two or more data are compared, there should be no substantive difference in them (Doku, 2018).

Several issues undermine the quality of data generated from HIS and most of these issues emanate from the organisational set-up and technical expertise of users of the system (Manya, & Nielsen, 2016). Manya and Nielsen performed an exploratory review of Kenya's HIS with the objective of assessing the accuracy, timeliness and completeness of data quality in four counties. Audits of data quality were performed in selected health facilities where data from the health facilities source documents were compared with data from the same period in the national health information systems. The findings showed a monthly reports completion rate of 86.9% while timeliness of reports was 78.7%. The study further revealed high accuracy of maternity reports and low accuracy levels for all other reports in all the health facilities visited. This observation of high accuracy, especially in the number of deliveries, were associated with the government's policy of free maternal care where financial incentives were given to facilities so that women could deliver in the facilities without paying for anything (Manya, & Nielsen, 2016). Manya and Nielsen concluded that whilst most HIS are beleaguered with poor quality of data, a simple and practical financial motivation could increase accuracy, timeliness and completeness. A similar study in Rwanda evaluating the quality and utilisation of routine health facility data reported 96.6% data completion rates and 93.8% reporting timeliness (Karengera et al., 2016), while in Southern Ethiopia, 82.9% data completeness rate, and 75.9% accuracy were reported (Ermias, Kidist, Taye, & Desalegn, 2016). In addition, a study conducted in India reported completeness of information recorded in Health Management Information System (HMIS) was 88.5% (Sharma et al., 2016). However, this study was different to the former in that it assessed

completeness of data in the health management information as opposed to recording of data at health facility.

Amoakoh-Coleman et al. (2015) used two dimensions of data quality (completeness and accuracy) to assess the transfer of routine maternal health service data in Greater Accra Region of Ghana. They found 94.3% mean completeness of the facility level aggregated data and 100% accuracy for the aggregate forms and DHIMS2 database. Again, using information system to determine completeness of maternal and perinatal care services, Dumont, et al. (2012) identified an average completeness of 94.0% to 97.0%. These findings were a departure from a study conducted in Uasin Gishu County referral hospital in Kenya, that reported very low routine health data completion and timeliness of 44% and 46% respectively (Cheburet, & Odhiambo-Otieno, 2016). Additionally, analysis of primary health care data in Mozambique, manual data completeness was between 37.5% and 52.1% (Gimbel et al., 2011).

Achampong et al. (2018) conducted research to assess the quality and accuracy of newborn health data transfer from facilities to the DHIMS2 application using four facilities (two public and two private hospitals) in the CCM, Ghana. They compared facilities registers with summary sheets as well as the data in DHIMS2. The study revealed a general under-reporting from facility registers to summary forms and over-reporting from the summary forms to DHIMS2 except for institutional neonatal mortality which was largely under-reported. The overall percentage errors in transfer of the data from: the primary sources to the aggregate data forms, the primary source and

DHIMS2, and aggregate forms and DHIMS2 were respectively 7.5%, 43.1%, and 3.6%.

Information use in organisations such as GHS is dependent on individuals decision-making power and the importance attached to other factors and not just on the availability of information (Grindle, & Thomas, 1991; Sauerborn, 2000). It is however difficult to determine if RHIS meets its goal of increasing evidence-based decision-making and therefore contributing to better performance of the health system without evaluating information use (Aqil et al., 2009). Hence, efforts to operationalised use of information were introduced in the measurement. The framework for PRISM describes information use by employing measures such as the use of information to identify problems, to consider or make decision from several alternatives, and for advocacy (Aqil et al., 2009). The PRISM framework, by defining and measuring RHIS performance, focuses on setting and achieving goals that serve as motivators (Locke, Shaw, Sarri, & Latham, 1981) for self-regulation and continuous performance improvement (McLaughlin, & Kaluzny, 2004). The framework identifies the responsibility for actions that leads to better accountability (Aqil et al., 2009). Performance, on the other hand, is believed to be a feature of a system (Berwick, 1996) and should not be viewed in isolation, but together with RHIS processes and the determinants that affect them (Aqil et al., 2009).

Previous studies had observed that, RHIS data generated from the healthcare settings are not used for decision making in developing countries, because of weak data management, communication, and utilisation practices (Jeremie et al., 2014; Mucee et al., 2016; Nisingizwe et al., 2014). For

instance, findings from Cote D'Ivoire using PRISM framework indicated a 38% overall utilitisation of health information at the facilities (Nutley et al., 2014). Likewise, studies from Addis Ababa, Ethiopia revealed health data utilisation was limited and focused on data collection and reporting to the respective bodies (Hirpa, Tesfaye, Nigussie, & Aragaw, 2010). Other findings from Ethiopia indicated a 53.1% utilisation of health information (Teklegiorgis et al., 2016). Friendly format for reporting and managers providing regular feedback to their staff were significantly associated with health information utilisation. Ermias et al. (2016) assessed the utilisation of HMIS and associated factors in Hadiya zone health centres in Southern Ethiopia and reported that completeness and consistency of data were predictors of utilisation of HMIS. Dehnavieh et al. (2019) identified poor quality of data, weak analysis of data, lack of information culture, and lack of trained personnel in HIS activities as some of the reasons for poor information utilisation. Similarly, Mucee, Kaburi and Kinyamu (2016) reported lack of staffing training on HIS, weak supervision and lack of promotion of information use culture as negatively affecting health information use in Public Health Sector in Tharaka Nithi County, Kenya.

RHIS Processes

Processes of RHIS are accepted standards that lead to performance (Belay, & Lippeveld, 2013). Often the dimensions of data quality such as completeness and timeliness are used to evaluate data collection and transmission processes which create confusion about data quality as output and RHIS processes (Aqil et al., 2009). This confusion is resolved by incorporating specific indicators for assessing RHIS processes into the

framework, such as presence of data collection and transmission procedures and implications for failure to follow these procedures (Aqil et al., 2009). The PRISM framework considers RHIS processes, such as data quality checks, data display and feedback that had otherwise been overlooked, and incorporates them into the accepted standards. It is not possible to ensure quality assessment without a formal process of checking the quality of the data. Likewise, the way in which data are displayed shows whether the data has been transformed into information and demonstrates its importance for purposes of management, monitoring or planning (Belay, & Lippeveld, 2013). Also, feedback helps to identify problems for resolution, regulate and enhance individual and system performance, and also identify learning opportunities (Belay, & Lippeveld, 2013).

RHIS Determinants

The PRISM framework identifies three main determinants (behavioural, organisational, and technical) of RHIS performance. These determinants influence RHIS processes which intend influence data quality and information use.

Behavioural determinants

Behavioural determinants as hypothesised by PRISM framework are important determinants of RHIS performance because they influence the quality of the information generated by the system. These factors include: self-efficacy or confidence level for RHIS tasks; RHIS task competence; knowledge of the rationale for RHIS data collection; motivation; problem-solving skill. These factors are categorized into two groups, that is, perception and actual skills. Perceptions are measured in terms of confidence level for

RHIS tasks, level of knowledge for RHIS activities, and motivation, while actual skills are measured in terms of problem-solving skills, and actual competence displayed in RHIS activities which include calculating indicators, plotting data, interpreting data and using data for management. Perception levels are mostly assessed on a scale, from low or no confidence to full confidence in performing a particular RHIS task. Actual skill involves assessing RHIS users' ability to perform RHIS tasks, such as calculations, plotting data, interpreting data and using data. Self-efficacy measures the level of confidence RHIS users to perform RHIS tasks.

There is a general premise of strong relationship between confidence and objective reality (actual skills) (Aqil et al., 2010; USAID, 2014). The perception of an individual about the outcome and usefulness of a task, the level of confidence in carrying out that task, and complexities of the task determine the possibility of performing that task (Aqil et al., 2009). Again, limited knowledge of the utility of RHIS data could play a significant role in low quality of data and use of information. Negative attitude among clinicians and other health staff on data collection and management, such as data collection is a useless activity or a waste of care-provider time, could also be detrimental to data quality (Belay, & Lippeveld, 2013). The willingness, confidence, motivation and skills of RHIS users to perform RHIS tasks directly affect RHIS processes and performance (Aqil et al., 2009). Similarly, the gaps between HCPs' actual skills and perceived skills directly influence RHIS processes and performance, such as, data collection, transmission, processing, analysis, display, quality checking and feedback (Belay, & Lippeveld, 2013).

In many developing countries, users' competencies in RHIS task, when it comes to checking data quality, analysing and use of information, is very limited (Belay, & Lippeveld, 2013). Six countries that were assessed by the MEASURE Evaluation indicate significant gaps between self-perceived skill and actual ability to perform RHIS tasks among users at the health facility level (Belay, & Lippeveld, 2013). Previous studies also highlighted motivation and perception of staff to HIS tasks to have a substantial link with data quality (Ahanhanzo et al., 2014; Rumisha et al., 2020; Wandera et al., 2019).

Previous studies had reported low perceived confidence levels to perform RHIS tasks, such as prepare data visuals, interpret data, and perform data quality checks (Mimi 2015; Shama, Roba, Abaerei, Gebremeskel, & Baraki, 2021; USAID, 2014). Shama et al. for example, reported as low as 21.6% of staff having a good knowledge of rationale of routine HIS data. However, a recent study in Ethiopia reported high perceived confidence level to perform RHIS tasks (Haftu, Taye, Ayele, Habtamu, & Biruk, 2021).

Organisational determinants

The organisational factors relate to organisational structure, resources, procedures, support services, and culture to develop, manage and improve RHIS processes and performance (Aqil et al. 2009). Users of RHIS function in the context of the organisation are influenced by the rules, values and practices of the organisation. The framework proposes an operational definition of organisational determinants as "the capacity and control to promote values and beliefs among members of an organisation by collecting, analysing and using information to accomplish the organisation's goals and mission" (Aqil et al., 2009, p.222). It includes information culture, structure, roles and

responsibilities of key stakeholders at every point of the health system. In particular, organisational factors are operationalised under several dimensions, including, RHIS Management, promotion of culture of information, activities for the promotion of culture of information, supervision quality, reward for good work, availability of resources, and supportive management. Health system management involves managing resources and functions to produce better outputs. The management functions include RHIS governance, planning, finances, training/capacity development, supervision, and use of quality standards or performance improvement tools. The PRISM framework defines culture of information as "the capacity and control to promote values and beliefs among members of an organisation for collection, analysis and use of information to accomplish its goals and missions" (Aqil, Ávila, Parbul, & Plaza, 2010, p. 31). It assesses whether the organisational mechanisms are in place to produce the desired result. It assesses how staff and management value information generated and how evidence-based decision making would be enhanced through the promotion of culture of information in the organisation. It indicates top management support and commitment for enhancing RHIS activities for improved health system performance, leading to better health status of the communities served (Aqil et al., 2012). Activities to promote information culture are supported by communicating targets, facility head attending meetings to discuss MCH/RHIS information or share success stories, directives to use information, and advocacy based on MCH/RHIS information.

Organisational determinants directly or indirectly influence RHIS performance by behavioural determinants as shown in Figure 3 above. The

ability to use the information would be compromised if attention is not given to the knowledge and skills required to collect, analyse and interpret the results as well as solve problems that may emanate in the data management process (Aqil et al., 2009).

Senior health management's perceptions and attitudes towards designing and implementing health information system have a decisive influence on system performance. Failure on their part to encourage evidence-based decision-making and using information for transparency and accountability could lead to weak information culture in the organisation (Aqil et al., 2009). It would appear that using varied techniques from different disciplines to assess the perception and attitudes of senior health managers and other staff in the line of data management process is very vital in fostering the culture of information (WHO, 2007). Such methods gather subjective and objective data to recognize differences in quality between what is perceived and what actually exists, resulting in strategies being created to address such gaps.

Promoting a culture of information in an organisation, according to PRISM framework, leads to improvement in the ability to execute RHIS tasks and consequently improve the staff self-confidence in carrying out RHIS tasks (Belay, & Lippeveld, 2013). Key RHIS attitudes and principles in the work environment need to be promoted in order to enable workers to adopt the values necessary to generate, maintain and improve the information system (Belay, & Lippeveld, 2013). An assessment of RHIS performance in six countries revealed significant discrepancies between perceived promotion of information culture and actual skills and knowledge of RHIS tasks. Therefore,

suggesting workers perception of the fact that their organisation supports data quality and information use did not match with actual competence to check the quality of data and information use (Belay, & Lippeveld, 2013). PRISM evaluations in Pakistan, Mexico, Cote d'Ivoire, Uganda, Gabon, Dominican Republic, and Honduras consistently presented results of low RHIS performance combined with high expectations of promoting an information culture and self-efficacy of RHIS activities (Belay, & Lippeveld, 2013). These assessments demonstrated that the absence of rewarding good performance, inadequate supervisory appointments, and feedback influenced the motivation of health workers to perform RHIS tasks. A PRISM assessment in Uganda found that, while there were a lot of supervisory visits to health facilities, below 45% had received feedback (Belay, & Lippeveld, 2013). The Zambia assessment demonstrated that there is little incentive to conduct RHIS activities apart from data collection and reporting (Belay, & Lippeveld, 2013).

Organisational factors such as governance, training, finance, and supervision were found to have influence on the performance of RHIS in the Garissa Subcounty, Kenya (Kirimi, 2017). A related RHIS assessment in Southern Nations, Nationalities and People's Region (SNNPR) of Ethiopia found that 45% of the planning and training criteria, and 67% of the HMIS governance criteria were met. However, HMIS quality standards guidelines were absent in 53 % of the health facilities (Belay, Azim, & Kassahun, 2013). In Eastern Ethiopia Teklegiorgis et al. (2016) identified organisational culture as a determinant of data quality.

Supportive supervision, and feedback, are essential ingredients in improving RHIS data (Hahn, Wanjala, & Marx, 2013; Nicol, Dudley, &

Bradshaw, 2016; Puttkammer et al., 2016). Supervision is a means of providing assistance as well as serves for on-the-job training to staff. Studies specifically considering web-based reporting systems noted that, while digitalizing of the reporting systems can improve the completeness and internal consistency of reported data, supervision and feedback remains essential for achieving and maintaining improvements in data quality (Admon et al., 2013; Gimbel, Mwanza, Nisingizwe, Michel, & Hirschhorn, 2017; Mutale et al., 2013). Availability of staff is necessary to perform the RHIS tasks, however, shortage of skills in health care remains a challenge in many sub-Saharan countries (Haftu et al., 2021; Taderera, Hendricks, & Pillay, 2016; Tandi et al., 2015). A study in Ethiopia reported only 23.8% of staff received HMIS related training (Dagnew, Woreta, & Shiferaw, 2018).

Technical determinants

Technical determinants are defined as "all the factors that are related to the specialised know-how and technology to develop, manage and improve RHIS processes and performance" (Aqil et al., 2009, p.222). It refers to all the factors that are related to the technology and specialised know-how used in creating, managing, and improving RHIS processes and performance (Boone, Cloutier, Lins, & Makulec, 2013). These factors include among others: developing indicators; designing forms for data collection; procedural manuals preparation; complexities of the procedure manual and data collecting forms; information technology types; data processing and analysis software development, user-friendliness of the software for routine data management, training (Boone et al., 2013). These factors have implications on the performance of RHIS. For instance, given inappropriate data indicators, filling

of the data collection forms becomes extremely difficult. Also, motivation and confidence levels of RHIS users are affected if the software is not user-friendly. Boone et al. (2013) argues that the complexity of RHIS makes it hard for its users to utilize the system and they end up using manual paper files recording which makes information poorly managed. Use of information is affected if the software does not process data correctly and in a timely manner, and the resulting analyses do not provide meaningful conclusions for decision making. Undoubtably, health information technology is imperative for the development of health information systems because computers work and interact more easily (Aqil et al., 2009). It is therefore important for users of RHIS to have strong knowledge and skills in the field of information technology to use and manage it effectively.

In the course of arguing the technical factors determining performance of RHIS, the argument made by Gopalan, Mutasa, Friedman and Das (2014) is that information technology applications and use are a new concept in modern institutions in developing countries, particularly those in Africa. To fully utilise information technology in HCFs would mean to either fire old teams who have no knowledge on information technology use or provide additional training for such people. To make matters worse, the existing old working teams have a lot of experience and knowledge regarding the history of the health facilities, making them hard to fire.

Systemically, all stakeholders' involvement in indicator development is a strong factor in determining the performance of RHIS in health facilities especially in Sub-Saharan countries such as Ghana (Asiimwe, 2016). This issue also falls under the behavioural determinant. Thus, technical factors

could affect performance directly or through behavioural factors. For example, motivation and confidence levels of data collectors are affected if computer software is not user-friendly. Also, there is serious hindrance to information use if the computer software does not properly process data and in a timely manner, and resulting analyses do not provide meaningful conclusions for decision making (Aqil et al., 2012). Again, technical factors can also be affected by organisational determinants such as when an organisation is not ready for computerising its information system and therefore still uses a paper system.

An assessment conducted in Southern Nations, Nationalities and Peoples Region (SNNPR), Ethiopia, revealed that while procedural manuals were developed to guide the collection and analysis of data, they were not accessible at the health facilities as well as the district offices (Belay et al., 2013). Also, the Ministry of Health and Social Welfare (MOHSW) in Liberia established district health information technology with the capacity to collect raw data, pivot tables, dashboards and graphs to give a comprehensive picture of the performance of the health system. However, due to lack of technical capacity, it was hardly used by senior managers in county health offices (Belay, & Lippeveld, 2013). A study in Eastern Ethiopia reported that HCFs with well-designed reporting format, staff trained to fill data according to the formats, standard set of indicators, skilled human resource, were able to increase the possibility of achieving its data quality targets than HCFs without these infrastructure (Teklegiorgis et al., 2016).

Conceptual Framework

A conceptual framework was developed to explore the factors of MCH data quality and information use in RHIS in CCM (see Figure 4). It stems

from the PRISM framework developed by the MEASURE Evaluation (Aqil et al., 2009). The PRISM framework was adapted in this study due to the dual role it plays, defining and measuring the performance of RHIS as well as determining the factors associated with the performance. Consequently, opportunities for improvement are provided by identifying the information systems' weaknesses and strengths and the factors that determine its performance (Aqil et al., 2009).

Performance of RHIS is defined in the framework as an improvement in the quality of data and continuous use of information in making decisions (Aqil et al., 2009). The framework is the first of its kind to empirically examine the relationships between the determinants (technical, organisational and behavioural) on the processes and performance of RHIS (Aqil et al., 2009). It provides the opportunity to determine whether performance of RHIS is determined by these factors, acting directly or indirectly through behavioural factors or processes, or in collaboration with each other (Aqil et al., 2009). The conceptual framework (see Figure 4) posits that improvement in RHIS performance (improved MCH data quality) would result in improved MCH service delivery (antenatal, delivery, postnatal, immunisation, nutrition) which would impact on MCH outcomes consequently. The framework investigates how MCH data processes in RHIS affect the RHIS performance. Also, technical, behavioural and organisational factors influencing the performance of RHIS are identified. Routine health information system consists of inputs, processes and output (WHO, 2008). It is posited that determinants of MCH data in RHIS (inputs) affect MCH data processes, which leads to improved MCH data quality and information use (output) and

consequently results in improvement in MCH services and indicators (outcome) (see Figure 4).

The framework posits that technical, organisational and behavioural determinants affect RHIS processes, which in turn affects the performance of RHIS. It also shows the direct effect of behavioural factors on the processes and performance of RHIS. Further, RHIS processes and performance are affected directly by technical and organisational factors or indirectly through behavioural factors. For instance, a technical factor such as complexity of reporting tools and manuals, could directly or indirectly affect performance by lowering motivation. The framework also provides the opportunities to evaluate the relationships that exist between performance of RHIS, performance of health system, and health status (Aqil et al., 2009). Lastly, the framework incorporates four tools: Diagnostic Tool, RHIS Overview and Facility/Office Checklist, MAT, and OBAT, to explore the direct and indirect relationships of the technical, organisational and behavioural factors as well as provide opportunities to develop interventions to bridge the gaps (Aqil et al., 2009). The diagnostic tool also assesses the RHIS processes and output (see Figure 4).

Summary

There is a disconnect between the collection of data and its meaningful use, despite the efforts that have been made in data generation and its availability in the past years (Economist Intelligence Unit, 2013). Given that HCPs spend the most of their working hours producing data, it is important that the data they generate be put to use. However, high quality data is needed to make critical health decisions. Literature reviewed in this study showed that most studies used data completeness and timeliness as a measure of data

quality. As a result, the definition of data quality varied depending on the study under consideration. Again, few studies addressed the impact of the following constructs on RHIS performance: RHIS design, the complexity of reporting tools, standard indicators, confidence level for RHIS tasks, data demand, data quality checking skills. Most of the studies reviewed in this study, did not take organisational factors such as staffing, funding and planning into account. It was also clear from literature reviewed that no or limited studies have evaluated RHIS performance and the factors affecting it in Ghana. As a result, efforts to address factors affecting RHIS performance have not been supported by evidence. This study will help bridge the knowledge gap on RHIS performance as well as identify the behavioural, organisational, technical barriers to data quality and information use.

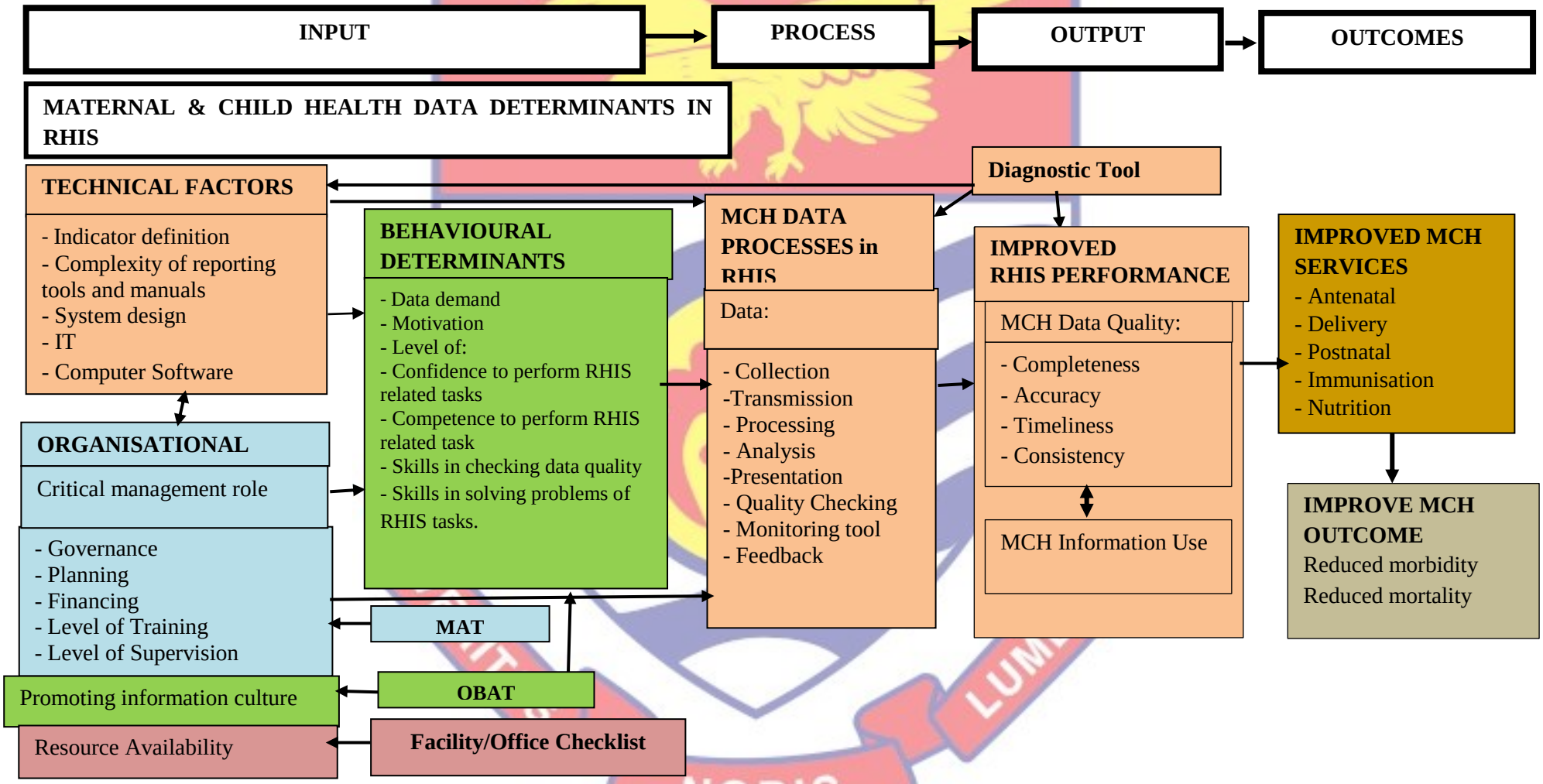

Figure 4: Conceptual framework

CHAPTER THREE

RESEARCH METHODS

The purpose of this study was to assess the performance of MCH data in RHIS with the view to establish an understanding on current status of MCH data, as well as identify the technical, organisational, and behavioural factors that contribute to MCH performance among HCFs in CCM. This chapter focuses on the study design, study area, population, and sampling procedure, instruments/tools for data collection, validation and reliability of the instrument, data collection procedure, and data processing and analysis.

Study Design

This study is based on the positivist ontological and epistemological philosophical tradition to describe the RHIS inputs (determinants), RHIS process, and RHIS output (performance of RHIS). With regard to performance of RHIS (MCH data quality and information use), it is the philosophical study of the nature of the performance of reality and how there could be varied perception of what is known about that reality. My ontological viewpoint is that performance of RHIS (MCH data quality and information use) exists and can be assessed (Greener, 2011). The study further asserts that RHIS performance is a function of better RHIS processes (such as, transmission, processing, and analysis), and their technical (such as, complexities in information technology, system design, complexity of reporting tools, and manuals); organisational (finance, governance, culture of information, level of training, and supervision), and behavioural determinants (competence in

performing RHIS-related tasks, perceived confidence level in performing tasks related to RHIS, motivation, and demand of data) (Aqil, Lippeveld, Moussa, & Barry, 2012). The motivation in this study is not only to assess the level of MCH/RHIS performance, but also to identify the RHIS determinants and the extent to which these determinants and processes affect RHIS performance.

Epistemology is the philosophical study of knowledge and the basis for which we believe in the truth of something (Oliver, 2010). According to Neuman (2000), positivists epistemological view on the nature of knowledge are that: (1) it can be described systematically, (2) it is made of verified hypotheses that can be considered as laws or facts, (3) research is a means of uncovering reality by scientifically describing/explaining phenomena, (4) it is accurate and certain, and (5) it is probabilistic. Again, the role of research is that, it uncovers reality (i.e., explains, describes, controls, and predicts phenomena systematically). Additionally, positivists hold the epistemological position that research results are credible if they can be observed, evaluated, and generalised. Neuman concludes that positivists epistemologically employ deductive reasoning to come out with common sense, and that research is based on deductive thinking (Aliyu, Singhry, Adamu, & Abubakar, 2015). My positivists epistemological viewpoint is that RHIS performance, MCH data quality, and information use can be described systematically, and that the influence of RHIS determinants and processes on performance of RHIS can be measured directly or indirectly from the perspective of HCPs, and existing records, and not how they construct and interpret the existence of these variables (Jackson, 2013). The HCPs formed the core of data management in the health facilities and these workers interact actively and daily with RHIS,

and thus, they are the best to provide the most useful information about the determinants of RHIS.

It has been argued that in the choice of research procedure and design, quantitative methods are appropriate if knowledge is believed to be real, objective and can be collected (Sikes, 2004). Sikes affirms that in such circumstances, researchers are able to observe, measure, and quantify the knowledge. My ontological position linked to my epistemological perspective shaped my methodological decision to use quantitative approach in this study. Therefore, I employed a descriptive quantitative cross-sectional case study design. Research approach using case study is one of the most widely used techniques in the field of information system (IS) since it has multiple perspectives embedded in a specific context and offers multiple methods of data collection (Cavaye, 1996). Benbasat, Goldstein and Mead (1987) argued that using case study in IS research provides an opportunity for the researcher to; (1) study IS in a natural environment, learn about the art, and generate theories from practice, (2) understand the complexity and nature of the process taking place, and (3) gain valuable insights into current issues in the fast-changing world of IS. Arguing for the utility of this approach, this study assumed the health systems (health facilities) in CCM as a case, and RHIS producing sub-systems such as people performing relevant functions and the concomitant interactive processes would be viewed as the survey units of analysis (Mimi, 2015).

The descriptive case study in this research allowed for exploration of the status of the performance of MCH data quality in RHIS, its determining factors, as well as their relationships. Thus, it described MCH data quality and

the use of information in RHIS, and described the factors affecting RHIS performance. Survey design is a social scientific method that focus on vital facts of people, their beliefs, opinions, attitudes, motivations, and behaviours (Babbie, 2007; Mathiyazhagan, & Nandan, 2010). Survey research is used to effectively describe large populations with accurate representative sample. It is a useful descriptive research technique for collecting data from the "representative" sample of the target population. According to Babbie, and Mathiyazhagan and Nandan surveys are flexible where many variables and questions are asked on a topic at a time. Consequently, this study focused on describing the perceptions of the HCPs about the behavioural and organisational determinants of MCH/RHIS. Given this aim, the most appropriate method to use was the survey (Ogah, 2013).

A number of limitations have been found with the use of descriptive survey as a research design, such as the difficulty with using it to study diverse or vast heterogeneous groups (Mathiyazhagan & Nandan, 2010). Sample selection bias can also result from the use of survey methods which may skew the data collected (Babbie, 2007; Creswell, 2009). However, in this study, a census of HCPs involved in MCH data management are used. Additionally, surveys are mostly appropriate in narratives and historical analysis of events (Choy, 2014), and cannot be used for exploratory research where there is the need to explore meanings and feelings of people (Babbie, 2007). Despite these limitations, this study produced the depth of information needed for assessing the performance of MCH data and its determinants thereof, using standardised PRISM framework tools with proven high reliability and validity.

Study Area

The study was conducted in the CCM, the only metropolis out of the twenty-two districts in the Central Region (CCMHD, 2020). The metropolitan area, one of the oldest districts in Ghana, was upgraded to a metropolitan status in 2007. The metropolis is located to the west by the Komenda-Edina-Eguafo-Abrem (KEEA) Municipality, to the south by the Gulf of Guinea, to the north by the Twifo-Hemang-Lower Denkyira (THLD) District, and to the east by the Abura-Asebu-Kwamankese (AAK) District (CCMHD, 2020). The metropolis covers an estimated land area of 124 square kilometres (Ghana Statistical Service, 2021), and currently, is the regional capital for the Central Region, Ghana. The 2021 Population and Housing Survey of Ghana pegged the population of the metropolis at 189,925 representing 6.6% of the Central Regional total (Ghana Statistical Service, 2021). The total fertility rate stands at 2.2 and a general fertility rate of 59.2 births per 1000 women aged 15-49 years (Ghana Statistical Service, 2014).

The metropolis has 38 health facilities, including 25 government facilities (1 Teaching Hospital, 1 Metropolitan Hospital, 1 Polyclinic, 2 Health Centers, 4 clinics, and 16 Community-based Health Planning and Services (CHPs) compounds [CHPs]); 5 Quasi-Government health facilities (1 hospital and 4 clinics); 1 Christian Health Association of Ghana (CHAG) clinic and 6 Private facilities (1 maternity home, 4 clinics and 1 hospital); and 1 Non-Governmental Organisations (NGO) facility. The Cape Coast Teaching Hospital (CCTH), one of the five Teaching Hospitals in the country, serves as a referral center for the region. Although the Teaching Hospital, private,

mission (including CHAG) and NGOs facilities are independent, the CCMHD has a collaborative function with these facilities (CCMHD, 2020).

Population

The setting for the study was the HCFs at the CCM. These facilities include the Teaching Hospital, the Metropolitan Hospital, hospitals (both public, private, and mission), the polyclinic, clinics, health centres, and CHPs compounds that provide MCH services in the Metropolis. The population for the study comprised the systems and personnel working at these facilities. The systems referred to MCH data found in the: (1) source data at the health facilities (including antenatal registers, delivery registers, postnatal registers, and child welfare (immunisation) registers); (2) facility aggregate data (including monthly midwife returns, and monthly vaccination report); and (3) data found in DHIS2 database. Further, the personnel include midwives and health information officers and health managers who directly engaged in MCH data management and routinely collect MCH data in making decision at their level of healthcare delivery system. Consequently, a target/accessible population of 278 HCPs formed the study respondents. Table 1 shows the summary of the target/accessible population per the facility and staff category.

Inclusion/exclusion criteria

All HCFs including private, mission and public directly engaged in MCH services. Also, facility staff who had worked for at least one year involved in either MCH data generation, processing or use, working in the study area and consented to participate.

Table 1: Target Population per Facility and Staff Categories

Facility	Midwife	Health Information Officers	Facility Head	Total
CCTH	133	11	1	145
UCC Hospital	21	4	1	26
Ewim Polyclinic	19	1	1	21
Metro Hospital	20	3	1	24
Adisadel Health Centre	15	1	1	17
Efutu Health Centre	12	1	1	14
DIS Clinic	4	1	1	6
Baiden Ghartey	3	1	1	5
Nkanfoa CHPS	3	-	1	4
The Saint Maternity Home	1	-	1	2
Brimso Sanford	4	-	1	5
Sanford World Clinic	4	-	1	5
Essuekyir CHPS	3	-	1	4
Total	**242**	**23**	**13**	**278**

Source: Field data, 2021

Sampling Procedure

The sampling was done in stages (multistage), namely, the selection of the Metropolis/district and health facilities, the selection of the health personnel, and the selection of the MCH data indicators. The CCM was purposefully selected because of its uniqueness as one of the largest districts in the region (out of the twenty-two districts in the region) and the only one with the full cadre of health facilities, including the Teaching Hospital. The second stage involved the selection of the health facilities. Desk review of documents showed that 38 health facilities, both government and private, are situated in the Metropolis. Thirteen health facilities, 4 private and 9 government/public, that met the inclusion criteria of providing MCH services in the Metropolis, were selected.

The third stage comprised the selection of health personnel, that is, all HCPs involved in MCH services from each selected health facility as well as key informants (KIs) who were mostly the head of the HCF. Thus, the whole target population of 278 HCPs were included in the sample size. The final stage involved the selection of priority MCH indicators that were assessed in DHIMS2 for CCM. A cursory look in the DHIS2 database revealed about 426 indicators for MCH services, specifically, in the monthly midwife's returns (Form A) and monthly vaccination report are found in DHIMS2. However, the study relied on key indicators for conducting MCH data quality assessment recommended by WHO (WHO, 2014b) and the identified priority indicators for tracking progress towards targets for MCH services in the SDGs era found in the strategic document, "*Ending Preventable Maternal Mortality and every Newborn Action Plan*" (WHO, 2015), for the selection of the MCH indicators. Based on these recommendation, the MCH indicators selected included antenatal care first (ANC1) coverage, antenatal care fourth (ANC4) coverage, first dose of intermittent preventive treatment in pregnancy (IPT1), administration of Tetanus–Diphtheria Vaccine (Td2+) in pregnancy, deliveries attended by a skilled birth attendant/midwife in a health facility, access to early postnatal care (PNC), pentavalent vaccine first and third (Penta1 and Penta3) dose coverage in children under one year of age (see Table 2).

Table 2: MCH Variables with Definition and Data Source

Variables	Definition	Data source
ANC1	Number of pregnant women reporting for antenatal care for the first time to any health facility with their current pregnancy	ANC register
ANC4	Number of pregnant women making their 4th antenatal visit for the period	ANC register
Td2+	Number of pregnant women who have had two doses of Tetanus–Diphtheria (TD) for their current pregnancy OR require only one dose for their current pregnancy OR have completed their TD schedule and therefore do not require any dose for their current pregnancy	ANC register
IPT1	Number of pregnant women given their first dose of Sulfadoxine Pyrimethamine (SP) at ANC	ANC register
Deliveries	Total number of deliveries	Delivery register
PNC	Mothers accessing PNC for the first time after delivery	PNC register
Penta1	Number of children under 1 year receiving the Penta1 vaccine in the year	EPI returns
Penta3	Number of children under 1 year receiving the Penta3 vaccine in the year	EPI returns

Source: GHS SOPs for Health Information Managers, 2012.

Data Collection Instruments

The questionnaire and checklists used to collect data on MCH/RHIS determinants, processes, and performance were adapted from toolkits developed by the MEASURE Evaluation: RDQA (MEASURE Evaluation, 2015), and PRISM framework (Aqil et al., 2012; MEASURE Evaluation, 2019). As a tool, the RDQA employs both quantitative and qualitative approaches to measure the quality of data in RHIS (MEASURE Evaluation, 2015). It uses a two-pronged approach to determine data quality with respect to data validation and system assessment. Thus, RDQA tool was used to

collect data for assessing the quality of MCH data in health facilities across three data sources.

The PRISM Framework toolkit collected data on MCH/RHIS processes, MCH/RHIS determinants, and MCH/RHIS performance with respect to information use. As a tool, the PRISM Framework describes the various components of RHIS and their synergies to improve RHIS performance (improve quality data and continuous information use) leading to improved health system performance and health status. The PRISM framework posits that improved RHIS performance is a function of RHIS processes and RHIS inputs such as behavioural, technical, and organisational determinants (MEASURE Evaluation, 2019). Although the framework provides six tools in the toolkit, this current study adapted and used four of the tools: Facility/Office Checklist, Performance Diagnostic Tool, MAT, and OBAT.

The checklist was used to evaluate the availability and status of resources at facility level required for MCH/RHIS activities. The level of MCH/RHIS performance, organisational and technical determinants such as supervision and feedback mechanisms, mechanisms of MCH/RHIS data use, presence of data quality assurance mechanisms, indicator definitions and reporting criteria, and complexity level of data collection tools and reporting forms were assessed using the RHIS Performance Diagnostic tool. The MAT assessed the MCH/RHIS management practices available at the facilities. The OBAT identified the behavioural and organisational determinants such as MCH/RHIS self-efficacy, motivation, competence in MCH/RHIS tasks, problem-solving skills, knowledge of the rationale for MCH/RHIS activities,

and the organisational environment that promotes information culture. The OBAT also assessed perceptions of HCPs on the promotion of a culture of information, their knowledge, self-efficacy, and competence to perform MCH/RHIS tasks

The toolkit, when used together in one study, provides a complete overview of the performance of RHIS and its associated factors, as in the current study. Previous studies on data quality in healthcare used these tools (Ahanhanzo et al., 2014; Aqil, Ávila, Parbul, & Plaza, 2010; Boadu, 2015; Cheburet, & Odhiambo-Otieno, 2016; Hotchkiss, Aqil, Lippeveld, & Mukooyo, 2010; Lippeveld et al., 2019; Mimi, 2015).

Data collection instrument for the current study consisted of seven (7) sections. The first section assessed the quality of data in the DHIS2 database, forms, and registers. It involved data verification for eight MCH indicators (ANC1, ANC4, IPT1, Td2+, deliveries, PNC1, Penta1, and Penta3). The section also contained questions for KIs with dichotomous responses: two questions on RHIS Processes, six on Data Processing/Analysis, and five on Data Quality Assessment Mechanism. The second section collected data from KIs on information use at the facility, two questions each on information use guidelines, and data visualisation; seven on RHIS analytic report production; four on feedback to the health facilities; nine on discussions and decisions based on RHIS information; six each on promotion and use of RHIS information; six on supervision; and three each on annual planning, display of information, and data dissemination outside health sector. All the questions were dichotomous (yes/no), except three questions, one in RHIS analytic

report production, and two in discussion and decisions based on RHIS, which had responses in quantities (e.g., 5 computers).

The third section was a checklist containing a set of questions on varied issues in RHIS Management; Equipment and Service Inventory, Utilities, Availability of Registers/Forms, and Inventory of Staff for Data Management. The fourth section involved questions for KIs on management functions such as governance (six questions), planning (three questions), quality standards (three questions), training and capacity development (five questions), supervision (two questions), and finance (four questions). The fifth section consists of questions for HCPs on a five-point Likert scale which assessed organisational and behavioural determinants of RHIS with the constructs, promotion of information culture, and responses, (1) strongly disagree, (2) disagree, (3) undecided, (4) agree, and (5) strongly agree. The sixth section used paper and pencil to test HCPs knowledge of the rationale for MCH/RHIS, knowledge on data quality, as well as their competencies to perform RHIS tasks. The last section was on self-efficacy of HCPs, measured on a scale of 0 to 100 with six questions.

Pilot testing

Prior to the main study, a pilot test was conducted at two health facilities, one in KEEA municipality and the other in AAK district to test the suitability of the instruments in addressing the research objectives. The test was critical to provide an initial evaluation of the internal consistency of the items; establishing the content validity of scores on the instrument; and to improve questions, format, and instructions. This provided an opportunity to estimate how long the data collection would take (and identify potential

concerns of respondents). A total of five HCPs each from the two facilities took part in the piloting and their comments were incorporated into the final revision of the instrument.

Validity and reliability of the instruments

Face and content validity of the PRISM data collection instrument were assessed through review of literature. The validity of the PRISM tool is well established. For instance, the diagnostic tool that checks data quality and information use through observation and review of documents as well as facility checklist that measures infrastructural and equipment availability for RHIS task is considered the gold standard for assessing validity (Belay & Lippeveld, 2013; Aqil et al., 2012; Lippeveld, Sauerborn, Bodart, & WHO, 2000). Also, the validity and reliability of the OBAT was assessed by the analysis of internal consistency. The current questionnaire measured the MCH/RHIS technical, organisational, and behavioural factors. Consequently, this validity helped to assess the structure of the current instrument (Sounan et al., 2012) and "tap" the various constructs being measured (Field, 2005). The HCPs were the unit of analysis. The organisational and behavioural constructs were identified through Cronbach's alpha analysis. A bivariate analysis was performed on organisational and behavioural constructs with alpha coefficient ≥0.60. This was to ascertain the relationship between the organisational factors (promotion of culture of information, reward system, supportive management, and availability of resources) and behavioural factors (self-efficacy, and motivation).

The confidence level of respondents to perform RHIS was measured with a scale that included self-reported perceptions on the following five

dimensions: perceived self-efficacy to collect data, analyse data, interpret data, use data, and check data quality. Reported self-efficacy to analyse, interpret and use data dimensions had alpha scores above 0.90, showing very high level of reliability. Alpha scores were, however, not computed for respondents' confidence level to collect data and check data quality since they were each based on a single question. The alpha level score for overall self-efficacy scale was 0.99, indicating a very high level of reliability.

The promotion of culture of information was categorized with multiple indicators under seven dimensions, assessing respondents' perceptions of their superiors in the health department (see Table 3), and assessing their self-reported perceptions on information culture, (see Table 4). Specifically, "promotion of data quality", promotion of information use, and promotion of feedback scales assessed respondents' perceptions of their superiors in the health department. Further, evidence-based decision making, use of information, feedback, problem solving, accountability/empowerment, and sense of responsibility scales measured respondents' self-reported perceptions on information culture in the health department. Questions in the evidence-based decision making that were worded negatively were reversed. Thus, reversed ratings were used for the negatively worded items to ensure consistency with other questions included in the composite indicator. The alpha scores for assessing respondents' perceptions of their superiors on culture of information in the health department was above 0.70, thus, promotion of data quality (0.71), promotion of information use (0.77), and promotion of feedback (0.81). An overall alpha level of 0.88 was recorded for

respondents' perceptions of their superiors on culture of information in the facilities.

Alpha scores for respondents self-reported perceptions on information culture emerged higher than the 0.60 threshold with the exception of "evidence-based decision making" and "use of information" dimensions having 0.50 and 0.56 respectively. Hence, "evidence-based decision making" and "use of information" dimensions were excluded in the bivariate analysis. Alpha score could not be computed for "feedback" since it was assessed with a single question. An overall alpha level of 0.86 was recorded for respondents self-reported perceptions on information culture, indicating high reliability.

Furthermore, scales for motivation to perform RHIS tasks, promotion of reward for better performance, supportive management, and availability of resources were tested. Questions in the motivation to perform RHIS tasks that were negatively framed were reversed. Thus, reversed ratings were used to ensure consistency with positively worded questions included in the composite indicator. These scales yielded an average alpha score of 0.60 or higher, indicating high reliability (see Table 5).

Table 3: Composite Indices for Measuring Underlying Constructs of the Determinants of RHIS Performance

Composite Indicator	Indicator Item	Statements	Cronbach's alpha
Self-efficacy scales	*Perceived self-efficacy in analysing data*	Ability to check the accuracy of data	0.98
		Ability to correctly compute percentages	
		Ability to plot graphs	
	Perceived self-efficacy in interpreting data	Ability to compute trends from graphs	**0.98**
		Ability to explain the implication analysed data	
	Perceived self-efficacy in using information	Ability to identify gaps and set performance goals using data	0.97
		Ability to make decisions using data	
	All of the above (Overall) on perceived self-efficacy		**0.99**
Culture of information scales		***Superiors in the health facility:***	
	Promotion of use of RHIS information	use data to set targets and monitor performance	0.77
		hold regular meetings on data use	
	Emphasize on data quality	emphasize adherence to data quality procedures in compiling and submitting reports	0.72
		check data quality	
		report regularly to higher level about accuracy of data	
	Feedback	ask for input/feedback from relevant/concerned staff.	0.81
		openly discuss conflicts to resolve them	
		seek feedback	
		promote multidirectional feedback	
		provide regular feedback on data quality	
	All of the above (Overall) on Culture of information scales		**0.88**

Table 4: Composite Indices for Measuring Underlying Constructs of the Determinants of RHIS Performance

Composite Indicator	Indicator Item	Questions	Cronbach's alpha
		Staff in the health facility	0.56
Expanded Culture of information scales		can make decisions appropriate to their job descriptions in response to the findings of data analysis	
		use RHIS data for community education and mobilisation	
	Problem solving	***Staff in the health facility are able to:***	0.81
		collect data to identify the root cause(s) of problems	
		Use of RHIS information	
		can come out with appropriate outcomes for a specific intervention	
		can evaluate if the goals of an intervention have been achieved	
	Sense of responsibility	***Staff in the health department:***	0.81
		are punctual	
		keep records	
		complete RHIS tasks	
		show commitment to the RHIS mission of generating and using good quality	
		set appropriate and realistic goals	
		feel responsibility for not accomplishing set targets	
		can prepare visuals showing progress toward targets	
		admit mistakes when they occur and take corrective actions	
	Accountability/ empowerment	***Staff in the health department:***	0.63
		can say no to superiors and colleagues for demands not backed by evidence	

	are empowered to make decisions are accountable for their performance feel guilty for not accomplishing the set target	
Promotion of evidence-based decision-making	Decisions in the health department are based on: personal preference of those making the decision. directives of superiors' data/ facts/evidence political interference/agenda/considerations what was done in the previous year funding directives from higher levels official strategic health sector objectives health needs locally identified in the population considering relative cost of intervention participatory decision making by taking contributions from relevant staff.	0.50
All of the above on expanded culture of information		0.86

Table 5: Composite Indices for Measuring Underlying Constructs of the Determinants of RHIS Performance

Composite Indicator	Statement	Cronbach's alpha
Motivation scales	I am discouraged when the data I collect are not used to take decisions I find data collection or recording to be boring Collecting/recording data is meaningful to me Recording data gives me the feeling that data is needed to monitor the performance Data collection/recording is forced on me My job of data collection/recording is appreciated by all Data collection is extra workload I feel it is not the duty of health care providers to collect/record data Data collection promote team work	0.56
Supportive management scale	Superiors in the health facility are open to alternative views Superiors in the health facility listen to employees' ideas and concerns Superiors in the health facility allow disagreement before reaching a decision Superiors in the health facility are concerned about serving target community or clients' needs	0.76
Promotion of reward scale	Superiors in the health facility reward staff for good performance Staff in the health department receive award for good work	0.64
Availability of resources scale	Staff in the health department have the required forms and instruction guide for MCH/RHIS activities Staff in the health department are given appropriate training on MCH/RHIS activities	0.72

Data Collection Procedure

Approval of the research protocol, and obtaining ethical clearance from Cape Coast Teaching Hospital Ethical Review Committee (CCTHERC), the University of Cape Coast Institutional Review Board (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS-ERC) paved way for data collection. Permission was sought from the CCMHD of the GHS. Consent was also sought at every level of the research process, that is,

individuals such as facility heads, health information managers, and HCPs who filled the questionnaire. They were briefed on the research objectives, their role, and freedom to stop at any point of the research process (voluntary participation). In addition, they were made aware that the research was solely for academic purposes and that no compensation or monetary rewards will be given them. However, the finding and conclusion from the study could be presented at workshops, seminars, conferences, and can be used for teaching purposes. Meanwhile, respondents were assured of anonymity and confidentiality of the information they provide. To allay their fears on the confidentiality of their responses, they were made aware that all the responses will be aggregated and that no individual response will be singled out. Health care professionals who were willing to respond to the interview were asked to sign an inform consent form before proceeding to answer the questions. They were also made aware that the data collected will be saved on the personal computer of the researcher under password where no other person could gain access.

Data collection took place between February 2021 and May 2021, a period where Corona Virus Disease (COVID-19) was seriously challenging the health system in general. Hence, the following guidelines as recommended by the WHO (WHO, 2020a; 2020b) and the national preventive directives on COVID-19 (GHS, 2020) were duly followed to ensure adequate protection and also to ensure that the research was conducted in a manner that protected the safety, rights and welfare of the research participants as well as the research team:

- All COVID- 19 preventive protocols were strictly adhered to during the printing, packaging and administration of the questionnaires and the checklists.
- All research assistants (Ras) went through a mandatory daily temperature check before the start of the day's activities in order to ensure that their body temperatures fell within the acceptable range. Any team member whose body temperature was considered high was not allowed to embark on the day's activities and subsequently sent for further screening in a health facility.
- All RAs practised hand washing with soap under running water or sanitised their hands with alcohol-based hand sanitiser on arrival at the health facilities.
- Both respondents and RAs were given face masks and alcohol-based hand sanitisers at no cost to them.
- Both respondents and RAs were encouraged to wear face mask and use hand sanitizers.
- Research assistants were taught how to wear, remove and care for reusable facemasks.
- Social/physical distancing was kept between the RAs and the respondents.

Multiple data collection methods were used including, review of MCH relevant documents (registers and forms) and DHIMS2 software, distribution of two different sets of structured questionnaires to KIs and HCPs, written test to HCPs, and participant observation. Data collection took place at 13 selected health facilities (including Cape Coast Teaching Hospital, Baiden

Ghartey Memorial Hospital, Metropolitan Hospital, University Hospital, DIS Clinic) with the help of three trained RAs. The RAs were trained on the purpose, protocols, and instruments for data collections. This training offered the RA the ability to: build rapport with the participants; appropriately review MCH registers and forms; correctly use the checklists; conduct the written test and do participant observation; and distribute the questionnaire to the participants. The training involved translating the questionnaire items to the Fante language and back translating them in the English language to maintain same meanings and to avoid differences in interpreting the items (Ansah, 2017), to prevent misinterpretation of the items.

A data collation sheet was used to review documents from the MCH registers and reports for data quality (accuracy, completeness, and timeliness). Three data sources were used to examine data quality metrics: primary source data at health facilities like antenatal registers, delivery registers, postnatal registers, and EPI tally sheets; facility aggregate data such as Midwife's returns form and vaccination form; and facility-reported data in DHIS2. The ANC registers, PNC registers, Delivery book registers, and EPI tally book were used to collect data on accuracy of MCH indicators. For each selected MCH variable, the RAs recounted the data in the register on monthly basis and the results documented in a data collation sheet. Further, data in the monthly midwives, and vaccination report forms were documented in the data collation sheet for each of the selected indicators. The same process was repeated for facility-reported data in DHIS2 for midwives returns report and vaccination report. A double-visual verification approach was used to review documents from the MCH registers for data accuracy metric. Two RAs verified the data

separately from the various MCH registers and compared their results in order to correct any discrepancies. This implied that the likelihood of making any mistake during the verification of the data is directly proportional to the likelihood that these two RAs will make the same mistake. I conducted daily supervision to ensure that all collected data were complete and consistent among the two RA. There was largely agreement between the two RAs recounted data, except in one facility where variations were observed once in their figures for two indicators (deliveries, and PNC). Subsequently, new collation sheets were given to the RAs to recount the data for the two indicators, where the figures tallied.

The focus for data completeness, timeliness, and consistency was the data in DHIS2 database and not the registers or facility forms. Therefore, two main reports (the reporting rate summary and the summary reporting form) were extracted from DHIS2 database. The reporting rate summary was used to assess the completeness and timeliness of facility reporting, whereas summary reporting form assessed the completeness of indicator data and consistency of data (consistency over time, consistency between related data, and outliers in the referenced year). The reporting periods for data accuracy, timeliness, and completeness assessment were January 2020 to December 2020, and that of consistency was January 2017 to December 2020. Consequently, a yearly report for the three years, (January 2017 to December 2019), was downloaded from the DHIS2 database to serve as comparison for assessing the consistency of data overtime. Two RAs conducted the document review, and the third RA administered the questionnaire to the respondents. The copies of questionnaire

were administered to the respondents face-to-face, at their health facilities. Respondents had at least seven days to return the completed questionnaire.

At health facilities, checklists, document review and observations were done concurrently. Further, the RAs made documentary review and observations on MCH/RHIS recording tools and source documents, MCH monthly reports, guidelines, planning documents, feedback reports/notes, and minutes of meetings. Specifically, they observed the availability of copies of MCH/RHIS data management guidelines, evidence of use of standardised RHIS data collection and reporting tools, evidence of analysed data, and visual representation of data at the facility. They also observed availability of data quality assurance guidelines and tools, existence of documents on clearly assigned roles and responsibilities for data entry and review, and availability of regular internal data quality checks conducted by the health facility. Records of facility meetings, evidence of using data for discussion, decisions that had been made based on those discussions, supervisory feedback were also observed. The Health Information Officers for CCMHD and the Cape Coast Teaching Hospital assisted in extracting the relevant data in DHIS2 database for the study. Data collection at each health facility took an average of 3 days. Data collection took thirty-nine (39) days.

Data Processing and Analysis

Data gathered from the research was entered into MS excel, and Statistical Package for the Social Sciences (SPSS version 22.0) for windows. Frequency distributions and box plots were used to screen data for missing values and outliers to ensure the data is complete. Data analysis was done based on the demographic data, and the research objectives set for the study.

Research Objective 1: To assess the level of RHIS performance (MCH data quality and information use) in the HCFs at the CCM

This research objective sought to evaluate the level of MCH data quality, and information use in health facilities in the CCM. Frequencies, percentages, and verification factors (VF) were calculated to characterise data quality by accuracy, completeness, timelines and consistency.

Accuracy. MCH data accuracy was determined through data accuracy checks, which involved verification of the numerical consistency of the recoded data in the, (1) RHIS registers kept at the facilities, (2) monthly aggregated form generated from the registers, and (3) data found in DHIS2 database, for the eight selected MCH indicators, using VF. Verification factor is a summary indicator that measures the proportion of the number of recounted data from source documents to the number of reported data over the same period of time. Thus, VF is equal to the number of recounted data in the source document divided by the number of reported data in the forms or DHIS2 database multiplied by 100. The mean and associated 95% confidence interval (95% CI) of each variable was calculated. When the value of the recounted data and indicator data reported are equal, VF is equal to 1 and the report is said to be ideal. Any deviation from VF of 1 is indicative of either under (VF greater than 1) or over-reporting (VF less than 1). The difference of an ideal reported VF and observed VF (1-VF) demonstrates either under-reporting or over-reporting. A report was considered accurate if the VF was within ±10 precision (between 0.9 and 1.10), and inaccurate if the ratio of recounted data to the reported data was less than 0.9 or greater than 1.10. Three types of VFs were calculated for data accuracy across the three data sources (registers, aggregated forms, and DHIS2 database). Verification factor

1 (VF_1) measures the error in data transfer from the registers to the aggregate data forms; VF_2 measures the error in data transfer from the registers to the DHIS2 database; and VF_3 measures the error in transferring data from the form to the DHIS2 database, as shown in Figure 5 below.

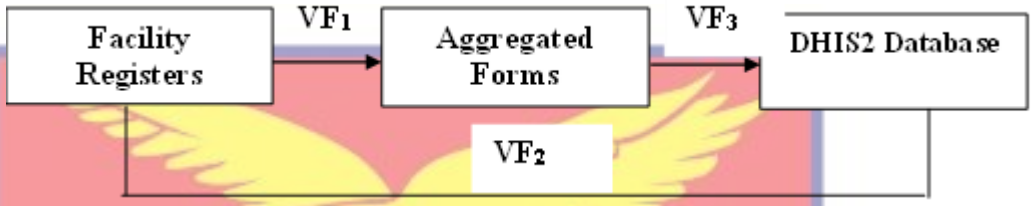

Figure 5: Verification factor from facility register to DHIS2 database

Data completeness. Data completeness was assessed in two strands: completeness of the reports, and completeness of indicator data reported in DHIS2. Two reports (Monthly Midwife's Returns for maternal health variables, and Monthly Vaccination Report for child health variables) were considered for completeness of the reports. Facilities which submitted these two reports for the 12 months of 2020 into the DHIS2 platform were assessed. The ratio of total reports available/received to the total reports expected were calculated to show the level of completeness of the reports. Completeness of indicator data reported in DHIS2 was assessed by finding the ratio of number of reports that are complete to the total reports available/received.

Timeliness. Timeliness of facility reporting data into DHIS2 database was assessed by finding the percentage of facility's expected monthly reports against the actual reports submitted into the DHIS2 database on or before a GHS scheduled date (5^{th} of the ensuing month) for monthly midwife's returns report, and monthly vaccination report.

Consistency. Consistency of the data was assessed under three groupings: consistency over time, consistency between related variables, and

consistency of event reporting. Consistency over time was analysed by finding the mean ratio of an indicator for reference year (2020) to the mean of the same indicator for the three preceding years (2017, 2018, 2019) combined. Data was considered consistent over time if the reported value for 2020 was within ±33% of the mean value for the preceding three years (2017, 2018, 2019), taking into account any expected changes in the patterns of service delivery (WHO, 2014b). Consistency over time was also assessed to ascertain how individual facility values were consistent or different from the district values for the eight MCH data reported into DHIS2 database. Consistency of related indicator was analysed by calculating the facility's ratio for values of indicator-pairs that have a predictable relationship. The indicator pairs considered include: Penta1 and ANC1; Penta1 and Penta3; and ANC1 and ANC4. Outlier analysis was used to assess consistency of event reporting. Two types of outliers (moderate and extreme) were calculated. Values that were at least two standard deviations from the average value for the MCH indicator at a specified time were considered moderate and three standard deviations were considered extreme outliers.

Information use. Three criteria were used to assess information use, including (1) presence of management or performance monitoring teams, (2) availability of document/report based on MCH/RHIS and reviewing the report for use of information, and (3) observing evidence of records (discussions, findings and decisions) of meetings held on MCH/RHIS in the referenced year, 2020. The responses to all questions on information use were dichotomous; therefore, frequency distribution of answered responses provided basic information about a given question. A mean percentage score

was calculated to indicate the overall information use metric. The average percentage score was calculated for all the constructs on information use.

Research Objective 2: To assess the functionality of MCH/RHIS processes in the HCFs at the CCM

The purpose of this analysis was to assess the functionality of MCH in RHIS processes in HCFs at the CCM. The functionality of these processes was measured by assessing the availability of data collection, data processing, and data quality checks manuals/procedures, as well as ascertaining whether there were directives on data quality check and transmission, analysed data, displayed data, and feedback mechanisms in place at the health facilities. All the questions measuring the functionality of RHIS processes in the HCFs were categorical with yes or no responses; thus, frequencies and percentages were calculated. Mean percentage scores were calculated for each of the following variables: data collection, verification and transmission at health facilities; data quality assessment mechanism; data processing and analysis; supervision quality; feedback mechanism; and display of information. Likewise, a mean percentage score was calculated to measure the overall functionality of RHIS processes in the HCFs.

Research Objective 3: To assess the technical, organisational, and behavioural factors of MCH data quality and information use in RHIS in the HCFs at the CCM

The purpose of this objective was to identify the factors that have implications on the performance of MCH data in the HCFs at the CCM. These factors were assessed under technical, organisational, and behavioural.

Technical factors of MCH/RHIS. All the questions measuring the technical factors were categorical with yes or no responses. Frequencies and percentages were calculated for the yes or no responses for each question.

Organisational factors of MCH/RHIS. The various RHIS management functions were assessed using more than two items with yes or no responses. Index percentile score was calculated for each function to determine if the criteria for a particular management function is met and the percentage of facilities meeting this function. For instance, a 100% score indicates that all the criteria are met for a said management function for all the facilities, and no criteria met led to zero percentile score. Again, mean score was calculated to determine the overall RHIS management function at all the health facilities.

Culture of information: A culture of information at HCFs in CCM was operationalised as how HCPs believe their superiors promote the following: problem solving skills related to data; data quality; use of MCH/RHIS information; evidence-based decision making; accountability and empowerment; a sense of responsibility; and feedback from staff and community. Respondents were asked to score how much they agreed or disagreed with statements that corresponded to these indicators. The ratings were on a five-point Likert scale of strongly disagree, disagree, undecided, agree, and strongly agree. Most of the variables were composite indices of more than two question items. Thus, they were converted into percentile score. Responses for items under each indicator were aggregated and divided by the total number of items, and the result multiplied by 100 to get the percentile

score for that indicator. The mean percentile score was calculated to measure the overall culture of information.

Activities for promotion of culture of information: All the questions measuring activities for promotion of culture of information were categorical with yes or no responses. Frequencies and percentages were calculated for the yes or no responses for each question. A mean percentage score was calculated to measure the overall activities for promotion of culture of information.

Reward for good work: This was measured by two items describing respondents' perception of behaviours on a five-point Likert scale of strongly disagree, disagree, undecided, agree, and strongly agree. The average percentage score was calculated to measure the overall reward for good work.

Availability of resources: Most of the questions in the facility checklist are categorical with yes or no responses, with a few that require responses given in quantities. Percentages were calculated for the yes or no responses. Responses that required quantities were grouped into numbers (0, 1 and 2) and described accordingly. Responses for the items measuring perceived availability of resources and supportive management were each aggregated and divided by the total number of items, and the results multiplied by 100 to get a percentile score

Behavioural factors of MCH/RHIS. The construct for assessing behavioural factors affecting MCH/RHIS performance in the CCM were operationalised under the following dimensions: self-efficacy or confidence level for MCH/RHIS tasks; MCH/RHIS task competence; knowledge of the

rationale for MCH/RHIS data collection; motivation; and problem- solving skill.

Confidence level (Self-efficacy) for MCH/RHIS tasks: The confidence levels were assessed on a scale of 0 to 100, that is, from respondents' perception of no confidence at zero to full confidence at hundred in performing a particular MCH/RHIS task. Confidence percentile scores were calculated for the following MCH/RHIS tasks: checking data quality, calculating percentages/rates, plotting graph, interpretation and information use. Competence in RHIS tasks involved assessing respondent's competence to check data quality, calculate, plot, explain, and use data. Overall score for respondents' competence to do calculation with data was determined by adding up the answers for the three questions. The raw scores vary between zero and one; thus, a correct answer receives a score of one and an incorrect answer gets zero. The percentile score was calculated by dividing the total raw score by three (number of questions on calculation), and multiplying the results by 100. The same procedure was repeated for their competence to check data quality, plot, explain, and use data.

Knowledge of the rationale for MCH/RHIS data collection: Six questions were asked regarding respondents' knowledge of the rationale for MCH/RHIS data collection. There are three correct answers for each question, except for one question that had two correct answers. Respondents who provided all three accurate responses to any of the questions receive a raw score of 3. To create an index score for knowledge of the rationale for RHIS data collection, all the raw scores from all the six questions are aggregated and the results multiplied by 100 to arrive at the percentile score.

Problem-solving skills: A pencil and paper test was used to assess the respondent's problem-solving skills. Respondents were given a scenario with an opening and closing, and they were required to fill the middle part by defining the problem quantitatively, listing four reasons for the problem, and describing five activities to solve the problem. Regarding problem definition, because no information was given about the target in the scenario, a respondent is expected to assume any target for data quality so as to be able to find the gap between the target and the actual level of data quality. Also, the problem has to be defined as a gap in performance. Consequently, if these two criteria are met, the definition of the problem would be considered correct and would receive a score of one, and zero if otherwise. Therefore, a percentile score was calculated by adding up the scores divided by the total items, and the results multiplied by 100. Regarding describing the problem, the respondents were expected to provide four possible reasons for the problem. Each correct reason provided gets a score of 1 and zero if otherwise. The range varied between zero and four. The overall percentile score was obtained by adding up the scores, divided by the total items (4) and multiplied by 100. Likewise, the respondents were required to provide five major activities or action plans, indicating specific steps to solve the problem as well as define monitoring and evaluating mechanisms. Each activity described by the respondents gets a raw score of one. The overall percentile score is obtained by adding up the scores, divided by the total items (5) and multiplied by 100. The range varies between 0 and 10.

Motivation: Eight items relating to perceived positive and negative outcomes of RHIS activities assessed HCPs motivation. Reversed ratings were

used for the negatively worded items. To get the percentile score, responses for the items were aggregated and divided by the total number of items, and the results multiplied by 100.

Research Objective 4: To determine how organisational factors (promotion of culture of information, reward system, supportive management, and resources availability) affect behavioural factors (self-efficacy and motivation)

The purpose of this analysis was to ascertain the relationship between the HCPs level association and indices identified through Cronbach's alpha analysis. The Bivariate analysis using Pearson product-moment correlation coefficient (r) was done to investigate relationship between organisational factors and the behavioural factors.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

The purpose of this study was to assess the performance of MCH data in RHIS with the view to establish an understanding on current status of MCH data, as well as identify the technical, organisational, and behavioural factors that contribute to MCH performance among HCFs in CCM. The results are presented in relation to the socio-demographic data and research objectives.

Socio-Demographic Characteristics of Respondents

The HCFs considered in this study were made up of 77% public and 23% private facilities. Table 6 presents the socio-demographic characteristics of respondents. A total of 278 respondents comprising 265 HCPs involved in the management of MCH/RHIS data and 13 KIs were interviewed from thirteen HCFs in the CCM. Majority (70.5%) of the respondents were females. Their ages ranged between 23 years to 65 years with majority of them in the age brackets of 30-39years (50.4%) and 20-29 years (39.69%), and a mean age of 32 years and 41 years for the HCPs and KIs respectively. Over 89% of the respondents had a Diploma or higher degrees. Majority of the respondent (78%) had between 1 to 10 years working experience in the relevant health departments, given an average of 7 years working experience for the HCPs, whereas that of the KIs was 15 years. Further, 84% of the HCPs had been working on MCH/RHIS between 1 to 10 years, with an average of 6 years working experience in MCH/RHIS in the health departments, whereas that of the KIs was 15 years.

Table 6: Socio-Demographic Characteristics of Respondents

Sex Distribution of Respondents				
Variable	**HCPs**		**Key Informants**	
	Frequency	**Percent**	**Frequency**	**Percent**
Male	73	27.6	6	46.2
Female	189	71.3	7	53.8
Don't want to answer	3	1.1	0	0
Total	265	100	13	100
Age Distribution of Respondents				
	HCPs		**Key Informants**	
Years	Frequency	Percent	Frequency	Percent
Years				
20-29	109	41.1	1	7.7
30-39	134	50.6	6	46.1
40-49	17	6.4	5	38.5
50-59	5	1.9	0	0
60 and above			1	7.7
Total	**265**	**100.0**	**13**	**100**
Mean	**32**		**41**	
SD	**5.9**		**8.2**	
Min	**23**		**28**	
Max	**54**		**65**	
Level of Education				
Level	**HCPs**		**Key Informants**	
	Frequency	Percent	Frequency	Percent
Senior high	3	1.1	0	0
Diploma	162	61.1	6	46.2
Bachelor	76	28.7	6	46.1
Masters	0	0	1	7.7
Others	24	9.1	0	0
Total	265	100.0	13	100
Number of Years of Employment				
Years	**HCPs**		**Key Informants**	
	Frequency	Percent	Frequency	Percent
1-5	157	59.2	1	7.7
6-10	58	21.9	1	7.7
11-20	42	15.9	10	76.9
21-30	6	2.2	0	0
≤ 31	2	.8	1	7.7
Total	**265**	**100**		
Mean:		**6.8**	**14.9**	
Standard Deviation:		**5.5**	**7.9**	
Minimum Value:		**1**	**4**	
Maximum Value:		**34**	**38**	

Number of Years of Working with MCH/RHIS				
Years	HCPs		Key Informants	
	Frequency	Percent	Frequency	Percent
1-5	185	69.8	1	7.7
6-10	59	22.3	1	7.7
11-20	16	6.0	10	76.9
21-30	5	1.9	0	0
≤ 31	0	0	1	7.7
Total	**265**	**100**		
Mean:		**6.3**	**14.9**	
Standard Deviation:		**5.0**	**7.9**	
Minimum Value:		**1**	**4**	
Maximum Value:		**30**	**38**	

Research Objective 1: To Assess the Level of RHIS Performance (MCH Data Quality and Information Use) in the HCFs at the CCM

The purpose of this objective was to determine the levels of MCH data quality and information use status at the HCFs in the CCM. The objective was analysed by reviewing facilities documents, interviewing KIs using a structured questionnaire, and carrying out observations at the HCFs. RHIS performance was assessed by two criteria: (1) level of MCH data quality, and (2) information use (access to data, existence of analysed data, and use of RHIS data for monitoring and planning).

Level of MCH data quality

The status of MCH data quality in terms of data completeness, timeliness, accuracy, and consistency were quantified by analysing eight MCH indicators. The indicators include, ANC registrants, ANC 4th visit, Td2+, IPT1, deliveries, PNC, penta1, and penta3.

MCH data accuracy. Maternal and child health data accuracy was determined through data accuracy checks. Data accuracy check involved verifying the numerical consistency of recoded data in the RHIS registers which is kept at the healthcare facility, the monthly aggregated form generated from the registers, and data found in DHIS2 database for the eight selected

MCH indicators, using VF. The data from these sources were then compared using the VF to check their accuracy. Thus, VF was calculated for data in the registers and that of forms, data in the register and that of DHIS2 database, and data in the reported forms and that of DHIS2 database for the periods, January 2020 to December 2020.

Data accuracy between the registers and monthly reported forms. The results indicated that the overall accuracy between the registers and forms at health facilities was 102.1% (95% CI = 97.5% to 106.7%) with variations among the indicators, month, and HCFs (see Table 7). The results showed that four of the eight indicators (ANC1, ANC4, Td2+, and IPT1) had scores above 100%, a situation which implies under-reporting (WHO, 2014b) of recounted data from the registers to the monthly report forms, indicating fewer ANC1, ANC4, and IPT1 services rendered monthly than what was contained in the source document, the register (see Table 7). Moreover, four of the MCH indicators (deliveries, PNC registrants, Penta1 and Penta3) had values below 100%, implying that there was over-reporting on the monthly report forms.

Apart from February and March which recorded a VF of less than 100% (indicating over-reporting) and December recording VF of 100% (no variation), the rest of the months recorded under-reporting of data from the registers to the monthly report forms (see Table 7). Data is said to be accurate when the reported value in the monthly reporting form is within ±10% of the facility register's value. The WHO (2014b) recommends a score of 90-110% (within 10% of a perfect 100%) as an ideal score for data accuracy when assessing the extent to which data match across sources. All the HCFs were within the tolerance limit for the Penta1, while 92% were within the set limits

for Penta3 (see Figure 6). For the maternal health indicators, 85% of the HCFs were within the threshold recommended by WHO for data accuracy for deliveries, 62% each for antenatal registrants and ANC4, 54% for PNC, and 46% each for IPT1 and Td2+ (MEASURE Evaluation, 2017; WHO, 2014b). About 68% of the facilities' data were within the ±10% tolerance limits for data accuracy for all the eight indicators when data found in the registers were compared to that on the forms. It was also observed that one facility had a VF of 1 when data was compared between registers and forms for all the MCH indicators.

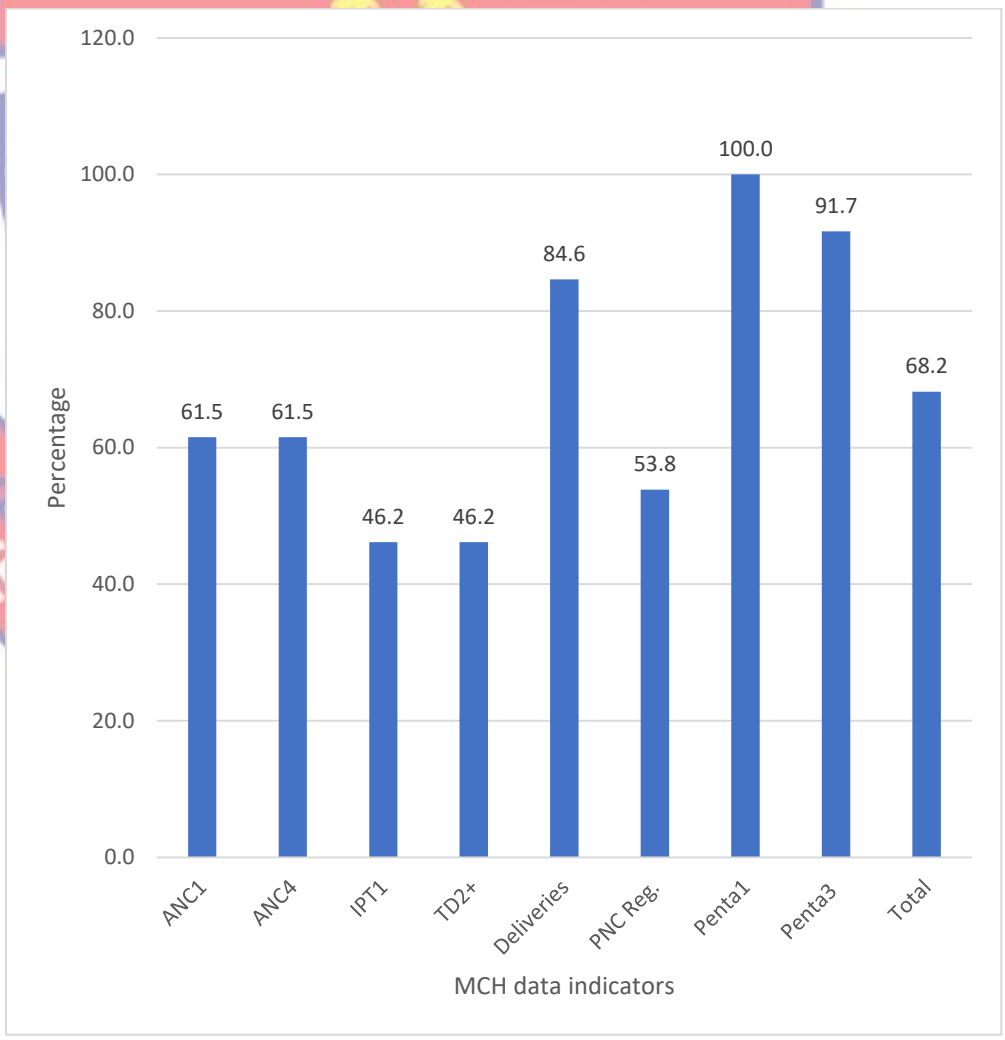

Figure 6: Percentage of HCFs within 10% threshold for accuracy between the registers and forms

Data accuracy between the registers and monthly report of DHIMS2. Quality of MCH data in the registers and that in the DHIS2 for ANC1, ANC4, Td2+, IPT1, deliveries, postnatal, penta1 and penta3, was also assessed by counting the data in the registers and matching them with those reported in the DHIS2 database. The results indicated disparities among the data in the registers and DHIS2 database across the eight MCH indicators for the 12 months period. Apart from January (92.5%) and November (97.9%) that had over-reporting, the rest of the months saw under-reporting from the registers to DHIS2 database (see Table 8). In addition, inaccuracies were observed in January for five indicators, three indicators each in May and September, two each in June, August, and December, and one each in February, March, April, July, and October, at the 100% ± 10% (MEASURE Evaluation, 2017).

An overall figure of 102.4% (95% CI = 94.4% to 110.4%) data accuracy was recorded between registers and DHISM2 (see Table 8). However, the VF for Td2+ (122.3%) fell outside the acceptable range of 100% ± 10% (WHO, 2014b), suggesting an inaccurate data in DHIS2 for Td2+. Unfortunately, none of the HCFs data were within the ±10% tolerance limits for data accuracy for all the MCH indicators. As evident in Figure 7, about 92% and 83% of the HCFs were within the set limits for the child health indicators (Penta1 and Penta3 respectively). For maternal health indicators, about 85%, 80%, 54% and 46% HCFs were within the 100 ±10% tolerance level for deliveries, ANC1, ANC4 and PNC, IPT1 and Td2+, respectively (see Figure 7).

Table 7: Data Accuracy between the Registers and Forms

Indicator	Months												Statistics: Overall mean VFs				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	SD	Min	Max	95% CI
ANC1	109.0	105.3	106.6	102.8	106.5	107.2	108.6	102.5	**114.1**	106.4	105.6	106.8	106.7	3.1	102.5	114.1	1.92
ANC4	**129.4**	108.9	103.0	109.8	100.7	109.8	98.5	99.6	**113.8**	107.9	98.2	106.6	107.4	8.7	98.2	129.4	5.5
IPT1	105.6	96.1	96.3	98.1	**130.6**	105.7	97.4	99.7	100.9	94.4	103.9	98.2	101.3	9.7	94.4	130.6	6.15
Td2+	**112.8**	99.1	99.7	108.3	**115.9**	100.5	**114.0**	101.2	105.0	105.7	**171.9**	**119.9**	**110.6**	19.8	99.1	171.9	12.61
Deliveries	105.3	99.3	101.0	98.4	97.1	100.0	100.2	101.1	98.0	100.4	97.5	100.2	99.7	2.2	97.1	105.3	1.38
PNC Reg.	91.7	95.3	95.6	95.9	95.5	93.4	94.1	96.1	95.4	93.4	97.2	94.8	95.0	1.49	91.7	97.2	0.95
Penta1	89.8	96.0	97.0	97.0	99.7	99.1	100.9	**112.1**	**88.9**	103.8	**121.3**	89.9	99.3	9.4	88.9	121.3	5.99
Penta3	**87.8**	91.1	92.0	99.3	100.0	95.6	98.5	96.8	99.7	109.7	98.3	93.5	96.9	5.6	87.8	109.7	3.56
Mean	103.8	99.0	99.0	100.4	102.1	100.6	100.8	101.1	100.9	102.1	105.8	100.0	102.1	5.5	95	110.6	4.61

Note: ***Values outside the threshold recommended by WHO for data accuracy (±10% tolerance limits) boldened***

Comparing the VFs by ownership, the findings revealed that all the government owned facilities (combined) were between 90% and 110% for all the MCH variables except for Td2+, while the privately owned facilities had two of the MCH variables (ANC1 and PNC) outside the acceptable WHO threshold for data accuracy (MEASURE Evaluation, 2017; WHO, 2014b). However, comparing the VFs by care, (see Table 9), it was observed that the Teaching Hospital, and Health Centres had VFs within the acceptable limit (90% to 110%) for all the MCH variables. In contrast, the District Hospitals, the clinics, the Metropolitan hospital, and CHPs compounds had VFs outside the acceptable limit (90% to 110%). For example, the District Hospitals had VFs of 111.7 and 128.2 for ANC1 and ANC4 respectively, Metropolitan hospital had VFs of 296.5% for Td2+ and 120.6% for Penta3, clinics had VF of 66.4% for PNC and CHPs compounds also had 75.5% for PNC (see Table 9).

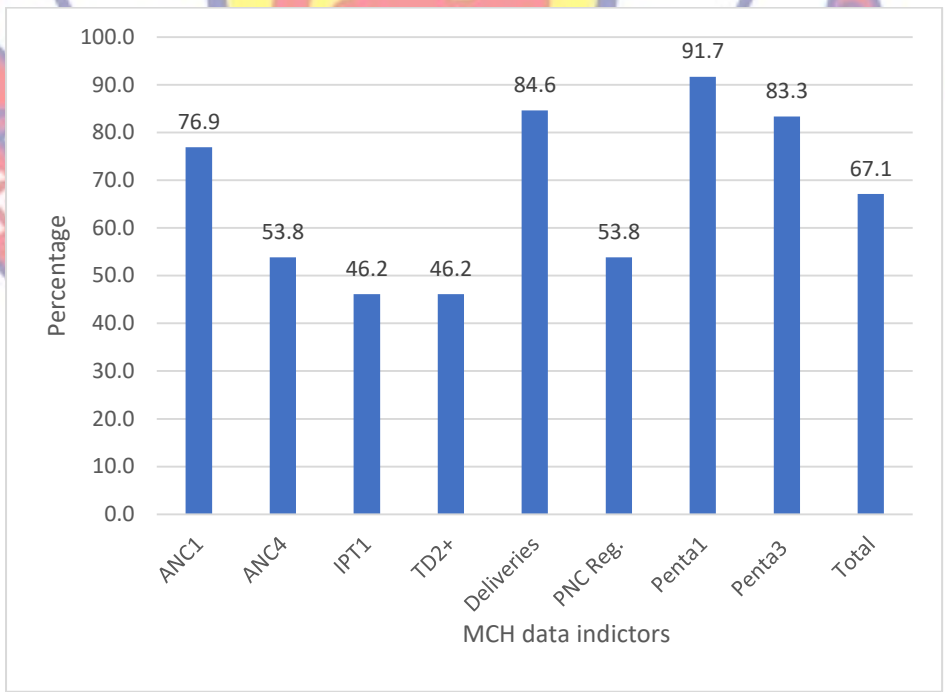

Figure 7: Percentage of HCFs within 10% threshold for MCH data accuracy between the registers and DHIS2

Data accuracy between forms and DHIS2 Database. Data were compared by calculating the VF for data in the monthly reported forms and that reported in DHIS2 (see Table 10). Aside Td2+ and Penta3 that had VF above 100%, indicating under-reporting from monthly reporting forms into the DHIS2 database, the rest of the indicators had VF below 100%, an indication of over-reporting from monthly reporting forms into the DHIS2 database. Similarly, under-reporting and over-reporting of data were observed in the monthly data in DHIS2 database. Thus, VFs for Td2+ (110.6%) was under-reported and the month of January (89.1%) was over-reported into the DHIS2 database (see Table 10). These scores fell outside the tolerance threshold of 100% ±10% (MEASURE Evaluation, 2017; WHO, 2014b), indicating that report on Td2+ and the report for January in DHIMS2 were not accurate.

The overall data accuracy found in the monthly report and that of the DHIS2 database was 100.1% (95% CI = 96.4% to 103.9%) (see Table 10), indicating that the overall MCH data in DHIS2 were accurate. Further, about 31% of the HCFs data were within the ±10% tolerance limits for data accuracy for all the MCH indicators, when data in the forms were evaluated against that of the DHIS2. Thus, these HCFs had all their MCH data in DHIS2 to be accurate. About 92% of the HCFs were within the set limits for data accuracy for the child health indicators (Penta1 and Penta3) (see Figure 8). Again, 92%, 85%, 77%, and 53% of the HCFs were within the WHO recommendations threshold (MEASURE Evaluation, 2017; WHO, 2014b) for the maternal health indicators, ANC1, ANC4 and deliveries, IPT1 and PNC, and Td2+ respectively.

Table 8: Data Accuracy between Registers and DHIS2 Database

Indicator	Months												Statistics: Overall mean VFs				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	SD	Min	Max	95%CI
ANC1	108.6	105.3	105.6	103.0	106.8	107.5	106.0	103.1	**111.9**	103.5	109.3	106.4	106.4	2.7	103	111.9	1.69
ANC4	**127.0**	103.6	103.0	109.8	100.7	108.6	96.4	101.2	106.6	107.9	101.2	105.9	106.2	7.7	96.4	127	4.87
IPT1	105.0	95.9	96.0	97.8	**129.4**	109.2	97.7	97.6	98.6	93.3	109.0	95.9	101.1	10.1	93.3	129.4	6.39
Td2+	108.2	**144.5**	**119.2**	149.2	**113.2**	**123.4**	**143.9**	**114.6**	**121.4**	**117.8**	99.6	**124.9**	**122.3**	15.3	99.6	149.2	9.7
Deliveries	**86.0**	99.3	101.0	100.5	97.2	99.5	99.7	101.5	96.9	99.4	98.7	100.2	98.4	4.1	86	101.5	2.61
PNC Reg.	**56.0**	94.9	95.3	96.2	93.0	90.9	92.9	93.7	92.9	91.5	95.3	99.8	90.8	11.3	56	99.8	7.17
Penta1	**89.8**	96.9	97.0	97.0	100.0	93.0	100.9	**111.8**	92.5	100.3	**84.5**	94.4	96.4	6.8	84.5	111.8	4.29
Penta3	**88.7**	91.1	92.0	99.3	**119.6**	95.6	98.2	93.9	**111.4**	107.9	**84.6**	90.5	97.4	10.3	84.6	119.6	6.56
Mean	92.5	101.8	100.2	103.1	103.2	100.4	101.3	101.0	102.0	101.4	97.9	101.2	102.4	9.6	90.8	122.3	8.00

Note: Values outside the threshold recommended by WHO for data accuracy (±10% tolerance limits) boldened

Table 9: Data Accuracy between Registers and Monthly Report in DHIS2 by Facility Type and Ownership

	By care						By ownership	
Indicator	Teaching Hospital	Metro Hospital	District Hospitals	Clinics	Health Centres	CHPS Compound	Government	Private
ANC1	106.2	100.0	**111.7**	109.8	106.2	107.3	104.4	**121.5**
ANC4	102.4	104.7	**128.2**	104.4	102.4	95.4	106.0	108.0
IPT1	100.2	100.0	96.4	100.9	100.2	97.8	101.4	98.4
Td2+	109.8	**269.5**	100.6	95.9	109.8	103.3	**126.8**	91.9
Deliveries	100.3	100.4	100.6	100.0	100.3	90.6	98.5	95.9
PNC Reg.	95.7	102.4	97.8	**66.4**	95.7	**75.5**	92.0	**76.0**
Penta1	96.2	100.2	102.7	97.4	96.2	96.4	96.4	97.0
Penta3	91.6	**120.6**	96.4	96.2	91.6	93.2	97.7	95.3

Note: Values outside the threshold recommended by WHO for data accuracy (±10% tolerance limits) boldened

Table 10: Data Accuracy between Forms and DHIS2 Database

Indicators	Months												Statistics: Overall mean VFs				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	SD	Min	Max	95%CI
ANC1	99.6	100.0	99.1	100.3	100.3	100.2	97.6	100.7	98.1	97.3	103.5	99.6	99.7	1.6	97.3	103.5	1.04
ANC4	98.2	95.1	100.0	100.0	100.0	98.9	97.8	101.5	93.7	100.0	103.0	99.3	98.9	2.6	93.7	103	1.62
IPT1	99.4	99.7	99.7	99.7	99.1	103.3	100.4	97.9	97.7	98.8	104.9	97.7	99.8	2.9	97.7	104.9	1.39
Td2+	95.9	**145.8**	**119.7**	**137.7**	97.7	**122.7**	**126.2**	**113.2**	**115.5**	**111.5**	**58.0**	104.1	**110.6**	22.6	58	145.8	14.38
Deliveries	**81.7**	100.0	100.0	102.2	100.2	99.5	99.5	100.4	98.9	99.0	101.3	100.0	98.7	5.4	81.7	102.2	3.42
PNC Reg.	**61.1**	99.6	99.7	100.3	97.3	97.3	98.7	97.5	97.4	98.0	98.1	105.3	95.6	11.2	61.1	105.3	7.10
Penta1	100.0	100.9	100.0	100.0	100.3	93.8	100.0	99.7	104.0	96.6	**69.6**	105.1	97.1	9.3	69.6	105.1	5.88
Penta3	101.0	100.0	100.0	100.0	**119.6**	100.0	99.7	96.9	**111.7**	98.4	**86.0**	96.8	100.6	8.2	86	119.6	5.18
Mean	**89.1**	102.9	101.2	102.7	101.1	99.8	100.5	99.9	101.1	99.3	92.5	101.2	100.1	4.5	95.6	110.6	3.78

Note: Values outside the threshold recommended by WHO for data accuracy (±10% tolerance limits) boldened

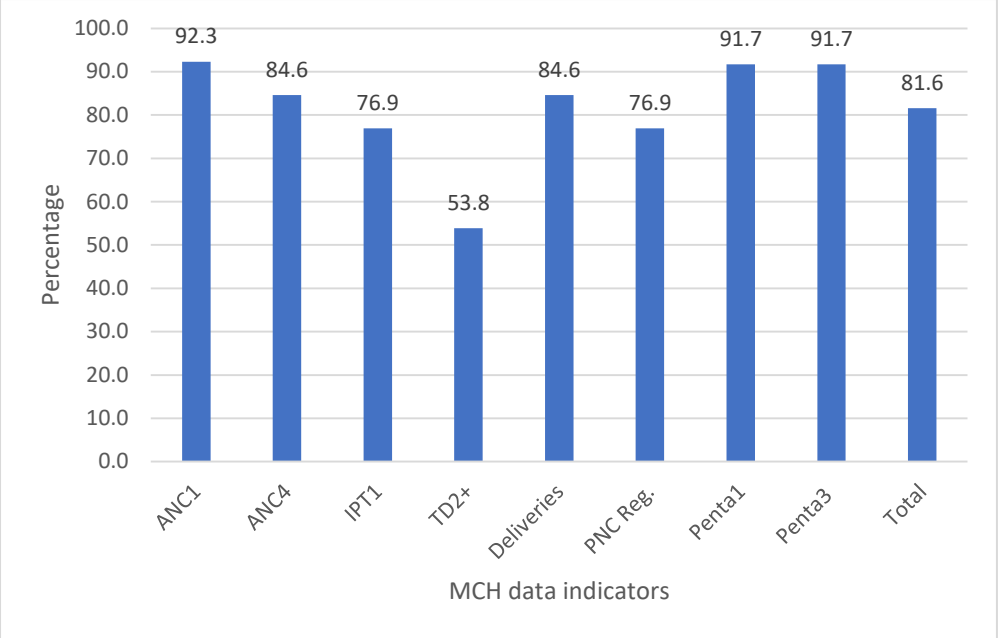

Figure 8: Percentage of HCFs within 10% tolerance levels for accuracy between the form and DHIS2

The percentage of facility's MCH data accuracy from the source document (registers) to the monthly reporting formats (Forms and DHIS2) was lower than from one reporting format (Forms) to the other (DHIS2). Specifically, the percentage of MCH data accuracy from the registers to forms, registers to DHIS2, and forms to DHIS2 were respectively, 68.2% (95% CI 50.6 - 85.8), 67.1% (95% CI 51.1 – 82.5), and 81.6% (95% CI 70.9 – 92.7).

Completeness of MCH data. Completeness of MCH data in DHIS2 database for the 12 months, January 2020 to December 2020, was also measured. Two separate component, completeness of facility reporting and completeness of the indicator data, were analysed.

Completeness of facility reporting. Two MCH reports were considered for their completeness in DHIS2, namely; Monthly Form A (Midwife's Returns) for Maternal Health indicators, and Monthly Vaccination Report for Child Health indicators. Facilities which submitted these two reports for the 12 months of 2020 into the DHIS2 platform were assessed. Results showed that

all (100%) the HCFs submitted the two reports that reflected the monthly utilisation of their MCH services for all the 12 months of 2020, indicating a complete reporting rate.

Completeness of the indicator data. Completeness of the eight MCH indicators in the registers, forms, and DHIMS2 were 94.2% (95% CI=93.1% to 95.2%), 92.1% (95% CI=90.8% to 93.47%), and 95.4% (95% CI=93.7% to 97.0%), respectively (see Table 11). All, except one facility did not meet the set limit for data completeness in DHIMS2 for the MCH indicators (see Figure 9). Facilities having completeness rate below 90% are considered to have poor reporting rate (WHO, 2014b). Moreover, the evaluation showed there were some variations in the completeness of data across the eight indicators, although not large.

Completeness of indicator data reported in DHIS2 database was also assessed by observing the zero or missing values for the eight MCH indicators in DHIS2 database (see Table 12). It was observed that HCFs data in DHIS2 database did not distinguish between true zero values and missing values. For example, a facility may have provided delivery services to clients but did not include this in their monthly report (missing value). Contrarily, a remote facility may have been equipped to provide delivery services but had no clients (for delivery) during a review month (true zero value). Consequently, these situations in the DHIS2 database were considered as missing data. The findings show that completeness was best for the child health indicators, that is, 100% and 99.6% respectively, for Penta3 and Penta1, which indicate that all the data were entered into the DHIS2 (see Table 12). However, the priority indicators with the most missing values were found in the provision of

maternal health services, with observed variations. For example, deliveries recorded the lowest completeness with 9% missing/zero values in DHIS2, followed by Td2+ (8.3%), IPT1 (7.7%), ANC4 (5.8%), PNC registrants (5.5%), and ANC1 (2.6%) as shown in table 12. Overall, a 4.8% (95% CI = 1.5%, 7.7%) zero or missing values was observed in DHIS2 for all the eight MCH indicators (see Table 12).

Table 13 represents the percentage range of completeness of facility's data across the three reporting sources. Estimates showed that 54%, 31%, and 38% facilities data were 100% complete in the registers, forms, and DHIS2 respectively. Also, 31%. 54%, and 38% of the facilities had their data in the register, forms, and DHIS2, respectively, which were between 90 to 99% complete. Further, about 8% of the facilities had 50% of their data in the registers and forms complete. It was further observed that completeness for privately owned health facilities (86.7%) was less than public sector facilities (97.2%).

Table 11: Monthly Percentage Completeness of MCH Data Sources

Month	Registers Entered/ Required	Forms Entered/ Required)	DHIS2 Entered/ Required
Jan	94.0	92.0	97.0
Feb	95.0	96.0	97.0
Mar	94.0	91.0	96.0
Apr	96.0	94.0	95.0
May	90.0	90.0	92.0
Jun	93.0	91.0	93.0
Jul	95.0	93.0	97.0
Aug	93.0	95.0	95.0
Sep	95.0	91.0	99.0
Oct	95.1	93.1	99.0
Nov	96.1	89.2	91.2
Dec	94.1	90.2	93.1
Total	**94.2**	**92.1**	**95.4**
95% CI	**(93.1, 95.2)**	**(90.8, 93.4)**	**(93.7, 97.0)**

Table 12: Zero or Missing Values by Indicators in DHIS2 Database

Indicators	# Missing values (Numerator)	# of values expected in the year (Denominator)	Numerator/Denominator
ANC1	4	156	2.6
ANC4	9	156	5.8
IPT1	12	156	7.7
Td2+	13	156	8.3
Deliveries	14	156	9.0
PNC Reg.	7	156	4.5
Penta1	1	144	0.7
Penta3	0	144	0.0
Total	60	1224	
Mean			**4.8**
Standard deviation			**3.5**
95% CI			**±2.9**

From Table 14, MCH indicators were 100% complete in the registers for all the levels of health care except in CHPs compounds where 78.4% completeness was recorded. The Metropolitan Hospital had all variables 100% complete for the three data sources, whereas the CHPS compounds had less than 90% of all their MCH variables complete in all the three data sources. The privately owned health facilities had an average of 84.5% completeness rate for all the three data sources, and a 96.8% completeness rate in the public sector facilities (see Table 14). Again, four (A, C, G, and H) out of the thirteen facilities had 100% data completeness across the three data sources (see Figure 9). Serious discrepancies were observed between the three data sources in facility M.

Table 13: Completeness Range of MCH Data Sources

Completeness Range	Registers	Forms	DHIS2
	N (%)	N (%)	N (%)
< 50%	1 (7.7)	1 (7.7)	0 (0)
50 – 79%	0 (0)	1 (7.7)	1 (7.7)
80 – 89%	1 (7.7)	0 (0)	1 (7.7)
90 – 99%	4 (30.8)	7 (53.8)	6 (46.2)
100%	7 (53.8)	4 (30.8)	5 (38.4)
Mean	**93.2**	**91.0**	**94.9**
Standard Deviation	**17.0**	**19.0**	**8.3**
Minimum	**38.9**	**30.6**	**69.4**
Maximum	**100.0**	**100.0**	**100.0**
95% C.I.	**±10.3**	**±11.5**	**±5.0**

Table 14: Completeness of MCH Data Sources by HCF Type and Ownership

	By care						By ownership	
Data sources	Teaching Hospital	Metro Hospital	District Hospitals	Clinics	Health Centres	CHPS Compound	Government	Private
Registers	100	100	100	100	99.5	78.4	97.1	84.5
Forms	93.8	100	99	97.9	99	75	95.7	80.6
DHIS2	96.9	100	99	96.5	98.5	88.2	97.5	89.2
Average	**96.9**	**100.0**	**99.3**	**98.1**	**99.0**	**80.5**	**96.8**	**84.8**

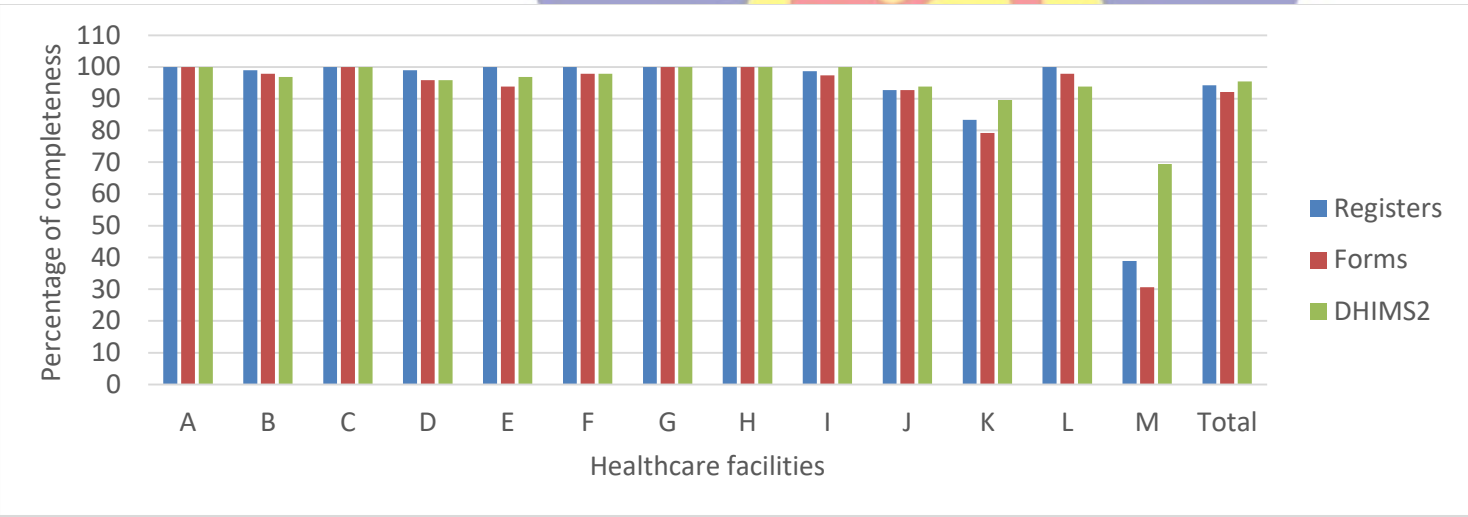

Figure 9: MCH data completeness by facility and the data source

Timeliness of the report. Data timeliness was assessed by extracting data in the reporting rate summary of DHIS2, the reports submitted into DHIS2 on or before the deadline for the two reports (Monthly Form A-Midwife's returns, and Monthly Vaccination Report). Estimates indicated a 100% reporting rate on time was recorded in 38.5% of the facilities for Monthly Vaccination Report, and 15% for Monthly Midwife's returns (see Table 15). Whereas 54% of the facilities recorded a 90 – 99% reporting rate on time for Monthly Midwife's returns report, that of Monthly Vaccination report was 46%. On the average, 87.2% (95% CI=80.5% - 93.9%) of the facilities submitted their monthly Midwife's Returns reports to the next level on time, and that of Monthly Vaccination Report was about 94% (95% CI = 89.3% - 97.3%). Facilities H and K submitted the two reports on time whiles facilities C, G, and L submitted only their monthly vaccination report on time (see Figure 10).

Table 15: Reporting Rate on Time for Monthly MCH Reports for HCFs

Timeliness range	Monthly Midwife's Returns	Monthly Vaccination Report
	N (%)	N (%)
<80%	3 (23.1)	0 (0)
80 – 89%	1 (7.7)	2 (15.4)
90 – 99%	7 (53.8)	6 (46.2)
100%	2 (15.4)	5 (38.5)
Mean	**87.2**	**93.6**
Standard Deviation	**11.1**	**6.0**
Minimum	**66.7**	**83.3**
Maximum	**100**	**100**
95% C.I.	**±6.70**	**±3.70**

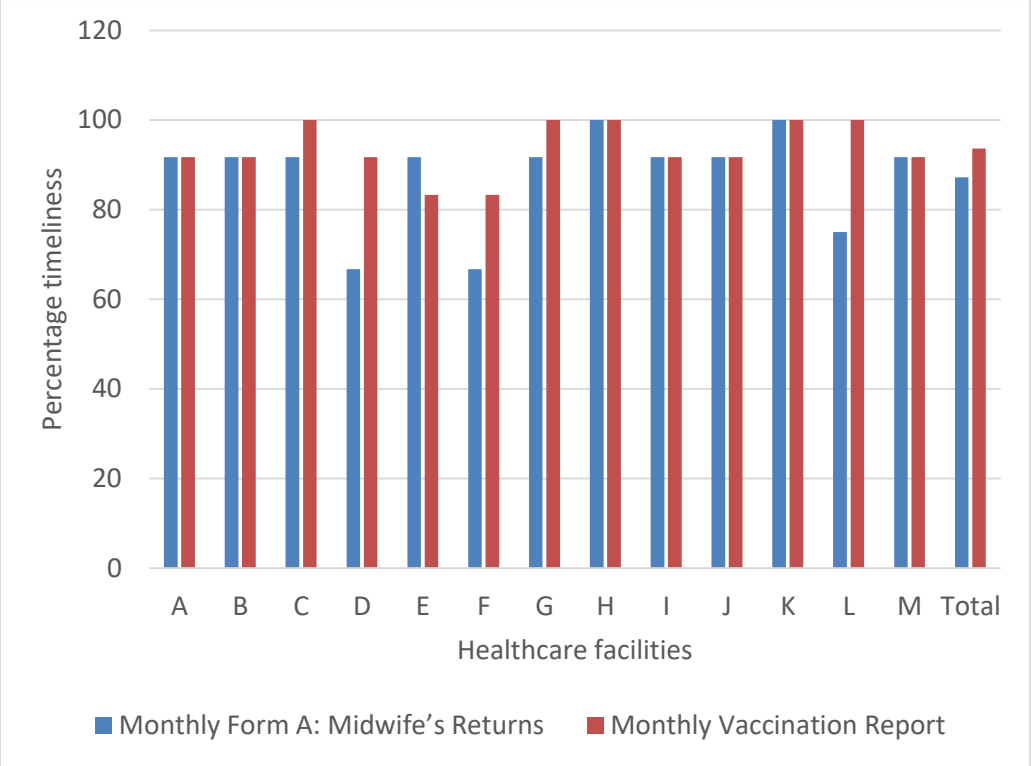

Figure 10: Timeliness of the MCH report submitted by HCFs in DHIS2

Consistency. Data must have underlying qualities that are largely devoid of extreme and unpredictable variations for it to be of maximum use. Consistency of the data was assessed under three groupings: consistency over time, consistency between indicators (Penta1 and ANC1, Penta1 and Penta3, and ANC1 and ANC4), and accuracy consistency of event reporting.

Consistency over time. Consistency over time is the mean ratio of an indicator for reference year (2020) to the mean of the same indicator of the three preceding years (2017, 2018, 2019) combined. Thus, consistency was assessed for the indicators, ANC1, ANC4, IPT1, Td2+, Deliveries, PNC, Penta1 and Penta3. As seen in Table 16, all except one indicator showed a ratio of less than 1, but all the indicators were within the WHO recommended quality range of 33% of the average of the three preceding years (WHO, 2014b). The ratio for 2020 to the mean of the three preceding years (2017,

2018, 2019) for ANC1, ANC4, IPT1, Td2+, Deliveries, PNC, Penta1 and Penta3 were respectively, 0.91, 0.90, 0.89, 0.79, 0.94, 1.16, 0.89, and 0.97 (see Table 16). An overall average ratio of 0.93 (95% CI=0.84 - 1.02) consistency over time was also observed, which suggests an overall 7% decrease in the MCH service outputs for 2020 when compared with that of the preceding three years across the eight indicators. Using the WHO guidance for data consistency with time, these figures suggest that reported data in DHIS2 for 2020 were consistent for all the eight MCH indicators in the metropolis. The WHO recommend that, when assessing the extent to which a data element's reported value was consistent over time, the reported value for the reference year be within ±33% of the mean value for the preceding three years, taking into account any expected changes in the patterns of service delivery (WHO, 2014b).

Further, consistency over time was assessed at the facility level to ascertain how individual facility's values were consistent or differ from the district values for the eight MCH data reported into DHIS2 database. Consistency over time at the facility level examines the percentage of facilities with at least 33% difference between their ratio and the district ratio across the eight indicators (WHO, 2014b). Available information indicated that as of 2017, five out of the thirteen HCFs were not providing certain services for some of the indicators considered in this research and therefore had no data in DHIS2 for such indicators. Thus, eight facilities that provided all the eight MCH indicators were considered in the consistency over time analysis and the remaining five that did not provide any of the services in the previous years were dropped from this analysis. Consequently, the percentage of facilities

with at least 33% difference between their ratio and the district ratio across the eight MCH indicators were calculated.

Estimate of consistency over time at the facility level showed that about 88% (7) of the HCFs recorded more than 33% difference between their ratio and the district ratio for at least one of the eight MCH indicators (see Table 16). The percentage difference between the facility ratio and the district ratio for three of the indicators, ANC1, ANC4, and Penta3, was less than 33% across the eight facilities. Three facilities recorded more than 33% differences between their ratio from the district ratio for IPT1 and Penta1, and two facilities and one facility recorded more than 33% differences between their ratio and the district ratio for Td2+ and PNC on one hand and deliveries on the other hand. There was also a percentage difference of approximately 115% and 73% between one facility's ratio and district ratio for Penta1 and Td2+ respectively.

Consistency between related data. Internal consistency between indicators measures the level at which values for two or more indicators pairs show predictable association. At the time of the data collection, one of the facilities (facility M) was not providing child health services; hence, 12 facilities were used in assessing the consistency between indicators. The consistency of related indicators was analysed by calculating the ratio for values of indicator pairs that have predicted relationship. The indicator pairs considered include: Penta1 and ANC1; Penta1 and Penta3; and ANC1 and ANC4.

Table 16: Consistency Over Time Ratios, 2017-2020

Indicator		District ratio (ratio of 2020 to mean of 2017-2019)	Health Care Facility							
			A	B	C	D	E	F	G	H
ANC1	Y	0.91	0.80	1.12	1.17	0.87	0.96	0.77	0.86	1.00
	Z	-	12.1	23.1	28.6	4.4	5.5	15.4	5.5	9.9
ANC4	Y	0.90	0.93	0.82	1.00	0.77	0.83	0.74	.99	1.06
	Z	-	3.3	8.9	11.1	14.4	7.8	17.8	10.0	17.8
IPT1	Y	0.89	0.79	1.21	0.83	0.79	0.51	0.88	1.19	1.02
	Z	-	11.2	**36.0**	6.7	11.2	**42.7**	1.1	**33.7**	14.6
Td2+	Y	0.79	0.73	0.53	1.02	1.37	0.44	0.65	0.68	0.76
	Z	-	7.6	32.9	29.1	**73.4**	**44.3**	17.7	13.9	3.8
Deliveries	Y	0.94	0.82	1.28	1.20	0.94	0.94	0.78	.95	1.16
	Z	-	12.8	**36.2**	27.7	0.0	0.0	17.0	1.1	23.4
PNC	Y	1.16	0.72	1.01	1.81	0.89	1.54	1.03	.98	1.13
	Z	-	**37.9**	12.9	**56.0**	23.3	32.4	11.2	15.5	2.6
Penta1	Y	0.89	0.84	1.07	1.35	1.91	0.75	0.53	1.02	0.88
	Z	-	4.9	20.2	**51.7**	**114.6**	15.7	**40.4**	14.6	1.1
Penta3	Y	0.97	0.83	1.19	1.11	0.77	1.26	0.72	1.09	0.80
	Z	-	13.7	22.7	14.4	20.6	29.9	25.8	12.4	17.5

Notes:

Y = an indicator's ratio of 2020 to the mean of the preceding 3 years

Z = ≥±33% difference from the indicators' district ratio

More than 33% difference between facilities and district ratio are bold

Moreover, consistency between Penta1 and ANC1 coverage was calculated, because both usually represent points of entry into the health system for infants and pregnant women (WHO, 2014b). The ratio of the consistency between the number of Penta1 doses administered and number of ANC1 was above one in 42% of the facilities (see Table 17). This ratio indicates a greater Penta1 administration than ANC1 coverage in these facilities. This situation suggests that less women attended ANC1 visit than children receiving their first dose of Penta1. Again, 58% of the facilities had their ratio less than 1 for the indicators such as ANC1 and Penta1, showing a lesser Penta1 administration than ANC1 coverage, suggesting that more women attended their ANC1 visit than children receiving their first dose of Penta1. The overall ratio of the consistency between the number of Penta1 doses and number of ANC1 visits was low (86%).

Comparing the number of Penta1 to Penta3 doses administered showed that about 22% of the children who received their first dose of Penta vaccine did not receive their third dose of the vaccine. Further, 58% of the facilities had a negative percentage difference between the two indicators (Penta1 and Penta3), suggesting a higher administration of Penta1 vaccines compared to Penta3. The remaining 42% of the facilities showed lower Penta1 vaccine administration compared with Penta3, as indicated by their positive percentage difference. Also, about 42% of the facilities were observed to have a higher than 2% consistency ratio for these indicators (see Table 17). Of the 13 facilities used in assessing the consistency between ANC1 and ANC4, only one showed a positive percentage difference. Also, one (8%) facility showed a

zero-percentage difference between the two indicators. The overall ratio of the consistency between the two indicators was 70%.

Outliers in the reference year. The purpose of this analysis was to examine the pattern of reported data in DHIS2 database for each of the eight indicators to determine whether a significant variation exists between the monthly reported data. As per the DQRC criteria, two types of outliers (moderate and extreme) were considered. The results showed that none of the MCH indicators were prone to extreme outliers (see Table 18). However, about 1% moderate outliers were detected in the months of May for IPT1, and June for Penta1.

Table 17: Consistency between Related Indicators

Facility	Ratio of indicators			Percentage difference		
	ANC4 & ANC1	Penta3 & Penta1	Penta1 & ANC1	ANC4 & ANC1	Penta3 & penta1	Penta1 & ANC1
A	0.80	0.52	0.82	-24.44	-92.42	-21.89
B	0.80	0.74	1.48	-25.47	-35.99	32.32
C	0.77	0.98	0.84	-30.36	-2.50	-65.44
D	0.78	0.83	0.60	-28.29	-21.03	-18.7
E	0.49	0.41	1.25	-104.63	-143.75	19.76
F	0.54	1.67	0.31	-84.62	40.00	-220
G	0.59	0.93	0.95	-69.43	-7.25	-5.26
H	0.80	0.91	0.54	-24.77	-10.00	-85.18
I	0.59	1.16	1.01	-70.00	13.75	1.45
J	0.94	1.40	1.89	-6.00	28.57	47
K	1.12	1.34	3.06	10.91	25.37	67.33
L	0.64	1.25	0.55	-55.78	20.19	-82.35
M	1.00	-	-	0	-	
Overall	0.70	0.78	0.86			

Table 18: Consistency of Event Reporting: Outliers in the Reference Year

Month	ANC1	ANC4	IPT1	Td2+	Deliveries	PNC Reg.	Penta1	Penta3
Jan	560	333	359	244	486	650	361	293
Feb	452	365	388	227	413	510	351	304
Mar	445	365	324	239	587	722	361	288
Apr	399	357	320	183	595	639	371	271
May	336	289	**211**	174	647	714	398	281
Jun	415	267	271	154	553	547	**469**	387
Jul	452	278	266	164	587	532	435	327
Aug	445	259	328	151	465	552	399	327
Sept	362	318	347	206	451	575	371	351
Oct	547	343	345	253	508	541	379	305
Nov	548	329	344	264	470	619	438	351
Dec	486	307	341	241	443	585	396	379

Note: Values in bold indicate moderate outliers

Information use

Three criteria were used to assess information use, including (1) presence of management or performance monitoring teams, (2) availability of document/report based on MCH/RHIS and reviewing the report for use of information, and (3) observing evidence of records (discussions, findings and decisions) of meetings held on MCH/RHIS in the referenced year, 2020). The assessment was done through reviews of documents, observations, and interviewing key informants by a series of dichotomous indicators. Results from interviewing facility heads or key informants show less than half of the facilities, 6 (46%), had a strategic document and information use guidelines in their facilities. However, observation of these documents shows only 31% of the facilities had copies of written national guidelines on RHIS information displayed and used at the health facility, and 15% said they had copies but the copies were not available at the facility at the time of the interview. Also, about 39% of the facilities had copies of their facility's annual plans, and/or performance targets available at the facility, while 8% indicated they had the document but copies were not available at the HCF at the time of this study.

All the HCFs collect routine data related to MCH activities. Only 8% of the facilities produced bulletins based on the analysis of MCH data (see Figure 11). These bulletins contain discussions and/or recommendations based on performance targets on coverage of maternal health, child health, performance indicators, human resource, and identification of emerging issues.

The findings revealed that 69% of the facilities prepared data visuals such as graph, tables and maps showing achievements towards targets on MCH, with 54% of the visuals on maternal health and 62% on child health. However, observations revealed only 31% of the facilities displayed updated data related to MCH in tables and charts, 39% displayed the map of their catchment area, while 23.1% had summaries of demographic information such as population by target group displayed in their facilities. It was also observed that about 62% of the HCFs had performance monitoring or management team in their facilities who held routine meetings in 2020 to review the performance of their facilities (see Figure 11). All these facilities kept minutes of their meetings. Figure 12 shows the frequency of the performance monitoring /management meeting in 2020. One (7.7%) facility each indicated weekly and annually, and 2 (15%) facilities each indicated fortnightly, monthly, and quarterly.

Reviewing these meeting records showed that discussions on data quality issues of MCH/RHIS had been brought up in 61.5% of the HCFs (see Figure 13). Additionally, 61.5% of the health facilities discussed MCH/RHIS findings and subsequently made decisions based on these discussions in 53.8% of the HCFs (see Figure 13). Also, 46.2% of the facilities took follow-up

action on the decisions made during the previous meetings on MCH/RHIS-related issues, including 38.5% of the facilities referring some of the issues to the next level for assistance (see Figure 13). This suggests that facilities try to solve most of the problems they encounter and occasionally request the assistance of the next level for issues that are out of their control.

The finding also revealed that the facility's performance review/management committee meetings also reviewed key performance targets based on MCH/RHIS data. These includes 46% of the facilities reviewing on MCH services, 39% each on facility's performance indicators, and identification of emerging issues/epidemics, 23% each on human resource management, and commodity stockout. Further, decisions were made based on discussions of the HCFs performance in terms of formulation of plans in 46% of the facilities; 23% facilities each on budget reallocation, medicine supply and drug management, human resource management, and promotion of service quality/improvement, and 15% facilities on advocacy for policy. 23% facilities indicated they did not require any action. Again, 6 (46.2%) facilities indicated that their performance review/management committee meeting minutes were circulated to all its members. The overall level of use of information in meetings was 53.2% (95% CI 39.9, 64.7).

Interviewing key informants revealed that 77% of HCFs have district/regional annual/monthly planned targets based on MCH/RHIS information. None of the HCFs records for 2020 showed reports, directives or newsletter issued by CCMHD or higher level to the facilities regarding information use. Again, there was no documentation in the facility showing information used for advocacy. About 77% of the HCFs in-charges

participated in meetings both at the district or higher levels to discuss the performance of MCH/RHIS, and usage of MCH/RHIS information for health system management in 2020. The findings also revealed low use of Information at the HCFs, because 40% of the HCFs had discussion on MCH/RHIS information, 30% of the HCFs used the information for monitoring, and 20% made decisions based on the discussions. Only 10% of the HCFs showed information use for promotional activities.

Availability of guidelines and strategic documents for information use was either none existent or very low. Majority of the facilities did not have information use guidelines and strategic documents in their facilities. A little over one-third of the facilities had copies of their annual action plan spelling out performance targets. Whereas all the HCFs collected routine data related to MCH activities, MCH report production showing findings, actions taken, and implications were found to be low in the facilities.

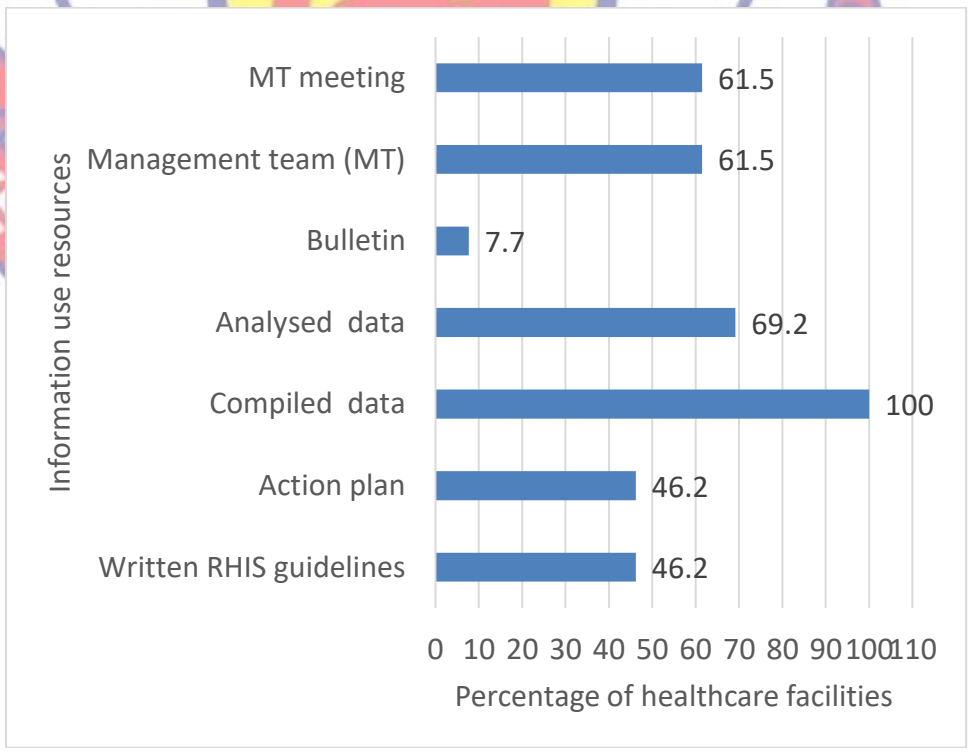

Figure 11: Percentage of HCFs with available resources on information use

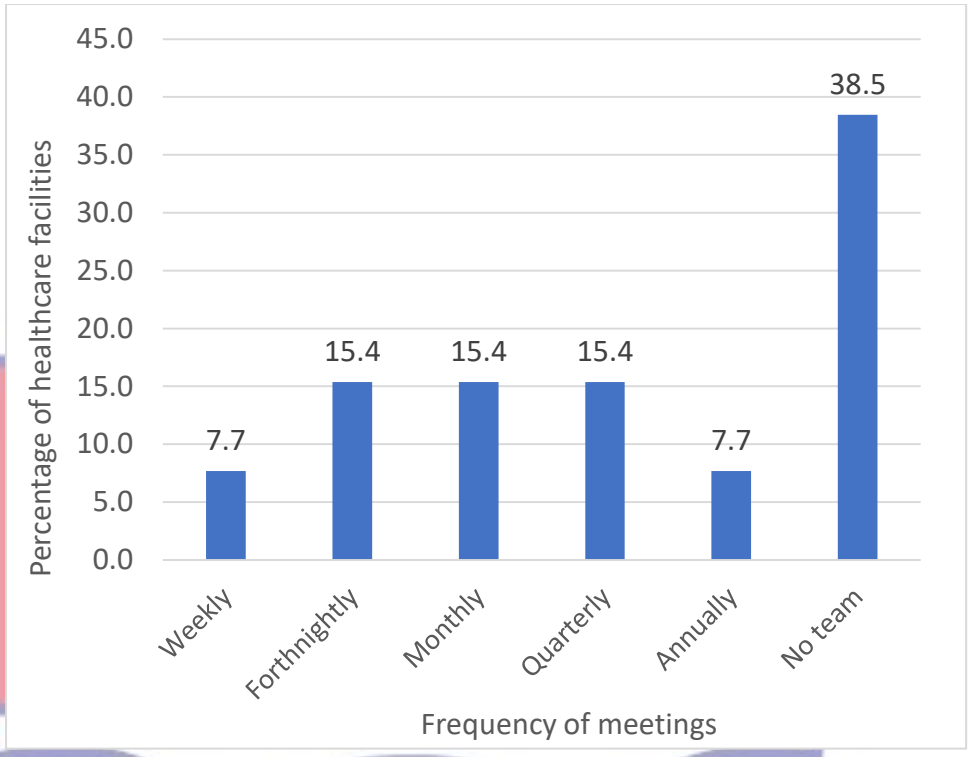

Figure 12: Percentage of HCFs and frequency of performance monitoring meetings

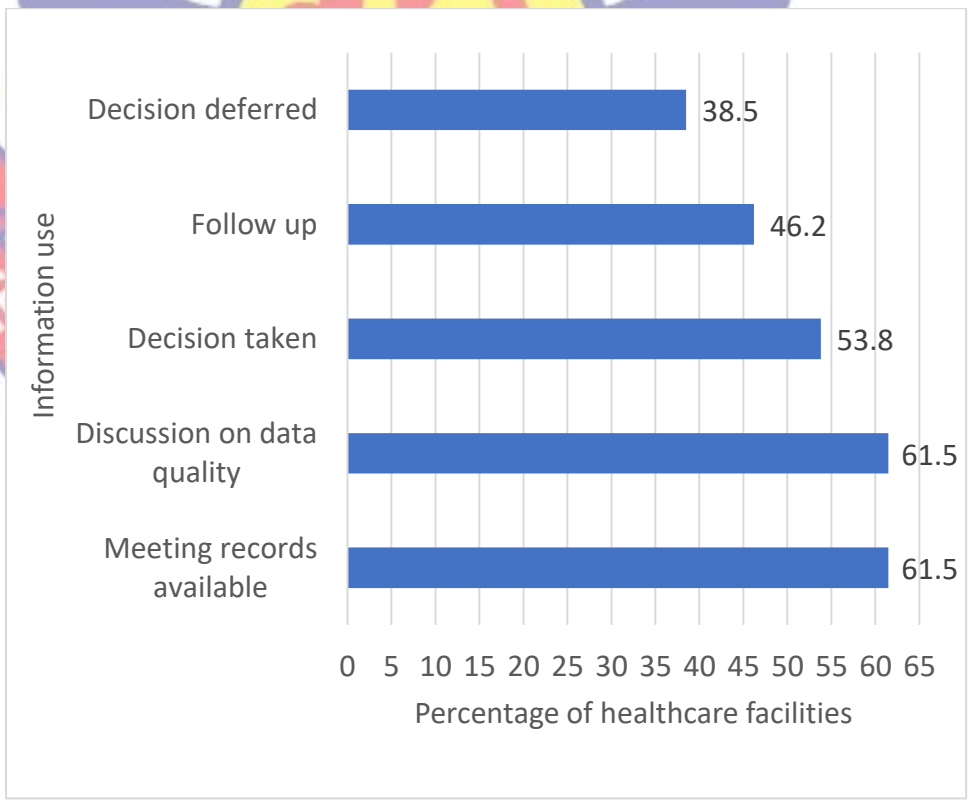

Figure 13: Percentage of HCFs meetings on information use

Research Objective 2: To Assess the Functionality of MCH/RHIS Processes in the HCFs at the CCM

The purpose of this analysis was to assess the functionality of MCH in RHIS processes in HCFs at the CCM. These processes include: data collection, data processing, data analysis, data quality assessment mechanisms and checks, data transmission, data display, supervision quality, feedback and promotion of information use. The functionality of these processes was measured by assessing the availability of data collection, data processing, and data quality checks manuals/procedures, as well as ascertaining whether there were; directives on data quality check and transmission, analysed data, displayed data, and feedback mechanisms in the HCFs.

Data collection, verification and transmission at health facilities. All the facilities collected, verified, and transmitted MCH data using both paper and electronic based formats. About 92.3% of the health facilities admitted receiving directives or reminders from the district office on data quality checking processes for data accuracy, completeness, and timeliness (see Figure 14). This was measured by asking key informants whether their facilities received directives from the Metropolitan Health Directorate (MHD) or higher level to, (1) periodically check the accuracy of data, (2) ensure that the monthly report form is filled completely, and (3) submit report on or before a declared deadline. However, no official correspondence or record was available at the facilities directing/reminding them to check data quality, fill the monthly report completely, and submit reports by a specified time. Again, 15.4% facilities admitted receiving reminders from the district office regarding sanctions if they failed to check data accuracy, fill the monthly reporting forms completely, and meet the deadline for submitting monthly reports.

However, there was no official correspondence or record at the facilities showing either the directives or stating the sanctions. Regular data quality checks were conducted in 76.9% of the facilities.

Data quality assessment mechanism. Written instructions or guidelines on data quality review/check was present in 38.5% of the facilities. Likewise, 30.8% of the facilities had data quality self-assessment tools (paper, electronic, or both). Whereas 76.9% of the facilities conducted regular data quality checks, only 23.1% of the facilities kept records of these data quality checks conducted in 2020. Additionally, 23.1% of the facilities kept records of the feedback to staff on the data quality findings. The overall data quality assessment mechanism in the HCFs was 38.5% (95% CI 10.7 - 66.3%) (see Figure 14).

Data processing and analysis. Whereas 76.9% of the facilities had reference procedure manuals with definitions for data collection and analysis, only 46.2% had reference guidelines for information use. With regards to the types of analyses done by the HCFs, 53.8% of the facilities indicated calculation of indicators for the facility catchment area. Also, 61.5% of the facilities reported processing data to enable comparisons to be made on the various MCH indicators in the facility summary report against the district/national targets. Further, 46.2% of the facilities analysed data to compare which services were performing better, while 53.8% performed trend analysis (monitoring over time). More than two-third (77%) of the facilities used an electronic system to enter and analyse MCH/RHIS data. Specifically, for data entry, 92.4% of the facilities used DHIS2 software, 46.2% used a facility's proprietary software, and 15.4% used an excel-based spreadsheet.

Likewise, for data analysis, about 77% used DHIS2 software, 7.7% used a national proprietary software, 38.5% used a facility proprietary software, 15.4% used an excel-based spreadsheet. The overall level of data analysis process in the HCFs was 54.1% (95% CI 44.3 - 63.9) (see Figure 14).

Supervision quality. It was observed that 92.3% of the HCFs had supervisory visit from the MHD team in the last quarter of 2020 (see Figure 14). On the frequency of these visits, 46.2% of the facilities stated once, 7.7% stated twice, 15.4% stated thrice, and 23.1% stated four or more times. Again, 61.5% of the facilities admitted that the supervisory team checked the quality of their data during the visits, which were done without the use of standard checklists. In addition, 53.8% of the facilities reported that the supervisory team discussed the facility's performance based on the MCH/RHIS data, as well as assisted them to either make a decision or take a corrective action based on information from the MCH/RHIS during the visits. Unfortunately, only 30.8% of the facilities indicated receiving report/feedback on the last two supervisory visits. Overall, 58.4% (95% CI ±27.5%) was recorded for supervision quality.

Feedback mechanism. Majority of the facilities reported receiving feedback reports based on their submitted MCH/RHIS data from the MHD (see Figure 14). Specifically, all the facilities received feedback on data quality, and 92.3% received feedback on their performance based on reported MCH/RHIS data. Despite these high level of feedback on the reported data in the facilities, only 38.5% of the facilities had documents available in the facility showing feedback (quarterly/yearly) that provided guidelines and recommendations for actions and for future reference. The following action-

oriented decisions were observed in these feedback reports: review strategy by examining service performance target and actual performance on month-to-month comparisons (in 31% of the facilities); review tasks/responsibilities of personnel by examining targets and actual performance on month-to-month comparison (23%); mobilisation/shifting of resources based on comparison by services (15%); and advocacy for more resources by comparing performance by targets and showing gaps (15%). The average for feedback was 76.9%.

Display of information. This was assessed by observing whether the HCF displayed; (1) updated information on MCH services, (2) a map of the catchment area, and (3) summary of demographic information either on table or chart/graph. The findings revealed that 30.8% of HCFs displayed data related to maternal health and child health each. All the child health data displayed were updated but that of maternal health were not updated for the last quarter of 2020. Maps of the catchment area and summaries of demographic information such as population by target group was also displayed in 38.5% and 23.1% facilities respectively. Overall, 25.7% was recorded for display of information (see Figure 14).

An overall assessment of the functionality of RHIS processes in the HCFs at the CCM was 63.7% (95% CI ±25.4) (see Figure 14). All the MCH/RHIS processes were above average, ranging between 54.1% and 100%, except for data display and data quality assessment mechanisms which recorded 25.7% and 38.5% respectively.

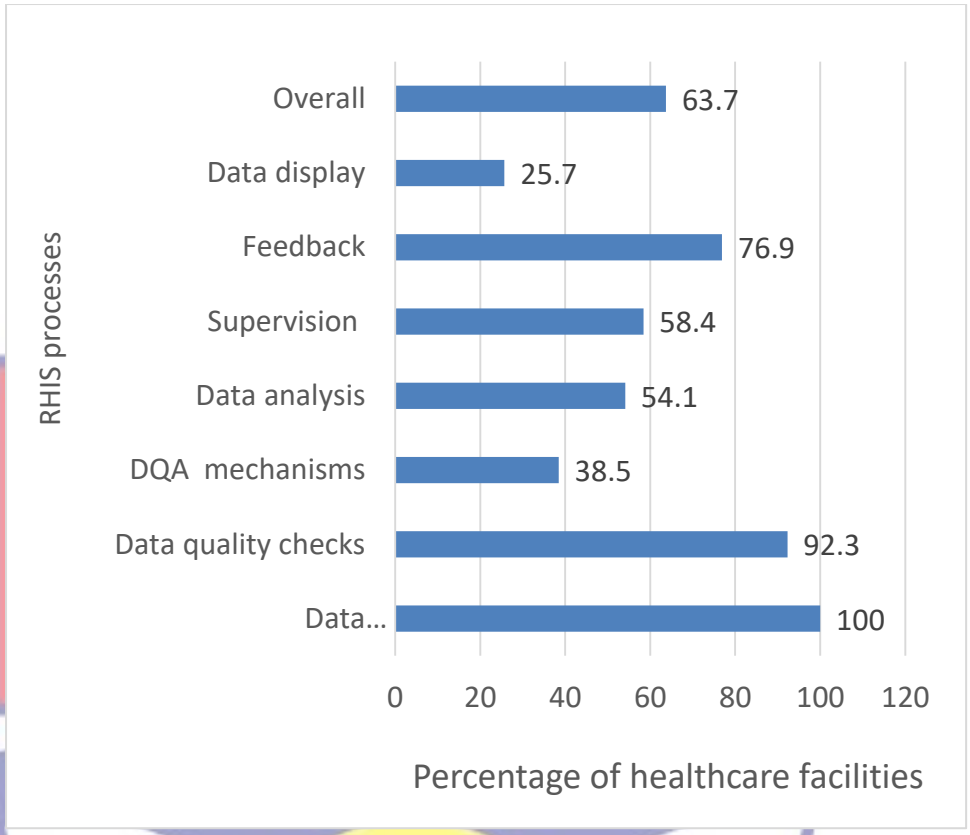

Figure 14: Percentage of existence of RHIS processes in HCFs

Research Objective 3: To Assess the Technical, Organisational, and Behavioural Factors of MCH Data Quality and Information Use in RHIS in the HCFs at the CCM

The purpose of this question was to identify the factors that have implications on the performance of MCH data in the HCFs at the CCM. These factors were assessed under technical, organisational, and behavioural.

Technical factors of MCH/RHIS

Technical factors that have implications on MCH/RHIS data quality were identified, and include training, availability of procedure manual with definitions for data collection, user-friendliness of the software for routine data management, complexities of the procedure manual and data collecting forms, data software providing a comprehensive picture of HS performance, software integrating information from other information systems, and management of information technology. These factors were assessed by

eliciting responses from key informants (KIs), and 265 HCPs involved in the management of MCH/RHIS data in the thirteen HCFs of the CCM.

Overall, about one-third (33%) of the HCPs admitted ever receiving a formal training in RHIS-related activities (see Table 19). Out of this figure, 54.8% received training in health statistics, 23.7% in ICT or data management/analysis applications, 21.5% in MCH/RHIS data management, and 12.9% in data analysis and use. Further, only 10.4% of the HCPs stated that they received some sort of RHIS-related activity training in 2020 (see Table 20). Relatedly, about 39% of the KIs (who are all health information officers admitted) ever received a formal training in RHIS-related activities, and this training was in health statistics. However, none of the KIs received any form of RHIS-related activities training in 2020, suggesting the need for ongoing RHIS training activities for the staff engaged in MCH/RHIS related activities.

All, except one HCF, use an electronic system to enter and analyse MCH data. Table 21 shows the responses on the technical issues affecting performance of MCH/RHIS. About 92.3% of the health facilities had a software or data warehouse that integrates data from different information systems. However, only 38.5% of the facilities had Land Area Network (LAN) or wireless network to provide access to information for MCH/RHIS management. Procedure manual with definitions for data collection were available in all the facilities. About 84.6% of the KIs and 43.4% of the HCPs indicated that MCH/RHIS procedure manual were user-friendly. On the complexities and difficulties in filling out the monthly report forms, 15.4% of the KIs and 49.8% of the HCPs responded in the affirmative. Again, 84.6% of

the KIs and 45.7% of the HCPs revealed that the data software was user-friendly, while 69.2% of the KIs and 51.7% of the HCPs perceived the information technology to be easy to manage. Also, 53.8% of the KIs and 51.7% of the HCPs perceived that the information system design provides a comprehensive picture of health system performance. Meanwhile, only 7.7% of the KIs and 53.6% of the HCPs thought that the existing RHIS gathers information that is also included in other information systems. Apart from DHIS2 software, which is a national open-source data processing system, none of the facilities used a national proprietary software for data management. However, facility proprietary software for data entry and analysis was found in most of the facilities.

Table 19: Training Received in the Past on RHIS-Related Activities

Question	Response	HCPs		Key Informants	
		Frequency	Percent	Frequency	Percent
Ever received formal training in RHIS-related activities?	Yes	88	33.2	5	38.5
	No	177	66.8	8	61.5
Receive training in 2020 on RHIS-related activities	Yes	29	10.9	0	0
	No	236	89.1	13	100

Table 20: Type of Formal Training Respondents Received in the Past

Type of formal training	HCPs		Key Informants	
	Frequency	Percent	Frequency	Percent
Health statistics	46	17.4	5	38.5
RHIS data management	20	7.5	0	0
Data analysis and use	12	4.5	0	0
Data management	22	8.3	0	0
N/A	165	62.3	7	61.5
Total	265	100.0	13	100

Table 21: Response of the Technical Factors

Questions	KI		HCP	
	Yes	No	Yes	No
Is there a procedure manual with definitions for data collection	100		100	
Are the MCH procedure manual user-friendly	84.6	15.4	43.4	56.6
Are the monthly report forms complex and difficult to follow	15.4	84.6	49.8	50.2
Do you find the data software user-friendly	84.6	7.7	45.7	54.3
Is it easy to manage information technology	69.2	23.1	51.7	48.3
Does the information system provide a comprehensive picture of the performance of health system	38.5	53.8	51.7	48.3
Does the existing RHIS collect data that is also included in other information systems	7.7	84.6	53.6	46.4
Is there software or data warehouse that integrates data from other information systems	92.3	7.7	59.6	40.4
Is there a wireless or Land Area Network in your facility	38.5	61.5	95.1	4.9
Is yours using any electronic system to enter and analyse data	92.3	7.7	95.8	4.2

Organisational factors of MCH/RHIS

Organisational factors were operationalised under seven dimensions: 1) RHIS Management, 2) promotion of culture of information, 3) activities for the promotion of culture of information, 4) reward for good work, 5) availability of resources, 6) perceived availability of resources, and 7) supportive management.

RHIS management functions at the facility. The RHIS management functions include governance, planning, finances, training/capacity development, supervision, and use of quality improvement standards or performance improvement tools. An average of 27.9% (95%, CI ±15.9%) was observed for all the RHIS management functions at all the health facilities.

Assessing governance functional level of RHIS, 15.2% of the health facilities had: written document that describe RHIS mission, roles, and responsibilities that are related to strategic and policy decisions; an updated

health service organisational chart detailing the functions related to health information; and a framework/plan for information and communication technology (ICT) infrastructure in the HCF. There were written SOPs and procedural guidelines for RHIS at 61.5% of the facilities. However, none of the facilities displayed RHIS mission in prominent position(s). There was management structure in place to deal with RHIS-related strategic and policy decisions in 46.2% of the facilities. The mean score for RHIS governance was 25.7%. (95% CI ±24.3%) (see Figure 15).

Assessing planning functional level of RHIS shows copies of the national strategic plan on RHIS were available in 15.4% of the facilities. Additionally, 23.1% of the facilities had copies of RHIS situation analysis/assessment report written within the last three years, from 2021. Similarly, 23.1% of the facilities set RHIS performance targets for data accuracy, completeness, and timeliness. The mean score for RHIS planning was 20.5% (95% CI ± 11.0) (see Figure 15).

In terms of use of RHIS quality improvement standards, copies of RHIS standard were found in 38.5% of the facilities, and performance improvement tools such as control chart and flow chart were displayed in 15.4% of the facilities. An average for use of RHIS quality improvement standards functional criteria was 27.0% (see Figure 15).

The presence of training manuals, on-the-job training in the previous three years, documentation on mechanisms for on-the-job training, a costed training plan, and its scheduling were used to determine the training functional level. Training manual on RHIS were found in 23.1% of the facilities, and 15.4% had documentation on mechanisms for on-job RHIS training. Similarly,

15.4% of the facilities conducted RHIS training using the RHIS training manual in the past three years. A costed training and capacity development plan that has benchmarks, time lines, and mechanisms for on-the-job RHIS training, RHIS workshops, and orientation for new staff was found in 15.4% of the facilities. Schedule for planned training were available in 7.7% of the facilities. The mean score for RHIS training or capacity development functional level was 15.4% (95% CI ±6.8) (see Figure 15).

A supervisory visit to a facility and availability of the reports measured the supervisory functional level. All the facilities admitted receiving supervisory visit in the facility for the past one year prior to the research, but copies of the report from the latest supervisory visit were found in only 15.4% of the facilities. The average for this criterion is 57.7% (see Figure 15).

In terms of financial functional level, 38.5% of the facilities had a budget for RHIS supplies such as guidelines, registers, and forms. Also, 15.4% had mechanisms for generating funds for RHIS activities. RHIS monthly/quarterly financial reports and a long-term financial strategy for funding RHIS activities in the facility were both present in 23.1% of the facilities. The average score for finance is 25.0% (95% CI ±15.4) (see Figure 15).

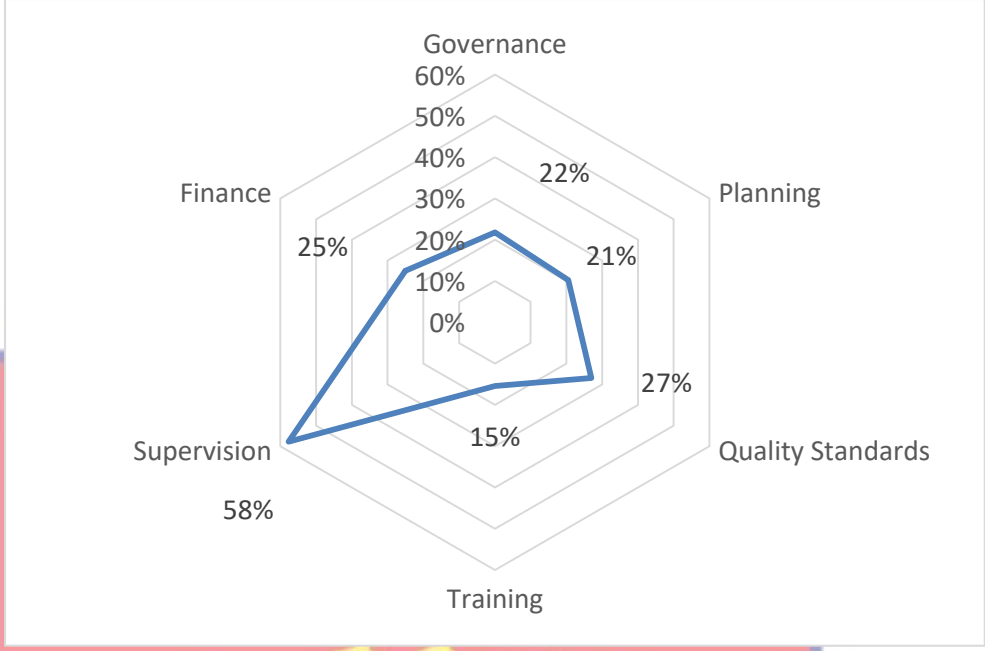

Figure 15: Mean levels of RHIS management functions

Promotion of culture of information. The PRISM framework defines culture of information as "*the capacity and control to promote values and beliefs among members of an organisation for collection, analysis and use of information to accomplish its goals and missions*" (Aqil et al., 2010, p. 31). It assesses the organisational mechanisms put in place to produce the desired results, by operationalising the culture of information concept as well as exploring the level of existence of a culture of information. Therefore, a culture of information at HCFs in CCM was operationalized as how HCPs believe their superiors promote the following values: data quality; use of MCH/RHIS information; problem solving skills; evidence-based decision making; a sense of responsibility; accountability and empowerment; and feedback from staff and community. Figure 16 provides information on respondents' perception of their HCFs promoting culture of information. It shows that overall mean perceived promotion of culture of information in HCFs at CCM is 64.1% (95% CI ±7.6%).

Emphasis on data quality. About 23% HCPs strongly agreed, 44.2% agreed, and 25.3% were equivocal that their superiors' placed emphasis on procedures for data quality, in the compilation and submission of monthly/quarterly reports. Similarly, 13.6% strongly agreed, 66.8% agreed, and 10.6% were equivocal that their superiors insist on checking routine data quality at points where data are captured, processed, or aggregated. Lastly, 21.5% of the HCPs strongly agreed, 57.4% agreed, and 13.6% were equivocal that they are told to report regularly to higher level about accuracy of data. Overall, 75.4% (95% CI ±18.2) of the respondents believe that their superiors emphasize on data quality (see Figure 16).

Promotion of use of MCH/RHIS Information. This indicator measured items regarding behaviours such as: staff in the health facility use MCH/RHIS data for everyday management of the HCF; staff can make decisions appropriate to their job descriptions using the findings from data analysis; staff use RHIS data for community education and mobilisation; and superiors in the health department use RHIS data for setting targets and monitoring service performance. On the average, 4.2% of the respondents strongly disagreed, 9.7% disagreed, 55.3% agreed, 13.3% strongly agreed, and 17.4% were equivocal about the perceived use of MCH/RHIS information in the health facilities. Over two-thirds (68.6%) of the respondents perceived the promotion of use of MCH/RHIS information in the health facilities (see Figure 16).

Promotion of evidence-based decision making. This indicator was measured by seeking answers to the questions on the extent to which decisions in the health facilities are based on: *personal preference; directives of superiors; facts/data/evidence; political considerations; history; directives of*

funding authorities; comparing strategic objectives; health needs in the community; cost considerations; and staff engagement. The findings show that, 73.6% of the respondents perceived decisions in the health facilities are based on data/facts, 61.9% on superiors' directives, and 61.2% on comparing strategic objectives. Further, 57.7%, 54.3%, 51.7%, 46.8%, and 44.5%, of the respondents perceived decision making in the facilities were influenced by, directives of funding authorities, history, relevant staffs' contributions, community health needs, and costs considerations, respectively. Personal preference and political interference were the least (35.1%) perceived considerations. On a whole, 52.2% (95% CI ±8.7%) of the respondents perceived that evidence-based decision making occurs at the health facilities.

Promotion of problem-solving. This indicator was measured through analysis of the following: *staff in the health facility can collect data to identify the root cause(s) of problems, develop appropriate criteria to select interventions for a particular problem, come out with appropriate outcomes for a specific intervention, and evaluate if the goals or outcomes of an intervention have been achieved.* An average score for this indicator is 60.4% (95% CI ± 3.3%).

Promotion of sense of responsibility. *This* was measured by seven items. Respectively, 84.9%, 81.2%, 78.5%, and 77.7% of the respondents perceived that staff document their activities, are punctual to work, complete tasks timely, and admit mistakes when they occur and take corrective actions. Also, 62.6% feel "personal responsibility" for not accomplishing set performance targets, and 61.8% show commitment to the RHIS mission of generating and using good quality data for evidence-based decision making.

Lastly, 58.1% pursue national targets and set appropriate and realistic goals for themselves for essential service performance. On average, a score of 72.1% (95% CI ±10.1) was recorded for this indicator (see Figure 16).

Promotion of staff empowerment and accountability. This was measured by seeking answers to the questions on the extent to which staff: *are able to say 'no' to superiors and colleagues for decisions/demands not backed by evidence; are empowered to make decisions; are held accountable for their performance; and feel guilty for not accomplishing the set target/performance.* The results show that a little less than half (49.1%) of the respondents perceived that staff in the facilities are empowered to make decisions, 70.9% perceived that they are held accountable for their performance, and 64.9% feel guilty for not accomplishing the set performance targets. Further, 61.7% perceived that staff are able to say 'no' to superiors and colleagues for decisions/demands not backed by evidence. An average of 61.7% (95% CI ±14.6%) was recorded for promotion of staff empowerment and accountability (see Figure 16).

Promotion of feedback from staff and community. The following results were recorded for the various statements on the perceived promotion of feedback from staff and community: 76.6% of the respondents perceived that staff in the health facilities ask for input/feedback from relevant/concerned staff; 60.8% perceived that regular feedback on reported data quality are provided; 55.4% perceived that staff promote multi-directional feedback mechanisms to share/present information within the team, and to the lower and upper levels of the health system; 50.2% perceived that staff seek feedback from the community they serve; and 49.5% perceived that staff openly discuss

conflicts to resolve the conflicts. An average of 58.5% (95% CI ± 13.8%) was recorded for this indicator (see Figure 16).

Figure 16: Culture of information percentile scores

Activities for promotion of culture of information. Activities to promote information culture are supported by *communicating targets, facility head attending meetings to discuss MCH/RHIS information or share success stories, directives to use information, and advocacy based on MCH/RHIS information*. About 77% of the HCFs reported communication about targets based on MCH/RHIS information, 84.5% of the facilities heads attended meetings at district level to discuss MCH/RHIS information. However, none of the facilities showed directives on the use of information, and advocacy. Thus, less than half (40.4%) of the facilities had activities for promotion of culture of information.

Reward for good work. Reward for good work was measured by two items describing respondents' perception of behaviours such as: *superiors in the health facility recognize or reward staff for good performance; and staff in*

the health facility receive award for good work. About two-thirds (64.5%) of the respondents agreed, 19% disagreed, and 16.2% were equivocal that superiors in the health facility recognize or reward staff for good performance. Further, 54.4% agreed, while 26% disagreed, and 19.6% were equivocal that staff in the health facility receive award for good work. A percentile score for reward for good work dimension was 59.5%.

Availability of resources. Majority (69.2%) of the facilities had desktop computers, laptops, and Uninterruptible Power Supply (UPS); 76.9% had printers and modems, 62% had back-up generators, and 84.6% had regular telephone and calculators for MCH/RHIS activities (see Table 22). All the computers, calculators and modems were in good conditions. Relatedly, 94.1% of the laptops, 95.7% of printers and telephones, 91.7% back-up generators, and 87.1% of the UPS were also in good working conditions. Overall, 95.5% of the equipment at the HCFs were in good working conditions. Again, an overall 58.8% gap was identified between equipment that were available and the actual quantity needed for MCH/RHIS activities in all the facilities and 4.5% gap in the availability and functionality of the available equipment at the facilities.

Equipment and service inventory. Data back-up units were available in most of the HCFs. Specifically, 53.8% HCFs backed data in USB key and servers, 46.2% in external hard drive, 38.5% in compact disc and 15.4% in zip drive. Most (69.2%) of these back-up units were kept in the facilities. Further, 46.2% of the HCFs had official mobile phone with access to telephone network, but only 7.7% had fax services for transmission of information. On an average, 92% of the HCFs have access to internet for over 19 days in a

month while 8% had it between 10 to 19 days. Wi-fi service (wireless reliability) was recorded in 69.2% of the HCFs. All the data managers in the HCFs had personal phones with access to internet network.

Utilities. Access to continuous water and electricity supply was high (92.3% and 84.6% respectively). All the facilities reported having less than ten days electricity interruption in a month. However, 91.7% of the HCFs report back-up generators to continue electricity coverage; therefore, availability of utilities is not problematic. The room housing computer hardware was air-conditioned in 53.8% of the HCFs.

Table 22: Equipment Inventory and Condition at the HCFs

Equipment	Quantity Available (A)	Quantity Needed (B)	Quantity in good working condition (C)	Percentage gap between (A) and (B)	Percentage between (A) and (C)
Desktop computer	113	147	113	30.1	0.0
Laptop computer	17	37	16	117.6	5.9
Printers	47	68	45	44.7	4.3
Modems	16	34	16	112.5	0.0
UPS	70	135	61	92.9	12.9
Generators	12	18	11	50.0	8.3
Regular telephone	41	56	40	36.6	2.4
Calculator	43	75	41	74.4	4.7
Overall percentage gap				**58.8**	**4.5**

Availability of registers. All the registers were available in all the facilities for MCH/RHIS performance and these were standard RHIS tools, indicating that supplies of registers for MCH/RHIS are quite good. However, the report suggests that 15% HCFs had shortage of antenatal registers, and 8% were out of stock of delivery, postnatal, vaccination and paediatrics registers in 2020 for 3 months.

Human resource: About 69% of the HCFs have designated persons to enter data or compile reports from the different units in the facility. About 67% and 22% of these designated persons received training in data entry/compilation and data quality review or data quality check but not in the referenced year (2020). Also, 69% of the HCFs reviewed the quality of compiled data prior to submission to the next level but no one was designated with such a responsibility.

Perceived availability of resources. The perceived availability of resources which measured the extent to which HCPs perceive that the HCF provides training, registers, reporting forms to carry out RHIS tasks and feedback to improve performance was 54%. About 51.7% of the respondents perceived that staff are given appropriate training on MCH/RHIS activities. These trainings were limited to data analysis and reporting, organised mainly at the district or higher levels. No institutionalised mechanisms for planned training existed and training usually occurs on an ad hoc needs' basis, curtailing opportunities for continuous improvement.

Supportive management. It assesses the extent to which superiors in the facility offer support to staff including promoting teamwork, expressing their views, and dealing with patients' needs. Most (74.7%) of the staff perceived superiors in the facilities promote teamwork, 71% are opened to alternative views, 67.2% listen to employees' ideas and concerns. Similarly, 44.5% perceived superiors allow disagreement before reaching decisions, and 57.7% of superiors are concerned about serving target community or clients' needs. An average of 63.0% (95% CI ±15.1%) was observed for supportive management.

Behavioural determinants of MCH/RHIS

The construct for assessing behavioural factors affecting MCH/RHIS performance in the CCM were operationalized as having five dimensions: self-efficacy or confidence level for MCH/RHIS tasks; MCH/RHIS task competence; knowledge of the rationale for MCH/RHIS data collection; motivation; and problem- solving skill.

Self-efficacy or confidence level for MCH/RHIS tasks. Self-efficacy measures the HCPs level of confident in performing MCH/RHIS tasks. Their confidence levels were assessed on a scale of 0 to 100, that is, from respondents' perception of no confidence to full confidence in performing a particular MCH/RHIS task. Confidence percentile scores were calculated for the following MCH/RHIS tasks: checking data quality, calculating percentages/rates, plotting graph, interpretation and information use. The average confidence level for all the *MCH/RHIS tasks* ranged between 33% and 40%, with perceived confidence to correctly calculate percentages/rates being the highest (39.8%) and that of using data to make operational/management decisions the lowest (33.8%) (see Table 23). The overall mean perceived level of confidence to perform MCH/RHIS tasks among the respondents was 36.8% (95% CI ±2.22).

Table 23: Self-Efficacy or Confidence Level for MCH/RHIS Tasks

Indicator	**Scores N=265 (%)**											
	0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Over all**
Check data quality	30.2	11.3	7.9	3.8	3.4	4.2	7.9	11.3	6.4	8.7	4.9	**37.8**
Calculation	20.8	20.8	5.7	6	2.6	7.9	2.6	7.9	10.2	9.8	5.7	**39.8**
Plot	26.4	13.2	9.1	9.1	3.4	4.5	3.8	9.1	5.7	5.7	10.2	**37.9**
Trend	25.7	18.1	6	5.7	1.5	6	11.3	2.3	7.9	7.2	8.3	**37.8**
Explain	32.1	14.7	7.2	1.9	1.5	9.8	6.4	6.4	5.7	7.2	7.2	**35.5**
Gaps	28.7	18.1	4.9	3	1.9	12.8	3.8	4.2	9.8	6.4	6.4	**36.1**
Use	34.3	15.1	3	2.6	6	6.4	6.4	6.4	6.4	9.1	3	**33.8**
Total	**36.8 (95% CI ±2.22)**											

MCH/RHIS task competence. Determining competence in RHIS tasks, respondents were asked to solve a problem in a paper and pencil test for each of the indicators. This test assessed respondent's competence to check data quality, calculate, plot, explain, and use data. In terms of data quality, respondents were asked to describe three dimensions of data quality, as well as three ways of checking data quality. An average of 20.4% was observed for this indicator/tasks. To assess respondents' competencies to do calculations, they were asked to undertake tasks such as; *calculate the percentage of pregnant mothers in a facility catchment area attending antenatal care, calculate the rate of malnutrition and find the number of malnourished children*. The average score for this indicator is 28.1%. Further, an exercise to develop a line graph depicting trends in IPT1 coverage and to develop a bar chart for vaccination coverage by years assessed their competence to plot data. The average score for this indicator is 11.9%. Similarly, respondents were asked to find trend and explain the findings of the bar chart, to assess interpretation of graphs. An average score of 19.1% was observed. Regarding the use of data, respondents were asked to provide at least one use of data in the facility and at the district levels. The average score of 17% was observed. The overall mean competence to perform MCH/RHIS tasks is 19.9% (95% CI ±10.6). The percentage gap between perceived confidence to plot graphs and the actual competence displayed in plotting graphs was the widest (26%), and that of calculating percentage/rates was the lowest (11.7%) (see Figure 17)

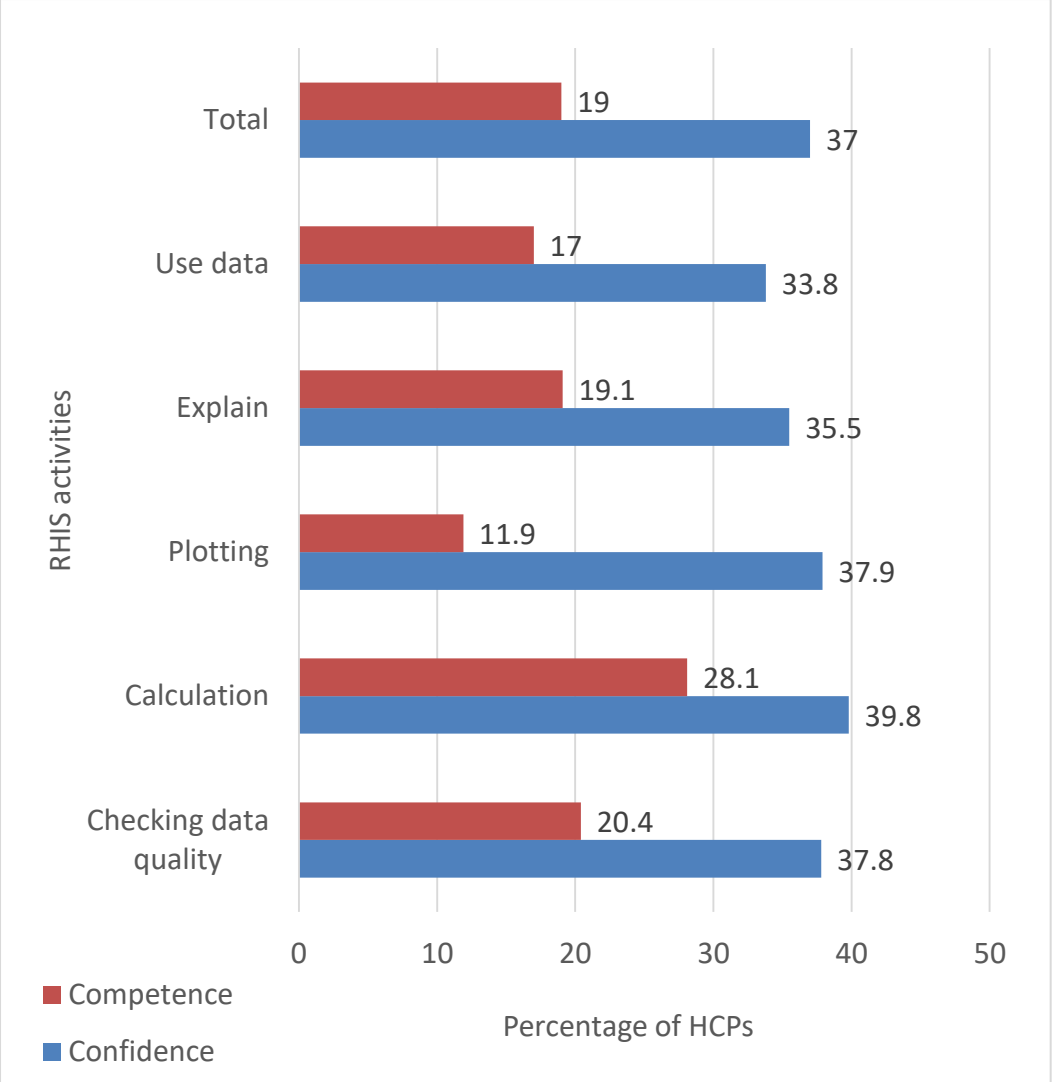

Figure 17: Comparison of confidence and competence levels for MCH/RHIS tasks in health facilities

Knowledge of the rationale for MCH/RHIS data collection. To assess the knowledge of the rationale for collecting MCH/RHIS data, respondents were asked to describe at least three reasons for collecting or using disease, immunisation, sex, age, and geographical data of clients, on a monthly basis. Whereas between 60.4% to 66.8% of the respondents did not have any idea on why they collect such data, between 3.4% to 8.7% of them provided answers that were incorrect. Between 11.3% to 22.6%, 6% to 14.3%, and 1.5% to 6% could correctly provide one, two or three reasons for collecting or using

disease, immunisation, sex, age, and geographical data of clients, on a monthly basis (see Table 24). Further, about 19% could tell why population data (such as catchment area) is included in MCH/RHIS.

Table 24: Respondents Knowledge of the Rationale for MCH/RHIS Data Collection

Indicator	Percentage of answers provided, N=265				
	Wrong answers	Only 1 correct	Only 2 correct	All 3 correct	No idea
Diseases	8.7	14	10.9	6	60.4
Immunisation	8.7	12.1	14.3	3	61.9
Sex of clients	3.4	22.6	9.1	1.5	63.4
Age of clients	7.9	11.3	9.8	4.9	66
Geographical data	6.8	16.2	6	4.2	66.8
Describe data quality dimensions	6	1.5	3.4	18.5	70.6
Check data quality	8.3	7.9	7.2	2.3	74.3

Problem-solving skill. A pencil and paper test were used to assess the respondent's problem-solving skills. A story/scenario with an opening and ending was given, and respondents were asked to fill the middle part by defining the problem quantitatively, listing four reasons for the problem, and describing five activities for solving it. Whereas 76.2% of the respondents said they had no idea to defining the problem quantitatively, 23.8% provided answers that were incorrect. On listing four reasons for the problem, 1% of the respondents provided four correct reasons, 7% provided three correct reasons, 3% provided two correct reasons, and 6% could list only one correct reason for the problem. With regards to describing five activities for solving the problem, 0.4%, 5.3%, 6.4%, 3.4%, and 3.8% could describe five, four, three, two, and one activity respectively for solving the problem, while 5% provided incorrect answers, and, 76% said they had no idea to solving the problem. The results showed that, averagely, the respondents had no skills in defining problems, problem identification, and in solving problem.

Motivation. Eight items relating to perceived positive and negative outcomes of RHIS activities were employed to assess HCPs motivation. Respondents were expected to indicate the extent to which they agreed or disagreed with the statements about their personal motivation to perform MCH/RHIS tasks. Their perceived positive and negative feelings towards performing MCH/RHIS activities were combined to measure motivation. About 84% of the HCPs agreed that collecting/recording data was meaningful to them, which gives them the feeling that data is needed to monitor the performance of the health services provided at the facilities. However, less than half (46.1%) of the HCPs felt their job of data collection was appreciated by their superiors. Further, 82.6% said they were discouraged when the data they collect or record are not used in decision making. Again, 28.3% find data recording to be boring, an activity which is being forced on them; 33.2% also found data collection to be a burdensome activity, and 26% think it is not their duty to collect/record data. Overall, the findings revealed that, on the average, 56% of the HCPs were motivated to carry out MCH/RHIS activities in their facilities.

Research Objective 4: To Determine how Organisational Factors (Promotion of Culture of Information, Reward System, Supportive Management, and Resources Availability) affect Behavioural Factors (Self-Efficacy and Motivation)

Bivariate analysis was done to investigate the effect of Organisational on Behavioural factors. The purpose of this analysis was to ascertain the relationship between the HCPs level association and indices identified through Cronbach's alpha analysis. The results are presented in Table 25 below. The indices measuring self-efficacy was moderately positively associated with indices measuring: culture of information scale, $r(265) = .36, p < .0001$;

activities for promoting culture of information, $r(265) = .33, p < .0001$; and supportive management, $r(265) = .29, p < .0001$. However, self-efficacy had weak positively associated with indices measuring: resources availability, $r(265) = .14, p < .027$; and reward system, $r(265) = .16, p < .008$. These associations were statistically significant. Again, organisational factors had very weak negative association with motivation, which were not statistically significant except for indices measuring motivation and resource availability.

Table 25: Pearson Correlation Coefficient for Organisational Factors and Behavioural Factors

Index	Culture of information	Activities for promoting culture of information	Supportive Management	Resources availability	Reward	Self-efficacy	Motivation
Culture of information	1	.665** .000	.631** .000	.499** .000	.408** .000	.359** .000	-.075 .224
Activities for promoting culture of information		1	.611** .000	.639** .000	.381** .000	.334** .000	-.056 .361
Supportive Management			1	.486** .000	.433** .000	.288** .000	-.083 .183
Resources availability				1	.446** .000	.136* .027	-.155* .012
Reward					1	.162** .008	-.008 .903
Self-efficacy						1	.231** .000
Motivation							1

****.** Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed)

Discussions

The purpose of this study was to assess the performance of MCH data in RHIS with the view to establish an understanding on current status of MCH data, as well as identify the technical, organisational, and behavioural factors that contribute to MCH performance among HCFs in CCM. This section discusses the findings in relation to the research objectives.

Research Objective 1: To assess the level of RHIS performance (MCH data quality and information use) in the HCFs at the CCM

The purpose of this objective was to assess the level of RHIS performance in HCFs at the CCM. RHIS performance is defined in terms of MCH data quality and information use.

Data quality. The quality of MCH data in RHIS (Registers, Forms, and DHIS2) was assessed at HCFs in the CCMA. Eight facility-based indicators reflecting services that every woman and her new-born should receive, were included in the study. The MCH data in the DHIS2 database met most of the defined criteria for sufficient quality, contrary to other studies assessing routine data. During the reference year, 2020, the data in DHIS2 database did reflect what was in the facilities' service registers and monthly reporting forms, were complete, timely reported, and exhibited high level of consistencies over time, and between related indicators, with minimal outliers. However, the data quality metrics assessed were not equally good across all priority MCH indicators.

MCH data accuracy. Data accuracy was assessed by comparing reports (Forms and DHIS2) with source document (registers). The percentage of facility's MCH data accuracy from the registers to the monthly reporting formats (Forms and DHIS2) was lower than from Forms to the DHIS2.

Specifically, the percentage of facilities MCH data accuracy from the registers to forms, registers to DHIS2, and forms to DHIS2 were respectively, 68.2% (95% CI 50.6 - 85.8), 67.1% (95% CI 51.1 – 82.5), and 81.6% (95% CI 70.9 – 92.7). These findings are less than the accuracy of data reported from Hadiya Zone, Southern Ethiopia, where 76% of the departments at the health centers reported accurate data (Ermias et al., 2016), and 79% in Oyo State, Nigeria (Adejumo, 2017), except for that from the forms to DHIS2. The variations could be due to difference in the type of facilities and the level of the feedback provided to the departments in which 95.8% of the departments at Hadiya Zone and 46.2% of the facilities in that study received feedback.

Disparities (over/under-reporting) were observed for some of the MCH indicators and for the months. However, these disparities were not fatal since the proportion of the reported numbers that were verified from the source documents were within the acceptable tolerance threshold of 100% ±10% (MEASURE Evaluation, 2017; WHO, 2014b) for all the indicators, except for Td2+ which was largely under-reported. This suggests that the MCH data transferred from the register to the monthly report forms, register to DHIS2, and forms to DHIS2 were accurate. Achampong et al. (2018) assessed the accuracy of newborn health data transfer from facilities registers with summary sheets and the DHIS2 application in four health facilities in the CCM were deemed accurate. They however reported a general under-reporting from facility registers to summary forms and over-reporting from the summary forms to DHIS2 except for institutional neonatal mortality which was largely under-reported. As part of performance evaluation in the study area, GHS reemphasises improvements in MCH service provision (GHS, 2014). Thus,

under/over-reporting services might indicate attempts to claim better performance. It is therefore important to carefully consider these variations (under/over-reporting) when using the data for decision making. Underlying these variations is the fact that recording of data into these sources is largely manual and paper-based.

All the government owned facilities reported accurately for all the indicators except for deliveries where the data were found to be inaccurate in DHIS2 database. Further, ANC1 and PNC were found to be inaccurate for the private owned facilities. The Teaching Hospital and all the Health Centres had all their MCH data accurate in DHIS2. Whereas clinics and CHPs compounds over reported their PNC services in DHIS2, the Metropolitan hospital hugely under reported its Td2+ services by over two times.

A number of factors can be attributable to variations in data from one source to another. For example, incomplete source documents and errors in computation when aggregating data could lead to over-reporting of data from registers to monthly reported forms. Previous studies identified insufficient time due to workload, lack of appreciation of the importance of data, transcription errors, and transposing errors (Amoakoh-Coleman et al., 2015; Boadu, 2015). In Ghana, most health facilities, especially in the lower levels, use lower cadre of staff who do not have the requisite training in data management processes. However, in this current study, majority of the respondents had higher education. Probably, what could account for the variations observed in the facility's registers and monthly report forms is lack of in-service RHIS training on data management because over 90% of them stated that they did not receive any training in RHIS-related activities in 2020.

Completeness of MCH data. All the HCFs submitted the two monthly reports (Midwife's Returns and Vaccination Report) on monthly utilisation of their MCH services for all the 12 months of 2020, indicating a complete reporting rate. This finding indicates that data generated does not remain at the facility level, but is distributed to the next level for necessary action. Sending the reports of the MCH coverage to the next reporting level indicate that the district health offices receive a complete representation of the MCH services provided in their catchment areas. This could have important implications for the health of pregnant women and new-borns, as information reported by the facilities may be used by the officers to guide future plans and inform accomplishments (Bhattacharyya et al., 2016). An assessment of RHIS data in Addis Ababa showed completeness rate of 100% (Bayisa, 2014), and in Gurage Zone, it was found that approximately 87% of the Primary Health Care Units had a reporting completeness rate of more than 90% (Tsedeke, 2015). Also, issues of completeness were found in a recent study where 83.3% completeness rate were reported among selected health centers in Southern Ethiopia (Solomon, Addise, Tassew, Balcha, & Abebe, 2021), and 76% completeness rate in data quality assessment performed in Primary Health Care Unit from a total of 17 districts across six regions of Ethiopia (Gebrekidan et al., 2012).

All, except one facility, did not meet the set limit for completeness of data in DHIS2 database for the MCH variables. Generally, completeness was best for the Child Health variables, that is, 100% for Penta3, and 99.6% for Penta1, which indicates that all the data were entered into the DHIS2. However, the MCH variables with the most missing values were found in the

provision of maternal health services, with observed variations. Further, about 8% of the facilities had 50% of their data in the registers and forms complete. This suggests that the HCPs are more focused on managing patients rather than recording data, perhaps due to workload or lack of commitment to the data.

In Ghana, DHIS2 is the final repository for data routinely generated from health facilities and is the main source of information used by the majority of the health managers in the country for planning and decision making. Completeness of data in DHIS2 was found to be generally high (95.4%). Assessing the completeness and accuracy of data transfer of routine maternal health services data in the Greater Accra Region of Ghana, Amoakoh-Coleman et al. (2015) reported 99.1% completeness in summary reporting forms and 100% in the DHIS2. The authors further reported 94.3% data completeness for the antenatal variables. However, lower completeness rates were found in Nigeria for the Monthly Summary Form at 89.3%, and 65.2% in DHIS2, with an overall average completeness of 77.3% (Adejumo, 2017). Relatedly, high (86.9%) data completeness was reported in four counties in Kenya (Manya, & Nielsen, 2016), and 96.6% from Rwanda (Karengera et al., 2016). In contrast, a study in Uasin Gishu County Referral Hospital in Kenya reported as low as 46% routine health data completion (Cheburet, & Odhiambo-Otieno, 2016). In the analysis of primary health care data in Mozambique, manual data completeness was between 37.5% and 52.1% (Gimbel et al., 2011). The findings of higher completeness rates of data aggregation and transfer in this study could be attributable to a more vigilant process of validating data aggregated from one medium before transferring it

to the next (Cheburet, & Odhiambo-Otieno, 2016). It also shows the availability of qualified human resource, appropriate policies and framework for data management in the metropolis, as evident in over 89% of respondents having diploma or higher degrees, and an average of respectively, 6.3 (SD ±5) years and 14.9 (SD ±7.9) years for HCPs and KIs working experience with MCH/RHIS. Additionally, there has been, in recent times, concerted effort by government/GHS in engaging the private sector in routine health information systems (Ministry of Health, 2016).

In this study, the registration (source document) content completeness was almost the same as the report content completeness. This is a departure from the recently published study which was conducted in public health facilities of Harari region, Ethiopia where the 69.6% registration (source document) content completeness was lower than the 93% report content completeness (Shama et al., 2021). Also, in East Wollega, 78.2% registration content completeness was less than the 86% report content completeness indicating that the health workers focus more on managing patients rather than recording data due to the work load and lack of commitment to the data (Kebede, Adeba, & Chego, 2020).

The MCH variables completeness for privately owned health facilities (84.8%) was less than public facilities (96.8%). The private sector provides a significant portion of healthcare in developing countries and will contribute significantly to the data available in RHIS. In the past, private HCFs in Ghana did not feel a sense of duty to the government by submitting their routine data. This development is not limited to only Ghana, as other developing countries have reported difficulty in integrating the private and public health

information systems. Data need to be submitted to the next higher level or used at the point of generation, but before that, issues of incomplete data must be resolved. The large number of reports that ought to be made at the end of the month along with an inadequate and unstable internet connection at the facilities could result in a shortage of time, forcing data officers to send the incomplete reports before the deadline.

Timeliness of data. The degree to which data is current and available when needed to make decisions is reflected in its timeliness. Timeliness represents the proportion of reports that are transmitted to the next level of the reporting system within the timeframe stipulated by the GHS. Our findings of timeliness of MCH data is higher than the timeliness reported elsewhere; 70% in East Wollega, Ethiopia (Fikru, & Dereje, 2018), 78.7% in four counties in Kenya (Manya, & Nielsen, 2016), and 46% reporting timeliness in Uasin Gishu County Referral Hospital in Kenya (Cheburet, & Odhiambo-Otieno, 2016) but similar to studies from Rwanda where 93.8% timeliness was reported (Karengera et al., 2016), and 93.7% timeliness reported among departments in public health facilities of Harari region, Ethiopia (Karengera et al., 2016). The results revealed that among the two MCH services considered, Monthly Vaccination Report was submitted on time better than Monthly Midwife's returns. According to WHO (2014b), facilities are considered to have good reporting if their timeliness rate falls above 80%. Whereas all the facilities met this threshold for the Monthly Vaccination Report, three (23%) facilities did not meet the threshold for Monthly Midwifes Returns report. Meanwhile, timely submission of MCH coverage estimates to the next reporting level is crucial in the provision of MCH services. This would have

important implications for the health of pregnant women and newborns living in the district, as information reported by the health facilities is used to guide future plans.

Consistency. Reported data in DHIS2 for 2020 were consistent for all the eight MCH variables in the Metropolis. Consistency over time indicated an overall 7% decrease in the MCH service outputs for 2020 when compared with that of the preceding three years across the eight variables. The impact of COVID-19 could have accounted for this decrease. Apart from PNC that showed a ratio of over 100%, the rest of the variables were below 100%. Nevertheless, all the variables remained within the quality range of 33% of the average for the three preceding years. This suggests that MCH data in the CCM for 2020 were consistent with that of the three preceding years. Each facility's data for ANC1, ANC4 and Penta3 were consistent over time. However, some of the variables and facilities data were found not consistent, when a facility data for a variable were compared to that of the district value. It is generally impracticable to have same values of an indicator over a period of time. Differences in values are expected from one year to the next, however, if the differences are very large, it calls for concern and raises issues of data quality. While large differences usually suggest some type of reporting error, it is also possible an introduction of a new intervention might have contributed to a large percentage increase in indicator values from one year to the next.

The overall ratio of the consistency between the number of Penta1 doses administered to children and number of ANC1 visits was low (86%). This means that roughly 14% more women attended their ANC1 visit than

children receiving their first dose of Penta, or that there were data quality challenges. This variation may also reflect a higher number of pregnancies than live births, which was not assessed directly in this study. Typically, women accessing health care during pregnancy have at least one ANC visit to the health facility and that most children that seek health care in their first year of life will have at least one visit to the health facility. It is expected that pregnant women who seek health care during pregnancy would also seek care for their children after they have given birth. In fact, evidence has shown that women who seek ANC services are more inclined to seek health services and the essential vaccinations such as Pentavalent vaccine for their newborns (WHO, 2014b). This assessment of the consistency between Penta1 and ANC1 presents potential gaps that warrant further investigation and raise concerns for data quality.

Comparing the number of Penta1 to Penta3 doses administered, it was observed that about 22% of the children who received the first dose of Penta vaccine did not receive the third dose of the same vaccine. Further, 42% of the facilities showed lower Penta1 vaccine administration compared with Penta3, as indicated by their positive percentage difference. The finding suggests that many infants who received their third dose may not have received their first dose in these facilities, an issue that warrants further investigation. Accordingly, the percentage difference of the number of Penta3 dose and Penta1 dose should be less than two percent for data between the indicator pairs to be consistent (WHO, 2014b). About 42% of the facilities were observed to have a higher than two percent consistency ratio for these variables. Generally, the number of Penta1 doses should be either more than

Penta3 or be the same. However, there is the possibility, theoretically, that the number of third dose of Penta is slightly more than the first, especially for administrative units with a lot of in-migration, but it is not likely to happen systematically (WHO, 2014b). Therefore, these positive percentage differences could suggest data quality challenge.

Of the 13 facilities used in assessing the consistency between ANC1 and ANC4, only one showed a positive percentage difference, suggesting a higher ANC4 uptake compared with ANC1. Higher coverage of ANC4 to ANC1 may be indicative of data quality limitation because it is expected that ANC1 would be higher than ANC4 coverage (WHO, 2014b). Also, 8% of the facilities showed a zero-percentage difference between the two variables which suggests that the same number of pregnant women who attended first ANC visit also attended the fourth ANC visit in that same facility. The overall ratio of the consistency between the two variables was 70%, indicating that 30% of pregnant women who attended the ANC1 did not attend ANC4 visit. Across all facilities, none of the priority variables compared demonstrated the expected numerical relationship.

Access to data has increased nowadays due to technological advancement, but the quality of data has been identified as critical area needing intervention (Endriyas et al., 2019). Meanwhile, quality data is essential for monitoring and evaluating MCH services in order to improve MCH health outcomes in LMICs (Lucyk, Tang, & Quan, 2017) A number of factors can be attributable to variations in data from one source to another. For example, incomplete source documents and errors in computation when aggregating data could lead to over-reporting of data from registers to monthly

reported forms. Previous studies identified insufficient time due to workload, lack of appreciation of the importance of data, transcription errors, and transposing errors (Amoakoh-Coleman et al., 2015).

Generally, data accuracy may be affected by errors that occur during data entry, intentionally manipulating the data for different reasons, possibly competition among the staff and facilities, false report to increase achievement, and reports not made on time. A study conducted in Tanzania supports some of these explanations; for example, data manipulation can affect the accuracy of data (Rumisha et al., 2020). In Ghana, most health facilities, especially in the lower levels, use lower cadre of staff who do not have the requisite training in data management (Amoakoh-Coleman et al., 2015). However, in this current study, majority of the respondents had higher education, hence, the high data quality.

Again, the high data quality observed in this study is indicative of presence of a validation team. It is a team of the multidisciplinary health workforce that is primarily responsible to improve data quality and use of information regularly. Members of the team meet on a monthly basis before the report is submitted to the next level to validate and monitor progress for improved performance. The high data quality observed could also be attributed to the effect of COVID-19 on the health information system performance, because this study was conducted while the COVID-19 was seriously challenging the health system in general. HCPs are mostly confronted with managing patients and collecting data in the line of their work. They have multiple tasks including the primary medical duties that may conflict with the time dedicated to the collection of data. They may prioritise

patient care over the collection of data. Thus, collection of data may take place several days after the event, and this delay may affect the quality of information produced. However, during the period of COVID-19, attendance to HCFs decreased, as evident in the 7% decrease in MCH data consistency over for 2020 over the average of the three preceding years. Hence, the workload for HCPs would have reduced so that much attention could be given to issues of data.

Information use. Information use in health system management functions had resulted in improvements in knowledge about the current health and management situation and use of such knowledge in routine management decisions. Availability of guidelines and strategic documents for information use was either none existent or very low. Majority of the facilities did not have information use guidelines and strategic documents in their facilities. A little over one-third of the facilities had copies of their annual action plan spelling out performance targets.

To have a better understanding of performance, various health providers need to collect and assemble data on their activities. Whereas all the HCFs collected routine data related to MCH activities, MCH report production showing findings, actions taken, and implications were found to be low in the facilities. A lot of the facilities were just compiling the data and forwarding same to higher levels. It would appear that for such facilities, data were mainly collected for onward submission to the next level without making use of those data for relevant local decision. Basically, there is a sequence of events that defines information use. There must be a management team in place who should meet regularly to discuss issues on available information, make

decisions based on the information, and then follow-up on those decisions. Except for percentage of facilities which meeting record showed discussions about RHIS findings, our findings on discussions about RHIS data quality, decisions made based on the discussions, decisions referred to higher level, and any follow-up actions regarding prior decisions, are an improvement over that of Harikumar (2012). In a study of HMIS in Kerala, India, Harikumar reported 34% of the facilities had discussions on data quality, 37% made decisions based on the discussions with 31% referring the decisions to higher level, and none of the facilities showing follow-up actions regarding prior decisions.

The decisions taken at the facility level were low compared to the discussion levels, which indicates either a low decision-making capacity or that the decisions are of a kind that needs approval from a higher level. These findings are consistent with that of Harikumar (2012). The overall level of use of information in meetings was 53.2%. Although discussions on data quality was high, decision making based on the discussions low, which indicates a low capacity to make decisions or the decisions are of a kind that needs approval from a higher level. A study on evaluation of Health Management Information Systems in Kerala, using the PRISM tools also found low levels of use of information even though the task competence and level of accuracy was high. Again, information use for promotional activities was none existent in most of the HCFs. Only 10% of the HCFs showed information use for promotional activities. This calls for the urgent need for senior management to promote more use of information, especially for MCH services.

A greater number of the data visuals prepared by the facilities (such as graph, tables and maps) showing achievements towards targets on MCH, were on child health; however, only one-third were visibly displayed in the facilities. A breakdown of the population by target group is crucial for calculating targets and indicator. The catchment population is essential for calculating service indicators for the target population. Thus, having a map can provide evidence that the facility is paying attention to the catchment population's needs.

Unlike high data accuracy, the limited use of information in CCM is more similar to that of resources limited countries (Harikumar, 2012; Mucee et al., 2016). This finding is consistent with a limited competence in checking data quality, analysis, interpretation and problem solving at the lower levels of the organisation, which hinders use of information. Weak data management, communication and utilisation practices of health facilities are reported mostly in resources limited countries (Kihuba et al., 2014; Mucee et al., 2016; Nisingizwe et al., 2014; Teklegiorgis et al., 2016). Poor RHIS data utilisation at the health facilities were reported in studies from Kenya (Jeremie et al., 2014; Kihuba et al., 2014; Mucee et al., 2016). Findings from Cote D'Ivoire using PRISM framework indicated a 38% overall utilisation of health information at the facilities (Nutley et al., 2014). Likewise, studies from Addis Ababa, Ethiopia, suggest health data utilisation was limited and focused on data collection and reporting to the respective bodies (Hirpa et al., 2010). Several reasons could account for this low utilisation of data. These may include poor quality of data, weak analysis of data, lack of an information culture, lack of trained personnel in HIS activities (Yarinbab, & Assefa, 2018).

Other studies identified poor data management skills, lack of support from management, infrastructure, and migration of trained workers as factors that reduce the management and use of health information at the health facility level (Jeremie et al., 2014; Mucee et al., 2016; Nisingizwe et al., 2014; Teklegiorgis et al., 2016).

Given the findings from this study, it is obvious some facilities employed local data for planning and monitoring local performance. Similar findings were reported elsewhere (Adane et al., 2021; Ohiri et al., 2016; Shiferaw et al., 2017). Many studies have recognised the effect data use and data quality have on each other (Braa, Heywood, & Sahay, 2012; Endriyas et al., 2019; Wagenaar et al., 2017)

The high level of data quality revealed in this study did not match with improved information use at data collection point. This revelation suggests that availability of quality data does not guarantee the use of information in making decisions as evident in various PRISM evaluations. Similar findings were observed in Cote d'Ivoire where, within a period of 4 years (2008 to 2012), data accuracy improved at health facilities by 17% and doubled at district level (from 40% to 81%); however, information use remained at 38% at the facility level within the same period (Belay, & Lippeveld, 2013). Again, in Mexico, only 53% out of 158 health facilities demonstrated information use in a PRISM assessment, although over 90% data quality was observed in the assessment (Belay, & Lippeveld, 2013). Along the same lines, proper use of information does not suggest that the data is of good quality. The process of data collection within health facilities can affect the quality of the data, good data management requires data quality check at all stages of data acquisition

(Solomon et al., 2021). Therefore, it is the responsibility of data management personnel to check and validate the quality of the data before submitting same to the next level (Cheburet, & Odhiambo-Otieno, 2016).

Research Objective 2: To assess the functionality of MCH/RHIS processes in the HCFs at the CCM

All, except one health facility, admitted receiving directives or reminders from the district office on data quality checking processes for data accuracy, completeness, and timeliness, but there was no such evidence at the facilities. Moreover, KIs mentioned that the directives were mostly communicated orally, either on phone or during supervisory visits to the facilities. The only facility which did not receive any reminders from the district office to check data quality claimed that they had reached such a high level that no reminder was needed and as a result checking data quality was less emphasised. There cannot be an effective RHIS without processes or mechanisms in place that encourage HCPs to perform RHIS-related tasks, such as checking data accuracy, preparing monthly/quarterly reports, and submitting such reports on time. Even when processes or mechanisms are in place, if there are no reminders to implement them, it could result in a lack of motivation to perform the tasks. There is therefore the need for reminders from the higher level of authority on the need to check for data quality.

Data processing and analysis. The findings revealed that the existing gaps between the facilities that have reference procedure manual with definitions for data collection and analysis (76.9%), and those that had reference guidelines for information use (46%) could be because, at the level of the health facility, information use is limited. Again, a little over half of the facilities, 54.1% (95% CI = 44.3 - 63.9), engaged in data analysis processes,

suggesting limited data analysis process at the health facility level. This is supported by limited competencies displayed by HCPs in analysing and interpreting data, as well as limited skills in solving data problem, which negatively affect the use of information. Most of the facilities processed data in a way that comparisons could be made on the various MCH indicators in the facility summary report against the district/national targets. Likewise, data were analysed to compare which services were performing better, and also make comparisons of data over time (i.e., monitor data over time to determine if a particular service is static, improving, or declining). Notwithstanding, there seems to be issues with the functionality of data analysis process.

Supervision quality. The high figure (92.3%) recorded in the number of facilities receiving at least one supervisory visit from the district team in the last quarter of 2020 demonstrates the effort the CCMHD puts in reaching out to the facilities. The performance of supervision by the district/sub-district supervisors is measured by supervision frequency and the use of checklist in checking data quality. Supervisors are also required to discuss the facility's performance based on the facility's data, assist the facility in decision making, as well as send feedback, in written report, to the facility after the supervision. The finding indicates that quality of the supervision was above average with 61.5% of the health facilities stating the supervisory team performed data quality check, 53.8% stating the supervisors discussed their performance and another 53.8% reported that supervisors assisted them in making decisions based on data from MCH/RHIS. Supervisory visit strengthens the health system, enables health workers to offer quality services and improve performance (Avortri, Nabukalu, & Nabyonga-Orem, 2019). Supervisory

visits to the health facilities should be accompanied with written feedback on the supervision. Notwithstanding the high reported supervisory visits, feedback on these visits were observed to be very low (33%), calling for an improvement in the supervision feedback mechanisms. This finding is similar to previous studies where high supervisory visits were recorded with low feedback reports to the facilities (Aqil et al., 2010; Mimi, 2015; USAID, 2014). It was also observed that, checking data quality and feedback systems using standard tools exist, but were rarely implemented in the routine supervisory visits.

Feedback mechanism on reported data. The culture of feedback is necessary in promoting data quality and supporting decision making in the health facilities. The high flow (76.9%) of feedback from the MHD on the submitted data is a testament that current design does promote the feedback loop which is very good for service performance. This culminated in the data quality observed in the facilities. The findings contrast previous studies which observed that feedback was a weak RHIS process in many resources limited countries (Adejumo, 2017; Boadu, 2015), but rather an improvement over the finding of Harikumar (2012) who reported that only 39.5% of the facilities receive feedback from higher levels. Further, it has been well reported in previous studies that regular data quality assurance with appropriate feedback can motivate positive changes in data quality and use (Gimbel et al., 2017; Yourkavitch, Zalisk, Prosnitz, Luhanga, & Nsona, 2016). Thus, district teams are expected to provide feedbacks on the submitted monthly reports from the facilities. Feedback is an important process for identifying problems for resolution, for regulating and improving performance at individual and system

levels, and for identifying opportunities for learning. It is a process through which information flows back to the data collectors. When facilities receive feedback about their performance, chances are that they will learn from it and use it to improve their data quality (accuracy, timeliness, completeness, and consistency) and service delivery performance, thereby improving RHIS performance.

The current finding shows that display of MCH/RHIS was relatively poor (30.8%). Interestingly, none of the data displayed on maternal health were updated for the last quarter of 2020. It would appear from the results of this study that data generated in most of the facilities were not used to monitor progress over time, including, in planning, and for decision making, as suggested by MEASURE Evaluation (2019) that how well data are displayed reflects whether the data have been transformed into information, and shows its relevance for management, monitoring or planning purposes. Data generated from the health facilities must be processed into a usable format, and displayed in the facility, hence, an important process signifying continuous use of data to monitor performance through visual presentation of data, showing progress over time, that strengthens transparency (USAID, 2012). This is influenced by availability of tools, data analysis, and skills that may facilitate both the processing and display of data. Data display serves a number of purposes, including creating a pictorial presentation of the work, demonstrating progress made in comparisons against targets, and strengthening transparency.

Again, the findings show that on average, the facilities have shown more availability of RHIS processes. For instance, more than half of the

criteria for assessing RHIS processes were found to exist, while it is lowest for data display and highest for data collection and transmission. However, these processes need more strengthening. RHIS processes play a very significant role in the production of quality data and also in facilitating the use of information. For consistent information use to occur, high quality data is needed, that will engender high level of confidence that the data being consulted are complete, timely, and accurate. Without quality data, demand for information could drop, evidence-based decision-making would not occur, and efficiency and effectiveness of health programmes will suffer. There is therefore the need to institutionalise processes in the health facilities to improve and ensure the quality of data.

Research Objective 3: To assess the technical, organisational, and behavioural factors of MCH data quality and information use in RHIS in the HCFs at the CCM

Technical factors. The technical factors include the ability of HCPs to use tools available to them to make their work easier, technological infrastructure, and interoperability of the systems. The findings reveal a significant variation in the responses of the KIs and HCPs to most of the questions on the technical determinants. These differences in the responses could be as a result of the significant gaps identified in the years of employment as well as number of years working with MCH/RHIS for the KIs and HCPs. Specifically, whereas 84.6% of the KIs had over 10 years working experience in relevant health departments, only 18.9% of the HCPs had such working experience. The same picture was observed in the number of years working with MCH/RHIS, where 84.6% of KIs and only 8% of HCPs had over 10 years working experience with MCH/RHIS. The KIs were considered

highly qualified staff; thus, qualified and competent personnel are required to make the RHIS operate efficiently. It is also possible that the KIs have exaggerated their responses more than the HCPs respondents.

The technical factors were moderately thought of by the respondents in this study, contrary to what was reported in previous studies (Aqil et al., 2010; Mimi 2015; USAID 2014). For instance, Mimi reported above 80% technical competence of RHIS in Palestine. All the health facilities considered in this study used standard registers, developed by the GHS, implying some level of uniformity in the data that are generated from different health facilities. Again, availability of a procedure manual, and use of electronic system to enter and analyse MCH (routine) data was well established by both the KIs and HCPs in this study. However, less than one-fifth of the KIs felt the monthly report form, procedure manual, and data software are complex and difficult to use, and that existing RHIS gathers information that is also included in other information system. On the part of HCPs, other technical aspect of MCH/RHIS such as the user friendliness of MCH/RHIS procedure manual and software, as well as simplicity of data collection tools were below average.

It appears when these forms are introduced, only a few professionals are trained to train others (trainer of trainers) but this are often not done or poorly done. Consequently, data collectors who use these forms/software end not having the requisite skills to use them. Maternal and child health indicators become irrelevant if data collection forms are complex to fill in. Likewise, motivation and confidence levels of data collectors are seriously affected if computer software is not user-friendly (Aqil et al., 2012). It was observed that, apart from DHIS2 software that was common to all the facilities, the health

facilities used parallel facility based proprietary software, such as Lightwave Health Information Management Systems (LHIMS), Patient Health Information Systems (PHIS), to collect and manage data in their facilities. Additionally, about half of the HCPs find the information system difficult to manage, stand-alone with no data warehouse to combine these information systems' data for producing a comprehensive picture of the health system performance at district or higher levels.

None of the KIs, and a tenth of the HCPs received RHIS training in 2020, a situation that calls for periodic training of HCPs involved in data management. Supplementing the formal training of HCPs with periodic workshops, continuous professional development, and mentorship is very vital in addressing challenges in data quality. These trainings enable the staff appreciate the importance of quality data for decision making and planning. MEASURE Evaluation (2019) underscores the need for continuous training in a continuous process, especially, where the staff turnover and tasks shifting which may affect the completion of data collection forms, data compilation, analysis and presentation (which are critical yet often underdeveloped skills) are used. Often, staff involved in data collection have limited skills in the use of data collection tools, lack the competence in checking data quality, and mostly do not understand the value of the data they collect. Unfortunately, these staff do not get the needed training (Nicol, Bradshaw, Phillips, & Dudley, 2013), as such data captured into the RHIS may be of low quality. This assertion is supported by Aung and Whittaker (2013) who underscore the importance of training data personnel on data analyses and presentation, yet unskilled personnel are mostly used in undertaking these activities. Cheburet

and Odhiambo-Otieno (2016) further affirmed that high demand for information in a global environment requires adequately trained health workforce in RHIS activities.

Technical factors could affect performance directly or through behavioural factors. For example, motivation and confidence levels of data collectors are affected if computer software is not user-friendly. Also, there is serious hindrance to information use if the computer software does not properly process data and in a timely manner, and resulting analyses do not provide meaningful conclusions for decision making (Aqil et al., 2012). This was confirmed by this study where a little over one-third and half of the staff were confident and motivated respectively about MCH/RHIS tasks. Technical factors can also be affected by organisational determinants such as when an organisation is not ready for computerising its information system and therefore still uses a paper system.

Organisational factors. Organisational factors include the management functions, promotion of culture of information, activities for the promotion of culture of information, supervision quality, reward for good work, availability of resources, and supportive management. RHIS management functions, and activities for promotion of culture of information were below average. Apart from the criteria on RHIS supervision which was met by more than half in the facilities, the rest of the RHIS management functions were very weak. However, other organisational factors such as culture of information, perceived reward for good work, supervision quality, perceived availability of resources were above average. Also, gaps were identified between equipment that were available and the actual quantity

needed for MCH/RHIS activities in all the facilities. Also, many of the available equipment were not functioning, creating availability and functionality gap at the facilities.

RHIS management function. It is an act of putting mechanisms in place for effective management of resources and functions for better RHIS performance (MEASURE Evaluation, 2019). The findings indicate that less than one-third (27%) of the assessment criteria of the management functions were met. Apart from the criteria on RHIS supervision which were met by more than half (58%) in the facilities, the rest of the RHIS management functions were reportedly very weak, ranging from 15% to 27%. However, this was a great improvement over figures reported by Mimi (2015) where 19% was reported for finances, 16.5% for planning, 4.5% for governance, 1.3% for supervision, and 0% for training as well as use of quality. Although all the facilities received supervisory visit from the higher level, only 15.4% had copies of the report from the latest visit. Training criteria was reportedly the least of all the management functions, indicating lack/low level of training at the facilities. All HCPs involved in RHIS tasks must be oriented and trained on information management and use. There should be planned trainings using standardised manuals. Unfortunately, this is not the case in this study, as most of the facilities did not have the training manuals or a schedule for planned training. Unfortunately, there was also no RHIS mission statement displayed in prominent position(s) at any of the facilities.

Culture of information. The findings show that significant gaps exist between perceptions and objective reality of culture of information at the health facilities. Meanwhile, a strong culture of information has been

hypothesised to correlate highly with RHIS competence levels, but this was not the case in this study. Respondents, on average, perceived that their departments emphasize data quality, promote problem-solving, and promote use of RHIS information, which ordinarily would reflect in similar proportional levels of RHIS competence in those areas. However, a comparative analysis shows that in practice, the respondents' perceptions did not match observed competence levels for checking data quality, use of information and problem solving. For instance, respondents' perceived promotion of evidence-based decision making was the lowest (52.2%) among the dimensions for promotion of culture of information, and highest for emphasis on data quality (75.4%). This may be an indication that respondents were less confident that their superiors foster evidence-based decision but are more confident in them putting emphasis on data quality. This finding is similar to that of Mimi (2015), where an average of 72% was observed for data quality emphasis. Thus, departments placing emphasis on data quality has a positive effect on the quality of data turned out for decision making. This is because data collectors at the facilities will pay more attention to data completeness and data error detection to ensure its accuracy.

Respondents' perceived promotion of use of MCH/RHIS information in the health facilities was above average (68.8%) in this study, but lower than the 75% reported by Mimi (2015). However, this did not reflect in the actual use of information, because significant gaps were observed in the use of MCH/RHIS information in the facilities. Further, 60.4% of the respondents perceived that their superiors promote problem-solving, which did not also reflect in the actual problem-solving skills of the personnel, because low

competence in solving problem were observed. This is consistent with previous studies which reported high rates for perceived promotion of problem-solving but very low rates for actual problem-solving skills (Boadu, 2015; Mimi, 2015). In addition, more than half (52.2%) of the respondents perceived that their departments foster evidence-based decision making in the health facilities. This finding is lower than what was reported in previous studies (Boadu, 2015; Mimi, 2015). For example, Mimi reported 78.2% whereas Boadu reported 61% in baseline and 57% in the endline. Top of it was data/facts, and lowest considerations were based on personal likings as well as the political considerations. Moreover, promoting feedback from community and staff is very important in managing RHIS.

Activities to promote an information culture. Activities to promote an information culture are a significant organisational factor. Whereas communication on the use of information did not exist in any of the HCFs, 85% of the facility records showed that the facility heads attended meetings at district level to discuss MCH/RHIS information, thereby sharing the success stories of their facilities. Attending these meetings does not only show the importance of their involvement but also provide them with excellent opportunity to share success stories on use of MCH/RHIS information at the facilities. Aside facility heads attending meetings, there seems to be no communication on the use of information, demonstrating limited avenues for sharing success stories on the use of MCH/RHIS information at the facilities. The current findings are an improvement over that of Aqil et al. (2010) which reported 64% on communication about targets, and 49% facility heads attending meetings at district level to discuss MCH/RHIS information, but a

decline in the directives on the use of information and advocacy. Whereas limited communication on the use of information were observed (40.3%) in this study and that of Aqil et al., a study conducted by Mimi (2015) reported higher (75%) values. District or higher levels are assumed to be actively involved in carrying out activities for the promotion of a culture of information. It would, therefore, be understandable if information use is limited at the lower levels. However, this study had the teaching hospital, metropolitan hospital, and private hospitals who ordinarily would use information for decisions making at their level.

Supervision is a means of providing assistance as well as serves as on-the-job training to staff. The principle is to teach, coach, guide and support officers to do their work better. GHS encourages facilitative supervision visits at all levels. According to GHS, supervisors at all levels are obliged to organize quarterly supervisory visit to provide technical support to sub-districts/facilities (GHS, 2017). Prior to these facilitative supervisions, supervisors are required to review performance of departments/facilities in order to identify outliers and broad issues that require clarification. After the visit, they are required to write supervisory reports, and provide feedback to the departments/facilities and incorporate them into future supervisory plans. Although a little over half was recorded for overall supervision quality, it is a great improvement over that found by Mimi (2015), who reported 7.6% of facilities receiving supervisory visit, zero checks on data quality during those visits, no feedback on the visits, no discussions on facility's performance nor helped the facilities in making decision using MCH/RHIS information during those visits. The findings indicate that supervisory function is working

relatively better, comparable to that reported by Aqil et al. (2010) and Mimi, but with a need to improve feedback. Data quality review, supervision, and feedback are essential ingredients in improving RHIS data (Hahn et al., 2013; Nicol et al., 2016; Puttkammer et al., 2016). Studies specifically considering web-based reporting systems noted that, while digitalizing of the reporting systems can improve the completeness and internal consistency of reported data, supervision and feedback remains essential for achieving and maintaining improvements in data quality (Admon et al., 2013; Gimbel et al., 2017; Mutale et al., 2013).

Reward for good work. Respondents' perception of behaviours such as *superiors in the health facility recognizing or rewarding staff for good performance*, and *staff in the health facility receiving award for good work* was above average (59.5%). Rewards differ from motivation because they are tangible benefits provided by the organisation for good performance rather than an internal feeling of doing something meaningful, useful, or receiving acknowledgment or appreciation from others. It defines the possibility that good performance is recognized and reinforced by some kinds of reward (Belay, & Lippeveld, 2013). This has positive effect on data quality and information use, thereby improving the performance of RHIS.

Availability of resources. Resource availability is fundamental in performing MCH/RHIS tasks. Overall, 95.5% of the equipment at the HCFs were in a good working condition, which could greatly contribute to MCH/RHIS performance. However, significant gaps were identified in the quantities of equipment available and quantities needed in most of the facilities and the district as a whole. The large gap recorded between the

available equipment and quantities actually needed is alarming since raw data are generated at this level and all resources needed for this purpose should be adequately available (Belay, & Lippeveld, 2013).

All the HCFs have the necessary staffing level to perform the MCH/RHIS tasks except for health information officers who were absent primarily at the CHPs compounds. Shortage of skills in health care remains a challenge in many sub-Saharan countries (Haftu et al., 2021; Taderera, Hendricks, & Pillay, 2016; Tandi et al., 2015). Also, a study in Ethiopia reported only 23.8% of staff received HMIS related training (Dagnew et al., 2018). However, in this study, 67% and 22% staff received training in the past on data entry/compilation and data quality review or data quality check. Despite these efforts on capacity building, data quality still needs improvement, perhaps due to HCPs attitudes toward RHIS activities. These professionals are more likely to give attention and time to clinical duties and tend to pay less attention to activities related to RHIS. Findings from this study also support the argument that over one-third of health professionals found data collection burdensome, which makes it difficult for them to complete other duties. Investment in right skills, knowledge, training, and deployment of the appropriate human resource creates value in data quality (Schroeck, Shockley, Smart, Romero-Morales, & Tufano, 2012). The appreciation of various skills from various academics blends the success of health delivery.

Behavioural factors. The PRISM framework hypothesises that behavioural factors are important determinants of RHIS performance because it influences the quality of the information generated by the system. Users of

MCH/RHIS require motivation, confidence, and competence to perform MCH/RHIS tasks which directly affect RHIS processes and performance. For example, how users who are directly involved in data generation, its exploration and interpretation feel about the outcomes or usefulness of a task, or his confidence in carrying out a task affects how the task will be performed (Teklegiorgis et al., 2016). Behavioural factors were categorized into two groups - perception and actual skills. The findings indicate that respondents' perceived confidence level to calculate percentages/rates emerged the highest among the MCH/RHIS tasks considered for perceived confidence, and using data to make operational/managerial decision emerged the lowest. The respondents' perceived confidence to perform MCH/RHIS tasks was low in this study, compared to a similar study in Ethiopia that reported 72%, 83%, and 74% of respondents perceiving that they could prepare data visuals, interpret data, and perform data quality checks respectfully (Haftu et al., 2021).

Respondents were only able to accomplish a fifth of the given MCH/RHIS tasks, suggesting that they were not proficient enough in MCH/RHIS tasks. The average competence level for all the indicators for respondents' competencies to perform MCH/RHIS ranged between 11.9% and 28.1%. Again, the respondents had lower scores in checking data quality (20.4%), interpretation (19.1%), and use of data (17%). If HCPs at facility level are adequately equipped with necessary skills, and understand the importance of the data they collect, chances are that it will impact data quality since much attention will be given to data error detection at the onset of the data collection process. Nicol et al. (2013) revealed that there was

considerable deficiency in the competencies displayed by HCPs in interpreting data to address any quality issues.

Overall, respondents had low knowledge of the rationale for collecting diseases, immunisation, sex, age, population, and geographical data of clients in the MCH/RHIS. From these results, it can be said that HCPs are collecting routine data without understanding completely why they are collecting such data. Again, the results suggest lack of demonstration of data utility, thereby creating little or no appreciation about data collection among HCPs (Alhassan et al., 2019; Asiimwe, 2016; Dagnew et al., 2018; Jeremie et al., 2014; Kihuba et al., 2014; Mimi 2015; Mucee et al., 2016; Shama et al., 2021; USAID, 2014). Shama et al. for example, reported as low as 21,6% of staff having a good knowledge of rationale of routine HIS data.

Comparative analysis among some components of RHIS show significance discordance, suggesting some systemic issues. There is a general premise of strong relationship between confidence and competence (Aqil et al., 2010; USAID, 2014), but this assertion was not supported from the results obtained in this study. Respondents were not quite objective in the MCH/RHIS self-assessment. Thus, the data exhibited significant discord between the objective and subjective (perceptions) assessment. This was evident in the 37% confidence levels and 19% competence levels observed, which indicates respondents perceived high confidence in MCH/RHIS tasks but in practice, they had no such competence to perform the tasks. Despite the high level of education of the respondents, huge gaps were identified between perceived confidence and actual competence for plotting data, calculations, interpretation, checking data quality, and use of information.

The range for respondents' competencies to perform MCH/RHIS tasks was more than twice their perceived confidence in performing MCH/RHIS tasks. It is unclear what could have accounted for these low average competence levels as compared to some countries where PRISM tools were used and respondents showed high competence level for all types of RHIS tasks. Despite having high perceived confidence in plotting data, the observed skills were the lowest. The reason for this discord could be the fact that most HCPs, in the Ghanaian context, do not play a key role in data analysis; such is left for the health information officers. A better explanation is that there is limited training on data management in general, which does not allow respondents to self-assess their perceived confidence level, and their actual data management skills properly, creating the gap. This explanation is consistent with a previous PRISM assessment (Belay, & Lippeveld, 2013; Mimi, 2015; USAID, 2014). This could feed into the reason for lack of data display at the facilities.

Low MCH/RHIS task competencies are also consistent with limited knowledge of the rationale for MCH/RHIS data collection. Less than a quarter (25%) of the respondents could describe at least one reason for collecting or using disease, immunisation, sex, age, and geographical data of clients on a monthly basis. Respondents had low knowledge describing and checking data quality, similar to their problem-solving skills. This suggests that emphasis is placed on how to collect data than why data is collected. This approach is appropriate if those collecting the data are part of a supply line with no other responsibilities. However, the approach is limited when data collectors are heads of the facility who are responsible for the catchment population health

and would need such useful information to fulfil that responsibility. Further, significant gaps were identified among respondents' knowledge of why specific data are collected under RHIS and their problem-solving skills. If they lack knowledge in why they collect data, it can affect their ability to solve problem, as they would have problem in identifying a problem using data.

Respondents' ability to solve data problem was extremely low. Thus, they had no skills in defining problems, 4.4% problem identification, and 3.9% in solving problem, on the average. This result is a departure from studies conducted by Mimi (2015) where 52.4% problem definitions, 17.5% problem identification, and 13.8% problem solving skills were reported at the health facility levels. Two key benefits can be derived from developing skills in problem-solving. Firstly, such abilities assist in defining problems in practical terms and identifying where opportunity for a solution exists, researching into the root cause(s) of the problem, identifying and prioritising solutions, and implementing and evaluating the solution to effect positive change. Secondly, improving problem-solving skills results in greater autonomy, empowerment, and higher motivation to perform tasks. Consequently, the need for close supervision is reduced with its accompanying costs, while also promoting trust and accountability.

The 56% motivation revealed in this study is less than that reported in a study conducted in all public health facilities in the Harari region of Ethiopia, which was 97.3% (Shama et al., 2021), but higher than what was reported in Palestine where 49.3% of the department staff were motivated to do RHIS tasks (Mimi, 2015). Previous studies also highlighted motivation and perception of staff to HIS tasks to have a substantial link with data quality

(Ahanhanzo et al., 2014; Rumisha et al., 2020; Wandera et al., 2019). Although HCPs appear to be reasonably motivated in this study, they lack sufficient knowledge and skills to carry out RHIS tasks proficiently. Knowledge and skills for RHIS tasks are usually not given due attention, which affects the ability to use information (Nicol et al., 2013).

Poor attitudes such as perceiving data collection as a "useless" activity or waste of care provider's time also hinders how professionals perform RHIS tasks. About one-third of the respondents found data collection to be a burdensome activity, and think it is not their duty to collect/record data, partly because most of RHIS are paper based. This could have a negative effect on the quality of the data generated by these professionals. Although DHIS2 was introduced in Ghana over a decade ago, most of the data management is still paper based. Daily services provisions are recorded on standardised GHS-approved registers. Staff in each department are expected to complete these registers which are then aggregated into monthly summary forms at the end of the month. This could explain why over one-third of the respondents feel data collection and recording are a burden on them, which could have an impact on the quality of the data.

Research Objective 4: To determine how organisational factors (promotion of culture of information, reward system, supportive management, and resources availability) affect behavioural factors (self-efficacy and motivation)

Results from the bivariate analysis suggests that organisational factors such as culture of information, activities for promoting culture of information and supportive management had moderate positive association with HCPs self-efficacy. Promotion of a culture of information is an important aspect of RHIS because it strengthens sustainability, self-reliance and creates an

enabling environment to make evidence-based decisions leading to better transparency and accountability. Most organisations are governed by rules, processes, values, and systems that have the ability to support or hinder staff's ability to perform tasks (Aqil, & Lippeveld, 2009). Thus, promoting a culture of information in an organisation can lead to improvement in the ability of HCPs to execute MCH/RHIS tasks and consequently improve their self-confidence in carrying out the tasks (Belay et al., 2013). If the work environment promotes key RHIS attitudes and values, chances are that HCPs will internalize the values required to generate, maintain, and improve the MCH performance. Further, the extent to which superiors in the facility offer support to staff including promoting teamwork, allowing staff to express their views without fear of victimisation, listening to staff ideas and concerns could engender confidence of staff to perform MCH/RHIS activities, thereby improving performance.

Again, the results show that, availability of resources for MCH/RHIS and reward systems for HCPs had a minimal influence on their confidence to perform MCH/tasks in the HCFs at CCM. The implication is that, provision of reward system and resources for MCH/RHIS activities, does not necessarily influence HCPs confidence to perform MCH tasks in HCFs in the metropolis. Further, the organisational factors in this study were found to have a negative relationship with motivation. It is expected that organisational factors such as culture of information, activities for promoting culture of information, supportive management, availability of resources, and reward system will be positively correlated with motivation; however, this is not the case in this study. There is perhaps a need to reassess the content of these factors to

include components that would strengthen the motivation of HCPs to perform MCH/RHIS tasks.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to assess the performance of MCH data in RHIS with the view to establish an understanding on current status of MCH data, as well as identify the technical, organisational, and behavioural factors that contribute to MCH performance among HCFs in CCM. This chapter looks at the summary, main findings, conclusions and recommendations.

Summary

Healthcare professionals routinely collect large amount of data. Reports indicate that small portion of this are used in the management of health at the facility, district, regional and national levels. To better manage the delivery of health services at all levels, proper data management becomes paramount. The demand for quality MCH data is critical for tracking progress towards attainment of the SDG3. Thus, MCH cannot be adequately monitored where health data are inaccurate, incomplete, untimely, or inconsistent. Meanwhile, the quality of data depends on certain factors including, organisational, technical, and behavioural.

Efforts had been made in Ghana to improve the collection and management of health data at the national and sub-national levels. One of such efforts is the development of DHIMS2 software, a web-based digital platform, to collect and collate routine health data from the peripherals to the national level. Notwithstanding the touted prospects of DHIMS2 following its introduction as a "game changer" in the better standardisation of data

collection, leading to improvements in data quality, data quality challenges still exist (Maïga et al., 2019). Similar efforts had been made over the years to improve the data collection in RHIS. The 2016 annual report of the GHS, for example, reported a number of feats in the area of health information management, including, a new health sector reporting portal (the MOH Health Information Exchange) developed by CHIM; distribution of the third edition of the standard operating procedures on health information to all health facilities across the nation; and DHIMS2 e-tracker modules for Tuberculosis, HIV/AIDS antiretroviral treatment and MCH services comprising family planning, delivery, antenatal and postnatal care. Despite these interventions, there are still problems related to RHIS data management, analysis, quality, and utilisation (Doku, 2018), endangering the usefulness of RHIS to monitor progress in health and health development in Ghana.

In practice, no health data regardless of its source can be considered perfect, because such data are subject to some quality limitations such as human errors in data entry and computation, bias, missing values, and measurement errors (Amoakoh-Coleman et al., 2015). Yet, high quality data is needed to monitor and evaluate programmes in LMICs striving towards universal health coverage. On the part of HCPs, challenges in counting from registers and tally sheets, inability to understand the indicators, problems in filling records, and inability to plot graphs to monitor progress and performance have been reported (Manya, & Nielsen, 2016). In the case of DHIS2, the data is collected in paper format (i.e., registers and standardised forms) at the facility level before it is transferred into the DHIS2 mostly at the sub-district and to the district level. This situation presents the possibility for

transcribing errors, especially, if the data is collected in non-conducive atmosphere. Challenges affecting data quality in many LMICs may also include accuracy, completeness, timeliness and consistency (Amoako-Coleman et al., 2015; Bhattacharya et al., 2019; Endriyas et al., 2019; Rumisha, 2020; Teklegiorgis et al., 2016; WHO, 2017). The situations could affect the level of confidence placed in the data that is used to make MCH decisions as well as the health sector performance.

The questionnaire and checklists used to collect data on MCH/RHIS determinants, processes, and performance were adapted from toolkits developed by the MEASURE Evaluation: RDQA (MEASURE Evaluation, 2015), and PRISM framework (Aqil et al., 2012; MEASURE Evaluation, 2019). Multiple data collection methods were used including, review of MCH relevant documents (registers and forms) and DHIMS2 software, distribution of two different sets of structured questionnaires to KIs and HCPs, written test to HCPs, and participant observation. Data collection took place at 13 selected health facilities with the help of three trained RAs.

The study relied on key indicators for conducting MCH data quality assessment recommended by WHO, and variables selected were ANC1 coverage, ANC4 coverage, first dose of IPT1, administration of Td2+ in pregnancy, deliveries, PNC, Penta1 and Penta3 dose coverage in children under one year of age. Three data sources were used to assess the routine data quality metrics: primary source data at health facilities (antenatal registers, delivery registers, postnatal registers, and EPI tally sheets); facility aggregate data (Midwife's returns form and vaccination form); and facility-reported data in DHIS2 database. Data for the MCH determinants were collected from 265

HCPs and 13 KIs from the 13 purposively selected HCFs in the CCM. Frequencies, percentages and VF were calculated to characterise data quality by accuracy, completeness, timelines and consistency. Frequencies and percentages were also calculated for the RHIS processes, as well as factors determining performance of RHIS. The following findings were arrived at based on the results of the study.

1. The level of MCH data quality in the HCFs at the CCM were within the threshold recommended by WHO. However, the level of information use was reported as the weakest part of the MCH/RHIS in CCM.
2. The functionality of MCH/RHIS processes, such as data collection, transmission, and data quality checks, were fully in place at the facilities. Moreover, feedback, supervision, and data analysis were above average, except for data display and data quality assessment mechanisms which recorded 25.7% and 38.5% respectively.
3. More than two-thirds of the HCPs never received formal training in RHIS-related activities. Additionally, more than half of the HCPs reported that the MCH/RHIS procedure manuals were not user-friendly, and filling out the monthly report forms were difficult and complex.
4. RHIS management functions, and activities for promotion of culture of information were below average. Apart from the criteria on RHIS supervision which was met by more than half in the facilities, the rest of the RHIS management functions were very weak. However, other organisational factors such as culture of information, supervision

quality, perceived reward for good work, perceived availability of resources were above average. Also, gaps were identified between equipment that were available and the actual quantity needed for MCH/RHIS activities in all the facilities. Also, many of the available equipment were not functioning, creating availability and functionality gap at the facilities.

5. The perceived confidence levels and competence to carry out MCH/RHIS tasks among the HCPs, as well as their knowledge of the rationale for MCH/RHIS activities were low.
6. Organisational factors (i.e., culture of information, reward system, supportive management, and resources availability) had positive associations with the behavioural factor (self-efficacy), but negative association with motivation to perform MCH/RHIS activities.

Conclusions

Based on the study findings, the following conclusion are drawn:

1. Given the WHO standard for data quality, the level of MCH data quality in the HCFs at the CCM, available through the DHIS2 is complete, reported on timely manner, consistent, and reflect accurately what exists in facility's source documents. However, less attention is being paid to RHIS utilisation at the health facilities in the Metropolis. Limited information use could have implications on the MCH outcomes.
2. Routine health information system processes were generally satisfactory with excellent data collection, transmission, and data quality checks. Data display and data quality assessment mechanisms

were near total absent in most of the health facilities. Also, feedback, supervision, and data analysis performed satisfactorily. Data collected at the HCFs should be analysed and processed into usable formats for effective utilization of such data for routine management and planning of healthcare.

3. There were no mechanisms in place for effective management of resources and functions for better RHIS performance as most assessment criteria of the RHIS management functions were not met.
4. RHIS management functions, such as training, finance, governance, use of quality improvement standard, were not met in most of the health facilities. However, HCFs in the metropolis promote culture of information which shows that emphasis is placed on data quality, information use, problem solving, evidence-based decision-making, empowerment/accountability, sense of responsibility, and feedback. Also, supportive management, and perceived high availability of resources for MCH/RHIS, culminated in good MCH/RHIS performance.
5. Healthcare professionals in the metropolis routinely collect data without understanding why they collect such data. There is also lack of demonstration of data utility in the facilities, thereby creating little or no appreciation about data collection among HCPs.
6. Where facilities in the metropolis increase their culture of information, reward system, supportive management, and resources availability, self-efficacy of the personnel is likely to improve to perform but these

had negative association with motivation which were statistically not significant.

7. Generally speaking, the MCH/RHIS performance has shown good in data quality. However, information use and different aspects of organisational, technical, behavioural measurements need serious improvement.

Recommendations

1. Although there is evidence that MCH data quality is good, there is still room for improvement in the quality of these data. Data validation teams in the various health facilities should be encouraged to have their data validated before transmitting to the next level. Consistent use of the standards operating procedures for data management in the metropolis should be greatly encouraged. HCFs in the metropolis should be encouraged to develop strategies for RHIS activities and also cultivate a culture of using routine data to make decisions. Also, to improve MCH outcomes which in turn affects the overall performance of health systems, there is the need to strengthen RHIS performance through better data quality and information use, through building the capacities of professionals involved in these data generation. Lastly, senior management should promote more use of information, especially for MCH services.
2. There is the need to institutionalise RHIS processes in the health facilities, especially, data display and data quality assessment mechanisms to improve and ensure the quality of data that will engender evidence-based decision making. Also, feedback,

supervision, and data analysis need to be encouraged at the health facilities.

3. The CCMHD needs to ensure there are adequate staffing for RHIS activities where possible and if not, responsibility for RHIS tasks be assigned to specific staff within other health cadres. Again, all HCPs involved in RHIS tasks need to be oriented and trained on information management and use through trainings. There should be planned trainings using standardised manuals.
4. Health system management involves managing resources and functions to produce better outputs. Therefore, managers of health care both at the facility and higher levels should put in structures and mechanism such as governance, finance, supervision, training, planning, in place for effective RHIS activities.
5. There is the need to institutionalise periodic workshops, continuous professional development, and mentorship to supplement the formal training of HCPs.

Suggestions for Further Research

The following suggestions are made for future research:

1. Future studies could consider using indicators beyond MCH, such as, immunisation, HIV, TB and malaria. Also, additional methods such as looking at the external consistency of the data by comparing it to any population metrics could be adopted for other studies.
2. There is the need to explore how behavioural, organisational, and technical factors interact with each other and its resultant effect on RHIS performance.

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APPENDICES

A INFORMATION SHEETS

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION

TITLE: PERFORMANCE OF MATERNAL AND CHILD HEALTH DATA IN ROUTINE HEALTH INFORMATION SYSTEM IN CAPE COAST METROPOLIS

INFORMATION SHEET FOR THE METROPOLITAN HEALTH DIRECTOR

My name is Obed Uwumbornyi Lasim, a PhD candidate at the Department or Health, Physical Education & Recreation (HPER) of the University of Cape Coast. I am conducting a research on the topic, **Performance of Maternal and Child Health (MCH) data in Routine Health Information System (RHIS) in the Cape Coast Metropolis**. The aim of this research is to assess the performance of MCH data in RHIS, focusing on the data quality (accuracy, completeness, timeliness, and consistency) and information use, as well as factors associated with the data quality. In this study, I will review documents (MCH registers, forms, and DHIMS2 database) using checklists. Also, questionnaires and written test would be administered to selected professionals who provide MCH services. This is to determine the factors that influence the generation of quality MCH data as well as information use at the facilities. A total of 13 facilities providing Maternal and Child Health services would be considered in this study. These facilities include, the Teaching Hospital, the Metropolitan Hospital, hospitals (both public, private, and mission), the polyclinic, clinics, health centres, and CHPS compounds that provide MCH services in the metropolis.

The expected duration for the data collection is thirty-nine (39) days, however, I will spend an average of ten (10) days in each facility. Apart from time inconveniences, this study poses no risks or discomfort to the health facilities. We will ensure adequate protection by practicing good personal hygiene through regular hand washing, the use of sanitizers, protective gloves, and wearing of face masks at all times during the processes. Also, socio-physical distancing would be kept at least 6 feet between the research team members and the participants at all times.

No monetary benefits nor compensations are attached to facilities or individuals participating in this research. However, the overall benefit will be that, the research will engender

1

the status of data in RHIS that is used in making decisions on MCH services. It will also help identify the factors that influence the quality of MCH data as well as information use. Finally, the study will add to current knowledge on Performance of Maternal and Child Health data in Routine Health Information System upon which many evidence-based quality decisions would be taken in further. Information provided for this study will be treated as highly confidential and no one else except myself will have access it. We will protect information about the health facilities and individuals to the best of our ability. No information that will identify any staff and their specific facility will be required.

Finally, this research has been reviewed and approved by the Institutional Review Board of University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). If you have any questions about your rights as a research participant you can contact the Administrator at the IRB Office, UCC between the hours of 8:00 am and 4:30 p.m. through the phone lines **0558093143/0508878309/0244207814** or email address: irb@ucc.edu.gh. You can also contact the ERC Administrator, Nana Abena Apatu, through the phone line, 0503539896 and email address ethics.research@ghsmail.org. Please note that the ERC Administrator must be contacted for ethical issues and rights to participation only.

For further explanations or clarifications on any other issue regarding this research, you may contact me on phone line, **0242539351** or email, olasim@ucc.edu.gh. You can also contact my supervisors Dr. Daniel Apaak, on the phone line 0208587866, or email daniel.apaak@ucc.edu.gh, and Dr. Edward Wilson Ansah, on phone line 0247703379 or email edward.ansah@ucc.edu.gh

You are kindly requested to sign or thumb-printed the consent form, if you agree for the research to be conducted in the health facilities in the Metropolis . A copy of the Information sheet and Consent form will be given to you after it has been signed or thumb-printed to keep.

Thank you.

This is to Certify that this Study's Inform Consent Form Has Been Approved by GHS - ERC for the Period 2nd Jan. 2021 to 1st Jan. 2022
Sign. Date 11-01-2021
Name: Richmond Kwi Ocloo
GHC-ERC Administrator

UNIVERSITY OF CAPE COAST

COLLEGE OF EDUCATION STUDIES

DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION

TITLE: PERFORMANCE OF MATERNAL AND CHILD HEALTH DATA IN ROUTINE HEALTH INFORMATION SYSTEM IN CAPE COAST METROPOLIS

INFORMATION SHEET FOR THE HEAD OF HEALTHCARE FACILITY

My name is Obed Uwumbornyi Lasim, a PhD candidate at the Department or Health, Physical Education & Recreation (HPER) of the University of Cape Coast. I am conducting a research on the topic, **Performance of Maternal and Child Health (MCH) data in Routine Health Information System (RHIS) in the Cape Coast Metropolis**. The aim of this research is to assess the performance of MCH data in RHIS, focusing on the data quality (accuracy, completeness, timeliness, and consistency) and information use, as well as factors associated with the data quality. In this study, I will review documents (MCH registers, forms, and DHIMS2 database) using checklists. Also, questionnaires and written test would be administered to selected professionals who provide MCH services. This is to determine the factors that influence the generation of quality MCH data as well as information use at the facilities.

Your facility was selected to be part of this research because of the Maternal and Child Health services it provides. The expected duration for the data collection is thirty-nine (39) days, however, I will spend an average of ten (10) days in your facility. Apart from time inconveniences, this study poses no risks or discomfort to you or your facility. We will ensure adequate protection by practicing good personal hygiene through regular hand washing, the use of sanitizers, protective gloves, and wearing of face masks at all times during the processes. Also, socio-physical distancing would be kept at least 6 feet between the research team members and the participants at all times.

No monetary benefits nor compensations are attached to participating in this research. However, the overall benefit will be that, the research will engender the status of data in RHIS that is used in making decisions on MCH services. It will also help identify the factors that influence the quality of MCH data as well as information use. Finally, the study will add to current knowledge on Performance of Maternal and Child Health data in Routine Health Information

System upon which many evidence-based quality decisions would be taken in further. Information provided for this study will be treated as highly confidential and no one else except myself will have access it. We will protect information about you to the best of our ability. No information that will identify any staff and their specific facility will be required.

Finally, this research has been reviewed and approved by the Institutional Review Board of University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). If you have any questions about your rights as a research participant you can contact the Administrator at the IRB Office, UCC between the hours of 8:00 am and 4:30 p.m. through the phone lines **0558093143/0508878309/0244207814** or email address: irb@ucc.edu.gh. You can also contact the ERC Administrator, Nana Abena Apatu, through the phone line, 0503539896 and email address ethics.research@ghsmail.org. Please note that the ERC Administrator must be contacted for ethical issues and rights to participation only.

For further explanations or clarifications on any other issue regarding this research, you may contact me on phone line, **0242539351** or email, olasim@ucc.edu.gh. You can also contact my supervisors Dr. Daniel Apaak, on the phone line 0208587866, or email daniel.apaak@ucc.edu.gh, and Dr. Edward Wilson Ansah, on phone line 0247703379 or email edward.ansah@ucc.edu.gh

You are kindly requested to sign or thumb-printed the consent form, if you agree for the research to be conducted in your facility. A copy of the Information sheet and Consent form will be given to you after it has been signed or thumb-printed to keep.

Thank you.

2

This is to Certify that this Study's Informe Consent Form Has Been Approved by GHS - ERC for the Period 2nd Jn. 2021 to 14 Jn. 2022
Sign. Date 11-01-2021
Name: Richmond Enos
GHC-ERC Administrator

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION

TITLE: PERFORMANCE OF MATERNAL AND CHILD HEALTH DATA IN ROUTINE HEALTH INFORMATION SYSTEM IN CAPE COAST METROPOLIS

INFORMATION SHEET FOR THE PARTICIPANTS

My name is Obed Uwumbornyi Lasim, a PhD candidate of the Department or Health, Physical Education and Recreation (HPER) of the University of Cape Coast (UCC). I am conducting a research on the topic, Performance of Maternal and Child Health (MCH) data in Routine Health Information System (RHIS) in the Cape Coast Metropolis. The aim of this research is to assess the performance of MCH data in RHIS, focusing on the data quality (accuracy, completeness, timeliness, and consistency) and information use, as well as factors associated with the data quality. In this study, I will review documents (MCH registers, forms, and DHIMS2 database) using checklists. Also, questionnaires and written test would be used to determine the factors that influence the generation of quality MCH data as well as information use.

You are invited to take part in this research to help unravel the factors that influence the performance of RHIS. If you accept to take part in this research, you will be required to fill out a survey and do a written test that I will administer to you. You are being invited to take part in this research because we believe that your rich experience gained in providing MCH services can contribute significantly to achieving the aim of this research. You may skip any of the questions, included in the survey which you do not wish to answer, and move on to the next one. The expected duration of this survey is about 60 minutes. No risks or discomfort is anticipated in taking part of this research, except for the time you will spend filling the survey. We will ensure adequate protection by practicing good personal hygiene through regular hand washing, the use of sanitizers, protective gloves, and wearing of face masks. Also, socio-physical distancing would be kept at least 6 feet between the research team and the participants.

We do not pay money to any participant for taking part in this research. However, the overall benefit will be that, the research will engender the status of data in RHIS that is used in

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making decisions on MCH services. It will also help identify the factors that influence the quality of MCH data as well as information use. Finally, the study will add to current knowledge on Performance of Maternal and Child Health data in Routine Health Information System. The information you provide will be treated as highly confidential and no one else except myself will have access to your survey. We will protect information about you to the best of our ability. No information that will identify you is required. You will not be named in any report. My supervisors (Dr. Daniel Apaak and Dr. Edward W. Ansah) may access the survey records or may sometimes look at your survey record.

Finally, this research has been reviewed and approved by the Institutional Review Board of University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). If you have any questions about your rights as a research participant you can contact the Administrator at the IRB Office, UCC between the hours of 8:00 am and 4:30 p.m. through the phone lines **0558093143/0508878309/0244207814** or email address: irb@ucc.edu.gh. You can also contact the ERC Administrator, Nana Abena Apatu, through the phone line, 0503539896 and email address ethics.research@ghsmail.org. Please note that the ERC Administrator must be contacted for ethical issues and rights to participation only.

For further explanations or clarifications on any other issue regarding this research, you may contact me on phone line, **0242539351** or email, olasim@ucc.edu.gh. You can also contact my supervisors Dr. Daniel Apaak, on the phone line 0208587866, or email daniel.apaak@ucc.edu.gh, and Dr. Edward Wilson Ansah, on phone line 0247703379 or email edward.ansah@ucc.edu.gh

You are kindly requested to sign or thumb-print the consent form, if you agree to take part in this research. A copy of the Information sheet and Consent form will be given to you after it has been signed or thumb-printed to keep.

Thank you.

2

B CONSENT STATEMENTS

PERFORMANCE OF MATERNAL AND CHILD HEALTH (MCH) DATA IN ROUTINE HEALTH INFORMATION SYSTEM (RHIS) IN THE CAPE COAST METROPOLIS

METROPOLITAN HEALTH DIRECTOR'S STATEMENT

I acknowledge that I have read the purpose and contents of the Information Sheet for the Metropolitan Health Director and all questions satisfactorily explained to me. I fully understand the contents and any potential implications of this research.

I voluntarily agree that this research be conducted in my Metropolis.

Name of Participant.....

Participants' Signature ..... OR Thumbprint.....

Date .....

INVESTIGATOR STATEMENT AND SIGNATURE.

I certify that the head of the facility has been given ample time to read and learn about the study. All questions and clarifications raised by the Director have been duly addressed.

Researcher's name.....

Signature ..... Date.....

This is to Certify that this Study's Inform Consent Form Has Been Approved by GHS-ERC for the Period 2nd Jan. 2020 to 1st Jan. 2022
Sign. ..... Date 11-01-2021
Name. Reginald Ewudzi
GHC-ERC Administrator

PERFORMANCE OF MATERNAL AND CHILD HEALTH (MCH) DATA IN ROUTINE HEALTH INFORMATION SYSTEM IN THE CAPE COAST METROPOLIS

HEAD OF FACILITY'S STATEMENT

I acknowledge that I have read the purpose and contents of the Information Sheet for the head of the facility and all questions satisfactorily explained to me. I fully understand the contents and any potential implications of this research.

I voluntarily agree that this research be conducted in my facility.

Name of Participant.....

Participants' Signature ..... OR Thumbprint.....

Date .....

INVESTIGATOR STATEMENT AND SIGNATURE.

I certify that the head of the facility has been given ample time to read and learn about the study. All questions and clarifications raised by the head have been duly addressed.

Researcher's name.....

Signature ..... Date.....

PERFORMANCE OF MATERNAL AND CHILD HEALTH (MCH) DATA IN ROUTINE HEALTH INFORMATION SYSTEM IN THE CAPE COAST METROPOLIS

PARTICIPANTS' STATEMENT

I acknowledge that I have read the purpose and contents of the Participants' Information Sheet and all questions satisfactorily explained to me. I fully understand the contents and any potential implications as well as my right to change my mind (i.e. withdraw from the research) even after I have signed this form.

I voluntarily agree to be part of this research.

Name of Participant.....

Participants' Signature ..... OR Thumbprint.....

Date .....

INVESTIGATOR STATEMENT AND SIGNATURE.

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher's name.....

Signature ..... Date.....

C **QUESTIONNAIRE**

UNIVERSITY OF CAPE COAST (UCC)

COLLEGE OF EDUCATION STUDIES

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION (HPER)

QUESTIONNAIRE FOR HEALTH FACILITY

Name of Facility:	**Title of person Interviewed:**
Type of Health Facility:	

Data Recording				
FQ1	Does your facility keep copies of MCH monthly reports sent to the district health directorate?	1. Yes	0. No	If no, go to FQ3
FQ2	For the twelve months of 2020, how many RHIS monthly reports on MCH services have been kept in the facility?			

Data Completeness		
FQ3	How many of the eight indicators (ANC1, ANC4, IPT1, Td2+, Deliveries, PNC registrants, Penta1 and Penta3) are you required as a facility to report in the RHIS monthly report?	
FQ4	What is the number of data elements that are supposed to be filled by the facility but left blank without indicating "0" in the selected twelve months report in DHIMS2?	
FQ5	Please enter the number of data elements that are required and those that actually entered in the registers, forms, and DHIMS2 in 2020	

Month	Registers		Forms		DHIMS2	
	required	entered	required	entered	required	entered
Jan						
Feb						
Mar						
Apr						
May						
Jun						
Jul						
Aug						
Sep						
Oct						

	Nov						
	Dec						
FQ6	If the source document and/or monthly reports are not completely filled in, what are the possible reasons for the missing data?			1. Storage or archiving problems 2. Staffing issues 3. Not understanding the data element(s) 4. Presence of other vertical reporting requirements 4. Other (specify) _____			
FQ7	If there was a discrepancy observed between the **main source document** and the **monthly reports**, what are the reasons for the discrepancy?			1. Data entry errors 2. Arithmetic errors 3. Information from all source documents not compiled correctly 4. Other (specify) _____			

Report Timeliness			
FQ8	Is there a predefined deadline for submission of monthly MCH report by this facility?	1. Yes	0. No
	If yes, what is the deadline		
FQ9	Does the health facility record the dates of submission of monthly MCH reports to the district or next level? ***(See Register/Computer)***	1. Yes	0. No

FQ10	*Please enter the number of actual reports on time and reporting rate on time in 2020*			
Month	**Monthly Form A: Midwife's Returns**		**Monthly Vaccination Report**	
	Actual reports on time	Reporting rate on time	Actual reports on time	Reporting rate on time
Jan				
Feb				
Mar				
Apr				
May				
Jun				
Jul				
Aug				
Sep				
Oct				
Nov				
Dec				

Maternal and Child Health Data in Registers, Forms, and DHIMS2

MCH Data Accuracy- 2020														
FQ11	**Indicators**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
REGISTERS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
FORMS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
DHIMS2	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													

MCH Data Accuracy- 2019														
FQ12	**Indicators**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
REGISTERS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
FORMS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
DHIMS2	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													

MCH Data Accuracy- 2018														
FQ13	**Indicators**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
REGISTERS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
FORMS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
DHIMS2	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													

MCH Data Accuracy- 2017														
FQ14	**Indicators**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
REGISTERS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
FORMS	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													
DHIMS2	ANC Reg.													
	ANC4													
	IPT1													
	TT2+													
	Deliveries													
	PNC Reg.													
	Penta1													
	Penta3													

RHIS Processes			
FQ15	Has there been any directive from the District Health Directorate (DHD) in the last quarter of 2020 to:		
	a. check the accuracy of data at least once in every three months?	1. Yes	0. No
	b. ensure that the monthly report form is filled completely	1. Yes	0. No
	c. submit report on or before the stated deadline	1. Yes	0. No
	Did you receive a directive from the DHD in the last quarter of 2021 that there will be sanctions if:		
FQ16	a. accuracy of data is not checked before submission?	1. Yes	0. No
	b. monthly reporting form is not filled completely?	1. Yes	0. No
	c. monthly report is not submitted by the declared deadline?	1. Yes	0. No

Data Processing/Analysis			
FQ18	Are there processing procedures or a tally sheet	1. Yes,	0. No
FQ19	Does the facility:		
	a. calculate indicators for each facility catchment area	1. Yes,	0. No
	b. process data in a way that comparisons can be made on the various MCH indicators in the facility summary report against the district/national targets.	1. Yes,	0. No
	c. analyse data to compare among types of service coverage (i.e., which services are performing better than others).	1. Yes,	0. No
	d. analyse data to make comparisons of data over time (monitoring data over time to determine if a particular service is improving, declining or static)	1. Yes,	0. No
FQ20	Is there a procedure manual with definitions for data collection?	1. Yes, Observed	0. No
FQ21	Do you think the MCH/RHIS procedure manual is user-friendly?	1. Yes	0. No
FQ22	Do you think that the monthly report form is complex and difficult to follow?	1. Yes	0. No
FQ23	Do you find the data software user-friendly?	1. Yes	0. No
FQ24	Do you find that information technology is easy to manage?	1. Yes	0. No
FQ25	Do you think that the information system design provides a comprehensive picture of health system performance?	1. Yes	0. No
FQ26	Do you think existing RHIS gathers	1. Yes	0. No

	information that is also included in other information systems?		
FQ27	Does a software or data warehouse exist that integrates data from different information systems?	1. Yes	0. No
FQ28	Does the information technology (Land Area Network [LAN] or wireless network) exist to provide access to information for MCH/RHIS management?	1. Yes	0. No
FQ29	Does the health facility use an electronic database/system to enter and analyse MCH (routine health) data?	1. Yes If yes go to FQ30	0. No If no go to FQ31

FQ30	Indicate the type of electronic system used for MCH data entry and analysis				
	Electronic system	A. For data entry		B. For data analysis	
		1. Yes	0. No	1. Yes	0. No
	1. National open-source data processing system (e.g., DHIMS2)				
	2. National proprietary software				
	3. Facility proprietary software				
	4. Excel-based spreadsheet				
	4. Access-based data processing module				
	Other (specify)				
FQ31	Ask relevant staff in the health facility to show up-to-date (i.e., not more than one year old) reports, documents, and/or displays that contain the following.				
	A. Aggregated/summary MCH/RHIS report in 2020.			1. Yes,	0. No
	B. Demographic data on the catchment population of the health facility for calculating coverages.			1. Yes,	0. No
	C. Indicators (e.g., Penta3 coverage) calculated for the health facility catchment area in 2020.			1. Yes,	0. No
	D. Comparisons between health facility and district/national targets.			1. Yes,	0. No
	E. Comparisons of data over time, including monitoring trends (e.g., for ANC, Penta3).			1. Yes,	0. No
	F. Comparisons of service coverage (e.g., ANC, TT immunisation).			1. Yes,	0. No

Data Quality Assessment Mechanism			
FQ32	Does the facility have written instructions/ guidelines on how to perform a data quality review or data quality check?	1. Yes,	0. No
FQ33	Does the facility conduct regular data accuracy checks (data quality self-assessment)?	1. Yes,	0. No.
FQ34	Does the facility have access to data quality self-assessment tools (paper or electronic)?	1. Yes,	0. No
FQ35	Does the facility maintain a record of its data accuracy self-assessments conducted in 2020?	1. Yes,	0. No
FQ36	Does the facility maintain a record of feedback to staff on data quality self-assessment findings?	1. Yes,	0. No

USE OF INFORMATION AT THE FACILITY

1.	Information Use Guidelines and Strategic Documents	
FU1	Are there written national/regional guidelines on RHIS information display and use at the health facility?	1. Yes, copies available at the facility
		2. Yes, but copy not available at the facility
		3. No
FU2	Does the facility have copies of the national/district strategic plans, health facility annual plans, and/or health facility performance targets?	1. Yes, copies available at the facility
		2. Yes, but copy not available at the facility
		3. No

Data Visualisation			
FU3	Does the health facility prepare data visuals (graphs, tables, maps, etc.) showing achievements toward targets (indicators, geographic and/or temporal trends, and situation data)?	1. Yes, paper or electronic copies of data visuals observed at the health facility	
		2. No	
FU4	If yes, what type of information is captured in the data visuals? (OBSERVE)		
	1. Maternal health (MH) care	1. Yes, observed	2. No
	2. Child health (CH) care (other than EPI)	1. Yes, observed	2. No
RHIS Analytic Report Production			
FU5	Does this facility compile MCH/RHIS data?	1. Yes	0. No
FU6	Does the facility compile any reports containing MCH/RHIS information?	1. Yes	0. No

FU7	Does the health facility have access to analysed MCH/RHIS data (e.g., summary tables, charts, maps)?		1. Yes	0. No	
FU8	Does the facility produce any report or bulletin (annual, quarterly, etc.) based on an analysis of MCH/RHIS data? ***(this excludes the monthly summary/aggregate reports submitted to the higher level)***		1. Yes	0. No	If no, go to FU12
FU9	If yes, list the reports, indicating the frequency of the reports and the number of times the reports were actually issued in the past 12 months				
FU10	1. Title of the report/bulletin	2. Number of times this report is supposed to be issued per year	3. Number of times this report was actually issued in 2020	4. Target audience of the report (e.g., MOH, civil administration, community forums, general population)	
	a. Monthly report				
	b. Quarterly report				
	c. Annual report				
FU11	Do any of these reports and/or bulletins contain discussions and decisions/or recommendations based on key performance targets and based on RHIS data, such as:				
	1. Coverage of maternal health service (i.e., ANC, delivery, EPI)		1. Yes	0. No	
	2. Coverage of child health service		1. Yes	0. No	
	3. Facility's performance indicators		1. Yes	0. No	
	4. Identification of emerging issues/epidemics		1. Yes	0. No	
	5. Human resource management		1. Yes	0. No	

Display of information					
FU12	Are the following data displayed at the facility? If No, go to FU15			1. Yes	0. No
	Indicate type of data displayed and whether the data have been updated for the last reporting period.				
	1. Indicator	**2. Type of display (Please tick)**		**3. Updated**	
FU12a	Data related to maternal health	Table		1. Yes	0. No
		Chart/Graph			
		Map/other			
FU12b	Data related to child health	Table		1. Yes	0. No
		Chart/Graph			
		Map/other			
FU13	Is there a map of the catchment area in the facility?			1. Yes	0. No
FU14	Are summaries of demographic information such as population by target group displayed in the facility?			1. Yes	0. No

Feedback to the health facilities			
FU15	Did the facility receive feedback reports from the district health directorate based on MCH/RHIS information in 2020?	1. Yes	0. No
FU16	If yes, indicate the types of feedback reports:		
	A. Feedback on data quality (including data accuracy, reporting timeliness, and/or report completeness).	1. Yes	0. No
	B. Feedback on service performance based on reported MCH/RHIS data (e.g., appreciation/acknowledgement of good performance; resource allocation/mobilisation.	1. Yes	0. No
FU17	Is there feedback, quarterly/yearly or any other report on RHIS data available in the facility which provides guidelines/ recommendations for actions?	1. Yes	0. No If No, go to FU19
FU18	If yes to question FU17, what kinds of action-oriented decisions have been made in the reports (based on MCH/RHIS data)?		
	Types of decisions based on types of analyses		
	a. Review strategy by examining service performance target and actual performance on month-to-month comparisons	1. Yes	0. No
	b. Review facility personnel responsibilities by examining targets and actual performance on month-to-month comparison	1. Yes	0. No
	c. Mobilisation/shifting of resources based on comparison by services	1. Yes	0. No

	d. Advocacy for more resources by comparing performance by targets and showing gaps	1. Yes	0. No

Routine Decision-Making Forums and Processes at the Health Facility			
FU19	Is there a performance monitoring or management team in the facility?	1. Yes	0. No
FU20	Does the facility have routine team meetings for reviewing performance and/or management?	1. Yes	0. No, if no, go to FU27
FU21	How frequent are the performance monitoring /management meeting supposed to take place? ***Circle the appropriate answer***. 0). No schedule 1). Weekly 2). After every two weeks 3). Monthly 4). Quarterly 5). Biannually 6). Annually		
FU22	How many times did the performance review/ management meetings take place during the last three months of 2020? ***Circle the appropriate answer***. 0). Not once 1). one time 2). two times 3). three times 4). Four times 5) five times 6). six times 7). Between 7 and 11 times 8). Twelve times 10). More than twelve times, specify		
FU23	Were minutes of performance monitoring or management meetings kept for January to December 2020?	1. Yes	0. No, if no, go to FU27
FU24	If yes, check the performance monitoring/management meetings records for 2020 (January to December) to see if the following topics were discussed:		
FU24a	Did the meeting discuss data quality issues in MCH/RHIS (such as, accuracy, completeness, timeliness)?	1 Yes	0. No
FU24b	Did they make any decisions based on the discussions on MCH/RHIS-related issues (including no interventions required at this time)?	1 Yes	0. No
FU24c	Has any follow-up action taken place on the decisions made during the previous meetings on MCH/RHIS-related issues?	1 Yes,	0. No
FU24d	Were there any issues/problems related to MCH/RHIS referred to district/regional level for actions?	1 Yes,	0. No
FU24e	Were discussions held to review key performance targets (tracking progress against targets) based on MCH/RHIS data, such as:		
	1. Coverage of maternal health service	1. Yes,	0. No

		observe	
	2. Coverage of child health service	1. Yes, observe	0. No
	3. Facility's performance indicators	1. Yes, observe	0. No
	4. Identification of emerging issues/epidemics	1. Yes, observe	0. No
	5. Human resource management	1. Yes, observe	0. No
	6. Commodity stockout	1. Yes, observe	0. No
FU25	Were any decisions made based on the discussions of the facility's performance? Such as:		
	1. Formulation of plans	1. Yes, observe	0. No
	2. Budget preparation	1. Yes, observe	0. No
	3. Budget reallocation	1. Yes, observe	0. No
	4. Medicine supply and drug management	1. Yes, observe	0. No
	5. Human resource management (training, reallocation, etc.)	1. Yes, observe	0. No
	6. Advocacy for policy, programmatic, or strategic decisions from higher levels	1. Yes, observe	0. No
	7. Promotion of service quality/improvement	1. Yes, observe	0. No
	9. No action required at this time	1. Yes, observe	0. No
FU26	Were the performance review/management meeting minutes circulated to all members?	1. Yes	0. No
Promotion and Use of MCH/RHIS Information at the Facility Level			
FU27	Are there district/regional annual/monthly planned targets based on MCH/RHIS information?	1. Yes	0. No
FU28	Did facility records for 2020 show that directives concerning the use of information were issued by district/ management?	1. Yes	0. No
FU29	a. Did the facility in 2020 receive a report or newsletter from the district or national RHIS office?	1. Yes	0. No
	b. If yes, did the report or newsletter give examples of how information has been used successfully in the past?	1. Yes	0. No
FU30	Is there a documentation in the facility showing the use of information for advocacy purposes?	1. Yes	0. No
FU31	a. Did the person in charge of the facility	1. Yes	0. No

	participate in meetings at the district level to discuss MCH/RHIS performance in 2020?		
	b. Did the head of this facility participate in meetings at the district level to discuss MCH/RHIS performance in 2020?		
FU32	a. Does your facility use MCH/RHIS information for health system management?	1.Yes	0. No
	b. Please give examples of how the facility uses MCH/RHIS information for health system management. …… ……		

Supervision by the district health office			
FU33	How many times did the district supervisor visit your facility during the last three months of 2020?	1. Zero, if zero, go to FU39 2. One times 3. Two times 4. Three times 5. Four times 6. More than four times, please specify _____	
FU34	Did the supervisor check the data quality?	1. Yes	0. No, If no go to FU36
FU35	If yes, did he/she use checklist to assess the data quality?	1. Yes	0. No
FU36	Did the supervisor during the visit discuss your facility's performance based on the use of MCH/RHIS information?	1. Yes	0. No, Go to FU38
FU37	Based on your discussions, did he/she help you to make a decision or take a corrective action based on using information from the MCH/RHIS?	1. Yes	0. No
FU38	Did you receive report/feedback on the last two supervisory visits?	1. Yes	0. No
Annual Planning			
FU39	Does the health facility have an annual plan for the year 2020?	1. Yes	0. No
FU40	If yes, does that annual plan use data from the MCH/RHIS for problem identification and/or target setting?	1. Yes	0. No
FU41	Does the annual plan contain activities and/or targets related to improving or addressing any of the following?		
	1. Coverage of maternal health service (i.e., ANC, delivery)	1. Yes	0. No

	2. Coverage of child health service	1. Yes	0. No
	3. Facility's performance indicators	1. Yes	0. No
	4. Identification of emerging issues/epidemics	1. Yes	0. No
	5. Human resource management	1. Yes	0. No
	6. Commodity stockout	1. Yes	0. No

Data Dissemination Outside Health Sector			
FU42	Does the facility have to submit/present performance reports to a council of public representatives/civil administration?	1. Yes	0. No
FU43	If yes, did the facility submit/present health sector performance reports to a council of public representatives /civil administration in 2020?	1. Yes	0. No
FU44	If yes, do those reports/presentations use data from the MCH/RHIS to assess the health sector's progress?	1. Yes	0. No
FU45	Is there a website updated at least annually for accessing the facility's MCH/RHIS data by the general public?	1. Yes	0. No
FU46	Are facility performance data shared with the general public via bulletin boards, chalkboards, and/or local publications?	1. Yes	0. No

FACILITY/OFFICE CHECKLIST

Equipment Inventory and Condition				
Please verify if the following equipment is available in the facility		**Quantity Available**	**Quantity Needed**	**How many are in working condition?**
FOC1	Desktop computer			
FOC2	Laptop computer			
FOC3	Printers			
FOC4	Modems			
FOC5	UPS (Uninterruptible power supply)			
FOC6	Generators			
FOC7	Regular telephone			
FOC8	Calculator			

Equipment and Services Inventory				
Please use the following checklist to assess whether or not the facility/office has the following inventory:				
FOC9	Data back-up unit	1. USB key	1. Yes	0. No
		2. Server	1. Yes	0. No
		3. Compact disc (CD)	1. Yes	0. No
		4. External hard drive	1. Yes	0. No

	5. Zip drive	1. Yes	0. No
FOC10	Back-up unit(s) is/are kept on site	1. Yes	0. No
FOC11	Telephone (regular or radio)	1. Yes	0. No
FOC12	Facility/official mobile phone with access to telephone network	1. Yes	0. No
FOC13	Personal mobile phone with access to telephone network	1. Yes	0. No
FOC14	Fax	1. Yes	0. No
FOC15	Access to an Internet network?	1. Yes	0. No if no, go to FOC18
FOC16	If yes, on average, how many days in a month do you have Internet access?	1. 20 days or more	
		2. 10-19 days	
		3. Less than 10 days	
FOC17	Wi-Fi (Wireless Reliability)	1. Yes	0. No

Utilities			
FOC18	Is there continuous electricity supply?	1. Yes, If yes go to FOC20	0. No
FOC19	On an average, how often is the electricity supply interrupted in a month?	1. 20 days or more	
		2. 10-19 days	
		3. Less than 10 days	
FOC20	Is there a functional air-conditioner in the room where the computer hardware is kept?	1. Yes	0. No
FOC21	Is there available running water in the facility?	1. Yes	0. No

Availability of registers/forms							
FOC22	FOC23		FOC24		FOC25		FOC26
Type of records, tally sheets, or reports for MCH services in the facility	**Is it available?**		**Is it a standard RHIS tool?**		**Have you run out of this form in the past twelve months?**		**If yes to 25, for how long were you out of stock?**
Antenatal registers	1. Yes	0. No	1. Yes	0. No	1. Yes	0. No	
Delivery registers	1. Yes	0. No	1. Yes	0. No	1. Yes	0. No	
Postnatal registers	1. Yes	0. No	1. Yes	0. No	1. Yes	0. No	
Vaccination register	1. Yes	0. No	1. Yes	0. No	1. Yes	0. No	
Paediatric consultation	1. Yes	0. No	1. Yes	0. No	1. Yes	0. No	

<table>
<tr><th colspan="7">B. Staff of the health facility and MCH data management</th></tr>
<tr><td>FOC27</td><td colspan="6">B.1. Please list total number of persons under each category below:</td></tr>
<tr><td></td><td>B.2. Title/ post</td><td colspan="2">Number by Sex</td><td>B.2. Title/ post</td><td colspan="2">Number</td></tr>
<tr><td></td><td></td><td>Male</td><td>Female</td><td></td><td>Male</td><td>Female</td></tr>
<tr><td></td><td>1. Medical officer</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>2. Registered nurse</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>3. Enrolled Nurse</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>4. Midwives</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>5. Laboratory assistant</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>6. Health assistant</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>7. Laboratory technician</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>8. Health information officer</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>9. Pharmacist</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>10. Biostatistician</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>11. Other</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>FOC28</td><td colspan="4">Who is responsible for filling MCH monthly reports?
Specify using number codes in question FOC27</td><td colspan="2"></td></tr>
<tr><td>FOC29</td><td colspan="4">Who prepares/complete MCH monthly report?
(answer using number codes in FOC27)</td><td colspan="2"></td></tr>
<tr><td>FOC30</td><td colspan="6">List the staff members who, within the past 3 years, received training in the recording, processing, or reporting of health information; the number of trainings received; and the year of the latest training.</td></tr>
<tr><td></td><td>a. Title or Post (use number coding from question FOC27)</td><td colspan="2">b. How many trainings courses/ sessions did this person received in the past three years?</td><td>c. Year of last training</td><td colspan="2">d. <u>Topic(s) of last training</u>:
1. Data collection
2. Data analysis
3. Data display
4. Data reporting
5. Using data to make decisions</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td><td colspan="2"></td></tr>
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</table>

Resources for Data Assessment			
RQ1	Is there a designated person to enter data or compile reports from the different units in the facility?	1. Yes	0. No
RQ2	Is there a designated person to review the quality of compiled data prior to submission to the next level.?	1. Yes	
		2. Partly (the data are reviewed but no one is designated with the responsibility)	
		3. Not at all	
RQ3	Are designated staff trained in:		
	A. Data entry/ compilation?	1. Yes (staff have received training in the past one year)	
		2. Mostly (all staff have received training but not in the past one years)	
		3. Partly (some staff have received training)	
		4. Not at all	
	B. Data quality review or data quality check?	1. Yes (staff have received training in the past one year)	
		2. Mostly (all staff have received training but not in the past one year)	
		3. Partly (some staff have received training)	
		4. Not at all	

RHIS MANAGEMENT ASSESSMENT TOOLS (MAT)

Governance			
MATG1	Is there a written document describing the RHIS mission, roles, and responsibilities that are related to strategic and policy decisions at the facility?	1. Yes	0. No
MATG2	Is RHIS mission displayed in prominent position(s)?	1. Yes	0. No
MATG3	Does the facility have an updated health service organisational chart showing functions related to health information?	1. Yes	0. No
MATG4	Is there a management structure for dealing with RHIS-related strategic and policy decisions at facility level?	1. Yes	0. No
MATG5a	Is there a written Standard Operating Procedures (SOPs) and procedural guidelines for the RHIS that include the following: 1. Data definitions 2. Data collection and reporting 3. Data aggregation, processing, and transmission 4. Data analysis, dissemination, and use	1. Yes 2. Yes, partially* 3. No	

	5. Data quality assurance 6. Master facility list (MFL) 7. International Classification of Diseases (ICD) codes 8. Data security 9. Data storage 10. Performance improvement processes ***Select yes, partially if written SOPs and procedural guidelines for the RHIS are available, but they do not have all the listed RHIS data management areas***.		
MATG6	Is there an overall framework/plan for information and communication technology (ICT) in the facility (e.g. describing the required equipment and plans for training in the use of ICT for RHIS)	1. Yes	0. No

Planning			
MATP1	Is there a copy of RHIS situation analysis/assessment report written within the last three years?	1. Yes	0. No
MATP2	Is there a copy of the national three or five-year RHIS strategic plan in the facility?	1. Yes	0. No
MATP3	Has the facility set RHIS performance targets for data accuracy, completeness, and timeliness at the facility?	1. Yes	0. No
Quality Standards			
MATQ1	Is there a copy of RHIS standard at the facility?	1. Yes	0. No
MATQ2	Are there performance improvement tools (flow chart, control chart, etc.) in the facility?	1. Yes	0. No
Training/Capacity Development			
MATT1	Does the facility have a RHIS training manual?	1. Yes	0. No
MATT2	If yes, has the facility conducted RHIS training in the past three years using the RHIS training manual?	1. Yes	0. No
MATT3	Is there a documentation on mechanisms for on-job RHIS training?	1. Yes	0. No
MATT4	Is there a costed training and capacity development plan that has benchmarks, timelines, and	1. Yes	0. No

	mechanisms for on-the-job RHIS training, RHIS workshops, and orientation for new staff?			
MATT5	Is there a schedule for planned training?	2. Yes, For ≥ 2 years	1. Yes, for 1 yr	0. No

Supervision			
MATS1	Has there been a supervisory visit in the facility for the past one year?	1. Yes	0. No
MATS2	Does the facility have copies of the report from the latest supervisory visit in which commonly agreed action points are listed?	1. Yes	0. No
Finance			
MATF1	Does the facility have a budget for RHIS supplies (e.g., registers, forms, guidelines)?	1. Yes	0. No
MATF2	Are there mechanisms for RHIS-generating funds at the facility?	1. Yes	0. No
MATF3	Does the facility have RHIS monthly/quarterly financial report?	1. Yes	0. No
MATF4	Is there a long-term financial plan for supporting RHIS activities in the facility?	1. Yes	0. No

UNIVERSITY OF CAPE COAST

COLLEGE OF EDUCATION STUDIES

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION

PERFORMANCE OF MATERNAL AND CHILD HEALTH DATA IN ROUTINE HEALTH INFORMATION SYSTEM IN CAPE COAST METROPOLIS.

QUESTIONNAIRE FOR HEALTHCARE PROFESSIONALS

Greetings! I am Obed Lasim, a PhD candidate in the Department of Health, Physical Education and Recreation, UCC. I am conducting a survey on "**Performance of MCH data in Routine Health Information System (RHIS) in Cape Coast Metropolis**". The objective of this survey is to assess the level of MCH data in RHIS in terms of its quality and information use with the view to establish an understanding on current status of MCH data in RHIS and factors that are associated with data quality and information use in Cape Coast Metropolis. As you fill out this survey, please express your opinions honestly. Your responses will remain confidential and will not be shared with anyone, except in aggregate and anonymous formats. Please let us know if you have any questions or require clarification about any section of the survey. We appreciate your assistance and cooperation in completing this study. Thank you.

SECTION A: RESPONDENT BACKGROUND

Name of Facility			
DD1	Age		
DD2	Gender	1. Male	2. Female
		3. Others	4. I don't want to answer
DD3	Highest level of education	1. None 2. Primary/Elementary 3. Secondary/High School 4. Diploma 5. Bachelor 6. Masters 7. PhD 8. Other _____	
DD4a	Number of years of employment (***not just in current role***)		
DD4b	Number of years working with health data or RHIS (***not just in current role***)		
DD5a	Have you ever received formal RHIS training?	1. Yes	0. No
DD5b	If yes, what type of formal RHIS training have you received in the past? (***circle all that apply***)	1. Health statistics 2. RHIS data management (data collection, transmission, storage, and/or data quality assurance) 3. Data analysis and use 4. ICT or data management/ analysis applications 5. Other (specify) _____	
DD5c	Did you receive training in RHIS-related activities in 2020 year?	1. Yes	0. No

SECTION B

FQ1	Is there MCH/RHIS procedure manual with definitions for data collection?	1. Yes, Observed	0. No
FQ2	Do you think the MCH/RHIS procedure manual is user-friendly?	1. Yes	0. No
FQ3	Do you think that the monthly report form is complex and difficult to follow?	1. Yes	0. No
FQ4	Do you find the data software user-friendly?	1. Yes	0. No
FQ5	Do you find that information technology is easy to manage?	1. Yes	0. No
FQ6	Do you think that the information system design provides a comprehensive picture of health system performance?	1. Yes	0. No
FQ7	Do you think existing RHIS gathers	1. Yes	0. No

	information that is also included in other information systems?		
FQ8	Does a software or data warehouse exist that integrates data from different information systems?	1. Yes	0. No
FQ9	Does the information technology (Land Area Network [LAN] or wireless network) exist to provide access to information for MCH/RHIS management?	1. Yes	0. No
FQ10	Does the health facility use an electronic database/system to enter and analyse MCH (routine health) data?	1. Yes	0. No

SECTION C

This section seeks your opinion on how strongly you disagree or agree about certain aspect of MCH/RHIS in your facility. The intensity of your belief is assessed on a scale ranging from strongly disagree (1) to "strongly agree" (5). You first have to agree or disagree with a statement and then decide about the intensity of your agreement or disagree. However, choose 3 if you neither disagree nor agree or you are not sure of the intensity.

The information you provide will not be shared with anyone except in aggregate and anonymous formats and thus, will remain highly confidential. Please choose your answer honestly.

Strongly disagree **1**	**Disagree** **2**	**Neither disagree/ agree** **3**	**Agree** **4**	**Strongly agree** **5**

Promotion of Information Culture						
Indicate the extent to which you agree or disagree with the following statements. **Decisions in the health department are based on:**		Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree
D1	personal preference/ liking /favouritism of those making the decision.					
D2	directives of superiors'					

D3	data/ facts/evidence					
D4	political interference/ agenda/considerations					
D5	what was done in the previous year (history)					
D6	funding directives from higher levels					
D7	official strategic health sector objectives					
D8	health needs locally identified in the population					
D9	considering relative cost of intervention					
D10	participatory decision making by taking contributions from relevant staff.					

Indicate the extent to which you agree or disagree with the following statements. **Superiors in the health department:**		Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree
S1	ask for input/feedback from relevant/concerned staff					
S2	emphasize that data quality procedures be followed in the compilation and submission of monthly/quarterly reports					
S3	openly discuss conflicts to resolve the conflicts					
S4	seek feedback from community they serve					
S5	use RHIS data for setting targets and monitoring service performance					
S6	promote multidirectional feedback mechanisms to share/present information within the team, and to the lower and upper levels of the health system					
S7	check routine data quality at points where data are captured, processed, or aggregated					
S8	ensure that regular meetings are held where data and information are discussed, performance reports are					

	presented and reviewed, decisions are made, follow-up actions are identified, and their implementation is monitored					
S9	provide regular feedback on reported data quality (e.g., accuracy of data compilation/reporting) to the staff responsible for compiling and reporting the data					
S10	report regularly to higher level staff about accuracy of data					
S11	recognize or reward staff for good work performance					
S12	promote team work					
S13	are open to alternative views					
S14	listen to employees' ideas and concerns					
S15	allow disagreement before reaching a decision					
S16	are concerned about serving target community or clients' needs					

Indicate the extent to which you agree or disagree with the following statements. **Staff in the health department:**		Strongly disagree	Disagree	Neither disagree	Agree	Strongly agree
P1	are punctual					
P2	document their activities/keep records					
P3	complete RHIS tasks (reporting, processing/aggregation, and/or analysis) in a timely manner (i.e., meet appropriate deadlines)					
P4	show commitment to the RHIS mission of generating and using good quality (i.e., accurate, complete, and timely) data for evidence-based decision making					
P5	pursue national targets and set appropriate and realistic goals for themselves for essential service performance					
P6	feel "personal responsibility" for not accomplishing set performance targets					
P7	receive award for good work					

P8	use RHIS data for everyday management of the facility e.g., service delivery, financial, commodities, and human resource management)					
P9	can prepare visuals (graphs, tables, maps, etc.) showing progress toward targets)					
P10	collect data to identify the root cause(s) of problems					
P11	can develop appropriate criteria to select interventions for a particular problem					
P12	can come out with appropriate outcomes for a specific intervention					
P13	can evaluate that the goals or outcomes of an intervention have been achieved					
P14	are able to make decisions appropriate to their job descriptions in response to the findings of data analysis (e.g., changes in service delivery or management practices)					
P15	are able to say 'no' to superiors and colleagues for decisions/demands not backed by evidence					
P16	use RHIS data for community education and mobilisation					
P17	admit mistakes if/when they occur and take corrective actions					
P18	are given appropriate training on MCH/RHIS activities					
P19	have the required forms and instruction guide for MCH/RHIS activities					
P20	facilities receive timely monthly feedback on their submitted report					
P21	are empowered to make decisions					
P22	are held accountable for their performance					
P23	feel guilty for not accomplishing the set target/performance					

Indicate the extent to which you agree or disagree with the following statements about your p**ersonal feelings:**		Strongly disagree	Disagree	Neither disagree	Agree	Strongly agree
BC1	I am discouraged when the data I collect or record are not used to take action (either for monitoring or decision making)					
BC2	I find data collection/recording to be boring (i.e., repetitive or duplicative)					
BC3	Collecting/recording data is meaningful to me					
BC4	Collecting/recording data gives me the feeling that data is needed to monitor the performance of the health services provided at my facility/unit					
BC5	Data collection/recording is forced on me.					
BC6	My job of data collection/recording is appreciated by all (i.e., co-workers/superiors)					
BC7	I find that the data that I collect burdens my workload, making it difficult for me to complete my other duties					
BC8	I feel it is not the duty of health care providers to collect/record data.					

SECTION D: KNOWLEDGE OF THE RATIONALE FOR RHIS DATA COLLECTION

This section seeks to find out your knowledge of the rationale for RHIS data collection. The information you provide will not be shared with anyone except in aggregate and anonymous formats and thus, will remain highly confidential. Please answer the questions honestly. *If you have no idea in solving any of the questions in this section, please indicate **NO IDEA** against the question*

Describe at least three reasons for collecting or using the following types of data on a monthly basis:	
U1A	Diseases
	1.
	2.
	3.
U1B	Immunisation
	1.
	2.
	3.
U1C	Sex of clients
	1.
	2.
	3.
U1D	Age of Clients
	1.
	2.
	3.
U1E	Geographical data or residence of clients
	1
	2
	3
U1F	Why are population data (such as catchment area) needed?
	1.
	2.
U2	Describe at least three aspects of data quality:
	1.
	2.
	3.
U3	Describe at least three ways of ensuring/checking data quality
	1.
	2.
	3.

SECTION E: CASE STUDY ON DATA QUALITY

*If you have no idea in solving any of the questions in this section, please indicate **NO IDEA** against the question*

The district health information officer for Sangul district prepared a report after he made a supervision visit to six out of the ten facilities in the districts. He cross-checked the reported data for the indicator- antenatal care first visit (ANC1)- with the recorded data in the source document and realised that the average data accuracy was 40%. The district health director, Dr. Maswi, felt very disturbed after reading the report. He exclaimed, “I need to take action”. Consequently, a meeting involving the entire district health team was held to identify the reasons for the discrepancy and come out with steps to improve

the quality of data. The team after some discussions about the possible reasons for the low percentage of data accuracy, came out with an action plan for all the health facilities in the district.	
PSa	Describe how Dr. Maswi and his team defined the data quality problem in this scenario: _____ _____ _____ _____ _____
PSb	List four potential reasons for the issues of data quality that were encountered: 1. _____ 2. _____ 3. _____ 4. _____
PSc	Describe five major activities/actions Dr. Maswi and his team may have included in the district action plan to improve data quality: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____

SECTION F: SELF-EFFICACY

This section of the questionnaire is about how you perceive your competence in performing tasks related to health information systems. We are interested in knowing how competent you feel in performing RHIS-related tasks. Please score your confidence in carrying out the following tasks on a scale of 0 to 100 percent. (Select 100 percent if you are very confident). Please be frank and rate your competence honestly.

Score your confidence for each scenario to a percentage from the following scale

		0	10	20	30	40	50	60	70	80	90	100
SE1.	I can check the accuracy of data											
SE2.	I can correctly calculate percentages/rates											
SE3.	I can plot data by months/years											
SE4.	I can compute trends from bar charts											
SE5.	I can explain the implication of the results of data analysis											
SE6.	I can use data to identify gaps and set performance goals											
SE7.	I can use data to make operational/management decisions (e.g., for service delivery, budget allocation, distribution of roles and responsibilities, staff assignment, and logistics distribution)											

SECTION G: COMPETENCY TO PERFORM RHIS TASKS

This survey is designed for staff responsible for the analysis and interpretation of health facility data. We would like you to solve the following problems in calculating percentages/rates, plotting data, explaining/interpreting data, and using data. *If you have no idea in solving any of the questions in this section, please indicate **NO IDEA** against the question*

<table>
<tr><td>CF1</td><td>The estimated number of pregnant mothers in the facility catchment area for the current period is 294. The antenatal clinic in your facility has registered 147 pregnant mothers. Calculate the percentage of pregnant mothers in the facility catchment area attending antenatal care (ANC).</td></tr>
<tr><td>CF2</td><td>The table below shows the number of pregnant women who attended ANC for the first time (ANC1), as well as the number of these women who received a first dose of intermittent preventive treatment (IPT1) for malaria.
Table 1. Pregnant women who attended ANC1 at Bisi clinic and who received IPT1
<table>
<tr><td>Indicator</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td><td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td></tr>
<tr><td>ANC1</td><td>145</td><td>151</td><td>147</td><td>140</td><td>157</td><td>137</td><td>117</td><td>127</td><td>134</td><td>160</td><td>153</td><td>141</td></tr>
<tr><td>women receiving IPT1 in ANC</td><td>90</td><td>99</td><td>96</td><td>95</td><td>110</td><td>94</td><td>86</td><td>98</td><td>106</td><td>133</td><td>132</td><td>127</td></tr>
</table></td></tr>
<tr><td>CF2</td><td>Develop a line graph depicting the trend over one year in IPT1 coverage among women attending ANC1 at Bisi Polyclinic.</td></tr>
</table>

CF3a	In a population of 6000 children under two years, 600 were found to be malnourished. What is the rate of malnutrition in this population?

CF3b	If the number of children under five years of age in a certain district is 30,000, and the malnutrition rate in children under five years of age was 30%, what is the number of children who are malnourished?
CF4	The coverage for fully immunised children 12–23 months was found to be 70%, 60%, 40%, 50%, 50% for years 2001, 2002, 2003, 2004, and 2005, respectively
CF4a	Develop a bar chart for coverage percentages by years.

CF4b	Explain the findings of the bar chart _____ _____ _____
CF4c	Did you find a trend in the data? 1. Yes 2. No Explain your answer _____ _____ _____
CF4d	Provide at least **ONE** use of above chart findings at: 1. Facility level 2. District level

D ETHICAL CLEARANCE

UNIVERSITY OF CAPE COAST
INSTITUTIONAL REVIEW BOARD SECRETARIAT
TEL: 0558093143 / 0508878309
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/856
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

9TH DECEMBER, 2020

Mr. Obed Uwumbornyi Lasim
Department Of Physical, Health Education and Recreation
University of Cape Coast

Dear Mr. Lasim,

ETHICAL CLEARANCE – ID (UCCIRB/CES/2020/101)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted **Provisional Approval** for the implementation of your research titled **Performance of Maternal and Child Health Data in Routine Health Information System in Cape Coast Metropolis, Ghana.** This approval is valid from 9th December, 2020 to 8th December, 2021. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-681109
Fax + 233-302-685424
Email: ethics.research@ghsmail.org

My Ref. GHS/RDD/ERC/Admin/App 121/003
Your Ref. No.

2nd January, 2021

Obed Uwumbornyi Lasim
Department of Health Information Management,
School of Allied Health Sciences, College of Health and Allied Science,
University of Cape Coast,
Cape Coast.

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC 007/09/20**
Study Title	Performance of Maternal and Child Health Data in Routine Health Information System in Cape Coast Metropolis.
Approval Date	2nd January, 2021
Expiry Date	1st January, 2022
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Dr. Cynthia Bannerman
(GHS ERC Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

In case of reply the reference number and the date of this Letter should be quoted

Our Ref.: CCTH

Your Ref.:

P. O. Box CT.1363
Cape Coast
CC-071-9967
Tel: 03321-34010-14
Fax: 03321-34016
Website: www.ccthghana.org
email: info@ccthghana.com

4th December, 2020

Mr. Obed Uwumbornyi Lasim
Department of Health Information Management
University of Cape Coast
Cape Coast

Dear Sir,

ETHICAL CLEARANCE – REF: CCTHERC/EC/2020/110

The Cape Coast Teaching Hospital Ethical Review Committee (CCTHERC) has reviewed your research protocol titled, "***Performance of Maternal and Child Health Data in Routine Health Information System in Cape Coast Metropolis***" which was submitted for Ethical Clearance. The ERC is glad to inform you that you have been granted provisional approval for implementation of your research protocol.

The CCTHERC requires that you submit periodic review of the protocol and a final full review to the ERC on completion of the research. The CCTHERC may observe or cause to be observed procedures and records of the research during and after implementation.

Please note that any modification of the project must be submitted to the CCTHERC for review and approval before its implementation.

You are required to report all serious adverse events related to this study to the CCTHERC within ten (10) days in writing. Also note that you are to submit a copy of your final report to the CCTHERC Office.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours sincerely

Dr. Stephen Laryea
Medical Director
For: Prof. Ganiyu Rahman, Chairman ERC

E PERMISSION/INTRODUCTORY LETTERS

Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast
31st August, 2020

The Municipal Health Director
Abura-Asebu-Kwamankese District
Abura-Dunkwa

Dear Sir/Madam

PERMISSION TO CONDUCT A PILOT STUDY IN YOUR HEALTH FACILITY

I am a PhD candidate pursuing a programme in Health Promotion (Maternal and Child Health) in the Department of Health Physical Education and Recreation of the University of Cape Coast. In partial fulfilment of the requirements for the programme, I am conducting a research on the topic **"Performance of Maternal and Child Health data in Routine Health Information Systems in the Cape Coast Metropolis, Ghana"**.

I have successfully defended my thesis proposal, and ready for data collection. I will need your permission to enable me do a pilot study in Abura-Dunkwa District Hospital. The data collection will take two (2) days. It is believed the pilot study would expose any potential, unforeseen issues prior to the start of the actual study and data collection for appropriate solutions to be put in place. I would therefore be most grateful if you could give me approval to conduct the research in the said health facility.

This research has been reviewed and approved by the Institutional Review Board of the University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). Be assured that the information collected would be treated with utmost confidentiality.

I count on your usual co-operation.

Thank you.

Yours faithfully,

Obed Cwumbornyi Lasim
(PhD Candidate)
ET/HPP/18/0001
Tel: +233 242539351
Email: olasim@ucc.edu.gh

CORE VALUES
- Professionalism
- Discipline
- Team Work
- Integrity
- Innovation and Excellence
- People Centered Service

GHANA HEALTH SERVICE

GHANA

April 2, 2...

INTRODUCTORY LETTER
MR OBED UWUMBRNYILASIM – PHD CANDIDATE

This serves to introduce to you the above named person who has my permission to conduct a research on the topic *"Performance Of Maternal and Child Health Data in Routine Health Information System in Cape Coast Metropolis"*.

By this letter, you are kindly requested to accord him with all the needed support he may require in this direction.

Thank you.

MS. G.A.V. GRAHAM-HAYFRON
(METRO DIRECTOR OF HEALTH SERVICE)
CAPE COAST

THE MEDICAL SUPERINTENDENT
EWIM POLYCLINIC, EWIM

THE PHYSICIAN ASSISTANT
ADISADEL AND EFUTU HEALTH CENTRE

THE CHO NKANFOA CHPS

THE CHO BRIMSU CHPS

THE CHO ESSUEKYIR CHPS

Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast
31st August, 2020

The Municipal Health Director
Komenda-Edina-Eguafo-Abream municipality
Elmina

Dear Sir/Madam

PERMISSION TO CONDUCT A PILOT STUDY IN YOUR HEALTH FACILITY

I am a PhD candidate pursuing a programme in Health Promotion (Maternal and Child Health) in the Department of Health Physical Education and Recreation of the University of Cape Coast. In partial fulfilment of the requirements for the programme, I am conducting a research on the topic **"Performance of Maternal and Child Health data in Routine Health Information Systems in the Cape Coast Metropolis, Ghana"**.

I have successfully defended my thesis proposal, and ready for data collection. I will need your permission to enable me do a pilot study in Elmina polyclinic. The data collection will take two (2) days. It is believed the pilot study would expose any potential, unforeseen issues prior to the start of the actual study and data collection for appropriate solutions to be put in place. I would therefore be most grateful if you could give me approval to conduct the research in the said health facility.

This research has been reviewed and approved by the Institutional Review Board of the University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). Be assured that the information collected would be treated with utmost confidentiality.

I count on your usual co-operation.

Thank you.

Yours faithfully,

Obed Uwumbornyi Lasim
(PhD Candidate)
ET/HPP/18/0001
Tel: +233 242539351
Email: olasim@ucc.edu.gh

Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast
31st August, 2020

The Medical Superintendent
Abura-Dunkwa District Hospital
Abura-Dunkwa
Central Region

Dear Sir/Madam

PERMISSION TO CONDUCT A PILOT STUDY IN YOUR HEALTH FACILITY

I am a PhD candidate pursuing a programme in Health Promotion (Maternal and Child Health) in the Department of Health Physical Education and Recreation of the University of Cape Coast. In partial fulfilment of the requirements for the programme, I am conducting a research on the topic **"Performance of Maternal and Child Health data in Routine Health Information Systems in the Cape Coast Metropolis, Ghana"**.

I have successfully defended my thesis proposal, and ready for data collection. I will need your permission to enable me do a pilot study in your health facility. The data collection will take two (2) days. It is believed the pilot study would expose any potential, unforeseen issues prior to the start of the actual study and data collection for appropriate solutions to be put in place. I would therefore be most grateful if you could give me approval to conduct the research in the said health facility.

This research has been reviewed and approved by the Institutional Review Board of the University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). Be assured that the information collected would be treated with utmost confidentiality.

I count on your usual co-operation.

Thank you.

Yours faithfully,

Obed Uwumbornyi Lasim
(PhD Candidate)
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Tel: +233 242539351
Email: olasim@ucc.edu.gh

Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast

25th January, 2021

The Medical Superintendent
Elmina Polyclinic
Central Region

Dear Sir,

PERMISSION TO CONDUCT A PILOT STUDY IN YOUR HEALTH FACILITY

I am a PhD candidate pursuing a programme in Health Promotion (Maternal and Child Health) in the Department of Health, Physical Education and Recreation (HPER). In partial fulfilment of the requirement for the programme, I am conducting a research on the topic **"Performance of Maternal and Child Health Data in Routine Health Information System in Cape Coast Metropolis, Ghana".**

I have successfully defended the thesis proposal, and I am ready for the field work. I will need your permission to enable me do a pilot study in your health facility. The data collection will take two (2) days in your facility. All the national Covid-19 protocols will be strictly followed throughout the data collection. It is believed that the pilot study will expose any potential, unforeseen issues prior to the start of the actual study and data collection for appropriate solutions to be put in place. I would therefore be most grateful if you could give me approval to conduct the pilot study in your health facility.

This research has been reviewed and approved by the Ghana Health Service Ethics Review Committee (GHS-ERC), University of Cape Coast Institutional Review Board (UCCIRB), and Cape Coast Teaching Hospital Ethical Review Committee (CCTH-ERC), and same had been attached to this letter. Be assured that the information collected would be treatment with utmost confidentiality.

I count on your kind consideration.

Thank you

Yours faithfully,

Obed Uwumbornyi Lasim
(PhD Candidate)
ET/HPP/18/0001
Tel: +233 242539351
Email: olasim@ucc.edu.gh

Please take note
Permission granted

Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast
21st August, 2020

The Chief Executive Officer
Cape Coast Teaching Hospital
Cape Coast

Dear Sir/Madam

PERMISSION TO CONDUCT RESEARCH IN YOUR FACILITY: OBED U. LASIM

I am a PhD candidate pursuing a programme in Health Promotion (Maternal and Child Health) in the Department of Health, Physical Education and Recreation (HPER) of the University of Cape Coast. In partial fulfilment of the requirements for the programme, I am conducting a research on the topic **"Performance of Maternal and Child Health data in Routine Health Information Systems in the Cape Coast Metropolis, Ghana"**.

I have successfully defended my thesis proposal, and ready for data collection. Your outfit was selected to be part of this research because of the Maternal and Child Health services it provides. I will need your permission to enable me collect data from your facility. I would therefore be most grateful if you could give me approval to conduct the research in your facility.

This research has been reviewed and approved by the Institutional Review Board of the University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). Be assured that the information collected would be treated with utmost confidentiality.

I count on your usual co-operation.

Thank you.

Yours faithfully,

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Email: olasim@ucc.edu.gh

Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast
21st August, 2020

The Medical Superintendent
Cape Coast Metropolitan Hospital
Cape Coast

Dear Sir/Madam

PERMISSION TO CONDUCT RESEARCH IN YOUR FACILITY: OBED U. LASIM

I am a PhD candidate pursuing a programme in Health Promotion (Maternal and Child Health) in the Department of Health Physical Education and Recreation of the University of Cape Coast. In partial fulfilment of the requirements for the programme, I am conducting a research on the topic **"Performance of Maternal and Child Health data in Routine Health Information Systems in the Cape Coast Metropolis, Ghana"**.

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This research has been reviewed and approved by the Institutional Review Board of the University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). Be assured that the information collected would be treated with utmost confidentiality.

I count on your usual co-operation.

Thank you.

Yours faithfully,

Obed Uwumbornyi Lasim
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Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast
21st August, 2020

The Director
Directorate of University Health Services
University of Cape Coast
Cape Coast

Dear Sir

PERMISSION TO CONDUCT RESEARCH IN YOUR FACILITY: OBED U. LASIM

I am a PhD candidate pursuing a programme in Health Promotion (Maternal and Child Health) in the Department of Health Physical Education and Recreation of the University of Cape Coast. In partial fulfilment of the requirements for the programme, I am conducting a research on the topic **"Performance of Maternal and Child Health data in Routine Health Information Systems in the Cape Coast Metropolis, Ghana"**.

I have successfully defended my thesis proposal, and ready for data collection. Your outfit was selected to be part of this research because of the Maternal and Child Health services it provides. I will need your permission to enable me collect data from your facility. I would therefore be most grateful if you could give me approval to conduct the research in your facility.

This research has been reviewed and approved by the Institutional Review Board of the University of Cape Coast (UCCIRB), and the Ghana Health Service Ethics Review Committee (GHS ERC). Be assured that the information collected would be treated with utmost confidentiality.

I count on your usual co-operation.

Thank you.

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College of Health and Allied Sciences
University of Cape Coast
Cape Coast
21st August, 2020

The Director
DIS Hospital
Cape Coast

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Department of Health Information Management
School of Allied Health Sciences
College of Health and Allied Sciences
University of Cape Coast
Cape Coast
21st August, 2020

The Director
Baiden Ghartey Memorial Hospital
Cape Coast

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