KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF HEALTH POLICY, MANAGEMENT AND ECONOMICS

THE ROLE OF QUALITY IMPROVEMENT PROCESS (QIP) IN ENHANCING THE EFFECTIVENESS OF ROUTINE HEALTH INFORMATION SYSTEM FOR HEALTH SERVICE PLANNING IN THE EJISU-JUABEN MUNICIPAL OF GHANA

BY

RICHARD OKYERE BOADU (MSc HSPM)

DATE: NOVEMBER, 2015

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A THESIS SUBMITTED TO THE DEPARTMENT OF HEALTH POLICY, MANAGEMENT AND ECONOMICS, COLLEGE OF HEALTH SCIENCES, SCHOOL OF PUBLIC HEALTH, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

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DECLARATION

I hereby declare that apart from references and other sources which I have cited and duly acknowledged, this work is my own and has not been presented in whole or in part for another degree elsewhere. I also declare that I am solely responsible for any errors and omissions that might appear in this work.

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D E D I C A T I O N

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LIST OF ABBREVIATIONS/ACRONYMS

ANC	Antenatal Clinic
APs	Activity Periods
API	Associates in Process Improvement
CBSVs	Community Based Surveillance Volunteers
CHAG	Christian Health Association of Ghana
CHIM	Centre for Health Information Management
CHPS	Community-Based Health Planning and Services
CHRPE	Committee for Human Research Publications and Ethics of Kwame Nkrumah University of Science and Technology
DHIMS2	District Health Information Management System (version II)
DHMT	District Health Management Team
DQIP	Data Quality Improvement Process
DQIT	Data Quality Improvement Team
GHS	Ghana Health Service
HIS	Health Information System
HMIS	Health Management Information System
JICA	Japan International Development Cooperation Agency
JUSE	Japanese Union of Scientists and Engineers
LQAS	Lot Quality Assurance Sampling
LS	Learning Sessions
MAT	Management Assessment Tool
MCH	Maternal and Child Health
MHD	Municipal Health Directorate
MHMT	Metropolitan Health Management Team

MOH	Ministry of Health
MQITs	Metropolitan Quality Improvement Teams
OBAT	Organizational and Behavioural Assessment Tool
PCA	Principal Components Analysis
PDSA	Plan-Do-Study-Act
PPME	Policy Planning, Monitoring and Evaluation
PRISM	Performance of Routine Information System Management
QI	Quality Improvement
QIP	Quality Improvement Process
RHIS	Routine Health Information Systems
RHMT	Regional Health Management Team

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ABSTRACT

Decision making in health is influenced by the quality of health information generated by the health system. Routine Health Information System (RHIS) is one of such information integral and forms over 90% health information. Yet RHIS is faced with huge challenges which reduce its decision making and planning yield. However, there is limited empirical evidence on the magnitude of dysfunction in the RHIS in most health districts, Ejisu Juaben Municipal Health Directorate (EJMHD) in Ashanti Region being no exception. This study assessed the role of Quality Improvement Process (DQIP) in improving RHIS in planning and decision making.

A quasi-experimental, uncontrolled before and after study involving the development of a Data Quality Improvement Process (DQIP) training module to train health staff, establish a team with the quality improvement framework for monitoring over a twelve-month period in the EJMHD. The modelled Data Quality Improvement Process (DQIP) involved RHIS management assessment tool (adapted from the Performance of Routine Information System Management [PRISM] tool package) which was administered to 141 health staff and management in 18 health facilities in Ejisu-Juaben Municipality before and after the intervention.The study evaluated the impact of the modelled Data Quality Improvement Process (DQIP) on RHIS performance at the end of the intervention period through a cross-sectional survey.

Health staff and management had relatively high confidence in undertaking RHIS tasks such as data analysis, interpretation and use of data. On the contrary, their actual performance of RHIS tasks scored objectively, yielded low average scores. The baseline and endline results indicated improvement in competency gaps, after the intervention, in analysis (-37%:+3%), interpretation (-42%:+10%) and use of data (-45%:+3%) respectively. Performance in the use of RHIS at the facility level improved significantly from 30 percent in baseline to 90 percent in the endline; and similar trends were observed in other parameters.

The study concludes that Quality Improvement Process (QIP) drives the effectiveness and performance of RHIS. Scaling up DQIP in the health system will necessarily lead to improved RHIS performance.

Contents

CHAPTER ONE

GENERAL INTRODUCTION

1.0 Introduction

This chapter discusses the current state of knowledge in Routine Health Information Systems (RHIS). It also presents the problem statement and Justifications for the study. The study research questions, objectives and theoretical framework are discussed in detail describing the organizational, technical and behavioural determinants and processes that influence RHIS performance. In addition, the chapter elaborates on unique innovations employed in the study which is the application of Quality Improvement Process (QIP) model to improve the effectiveness of routine health information for planning and decision making in health.

1.1 Current state of knowledge

Sound policy, resource allocation and day-to-day management decisions in the health sector require timely and accurate information from RHIS. This is needed to track the delivery of quality health care services and related support systems, including equipment and supplies, finance, infrastructure and human resources. However, previous assessments in developing countries indicate that the RHIS is often in disarray (Aqil et al.2009). Problems constraining RHIS performance at the country-level include: lack of policy and legal framework to guide generations, utilization and management of data; poor data quality (Mavimbe *et al*.2005; Odhiambo-Otieno 2005). It is common to observe that data generated in the health facilities have gaps either left unfilled on the pretence of lack of sufficient time due to work overload or due to lack of appreciation of the danger in using incomplete data in decision making. In some instances, there is limited use of available health information. Another dimension of the gaps is seen from the fact that not all cases of health condition are presented at the health

facilities due to beliefs and lack of knowledge on the part of the community. In most parts of the world, especially in developing countries, Ministries of Health resort to the use of community-based health workers to generate, store and forward the information to personnel at the health facilities. There is no analysis and interpretation of results at the community level and even at the sub-district or district level due to weak capacity.

Lack of understanding of the principles of data generation, processing and utilization is associated with limited use. Consequently, critical decisions made in the health system may not be as a result of analysis of the data generated but based on anecdotal evidence which are always not scientific (da Silva and Laprega 2005; Chae *et al*., 1994). Limited use of data is also as a result of weaknesses in how data are analyzed (Odhiambo-Otieno 2005; Nsubuga*et al.,* 2006). The analysis of data does not necessarily depend on the use of sophisticated software. Though necessary sometimes, it is not a sufficient condition. Having skills in data analysis and knowing what to analyze are integral in strengthening utilization of data and hence RHIS.

Limited use, poor quality and lack of understanding lead to poor RHIS management practices (Rotich *et al*., 2003; Kamadjeu 2005). In some instances, there is low capacity such as lack of space for storage of data, use of unskillful data collectors, lack of understanding of basic software such as Microsoft Excel, cabinets and files and poor filing system. This results in heaps of data which turn out to serve as haven for rodents and insects. With gradual appreciation and use of softwares the situation is expected to improve.

The situation in Ghana is not different though there is close to no literature on routine health information. In Ghana, the management of RHIS is handled mostly by the Records and Biostatistics Department but its generation transcends experts and non-experts in health informatics. In health facilities for instance, data are generated by health staff which are

complemented by data from the community. At the lower level and rural areas, especially, it is common to observe people with low level of knowledge manning health records which are sent to higher level to be used in decision making by the Ministry of Health (MOH). These cadres of staff, community-based surveillance volunteers (CBSVs), as they are called, undergo training in varying health projects and programmes but may not necessarily have the requisite skills in information management. Invariably, utilization of data for decision-making at the lower level is non-existent. This lack of appreciation and understanding of data and its relevance by the primary generators may be seen in discrepancies in information of some health outcomes (WHO, 2000).

In the past, the coping mechanisms adopted by the Ghana Health Service (GHS) had been organizing training updates, supervision and monitoring using the Primary Health Care concept. Recently, an improved health information system, District Health Information System (DHIMS) was developed. In this system, health information is collated and entered at the district level. An advanced form of the DHIMS is a web-based database, called DHIMS2, has been developed where the information is entered. In this system, it is possible for the regional or national level to assess information remotely (Nyonator et al, 2011).

1.2 Problem Statement and Justification

Countries and international organizations have recently renewed their interest in the performance of the health systems. This has led to the development of performance indicators for monitoring, assessing, and managing health systems to achieve effectiveness, equity, efficiency and quality in healthcare delivery (Arah et. al; 2003).

There is wide recognition of the function of data to underpin decision-making. Data processed from health information into biostatistics are used to improve overall management

and performance of the health sector. For example, the Ministry of Health (MOH) and Ghana Health Service (GHS) have a formal performance agreement in which the GHS is engaged to deliver specific outputs and outcomes using the inputs provided by MOH; as manifested in monthly or quarterly reporting based on performance indicators in the contracts signed. Usually, the agreement presupposes that systems to provide reliable and timely information are in place. In reality however this is not the case. The degree of understanding of the role and function of health information is illustrated in the Bulletin of Health Information published by the Ministry of Health (MOH, 2004). This draws attention to the need to transform data into information for action, especially at the local level.

Mechanisms to address the low understanding and unreliably and untimely information include facilitative supervision, on-the-job training, bi-annual and annual performance hearing (WHO, 2000). The annual performance hearings serve as a peer review mechanism and are used to validate the reported performance figures. Despite these significant efforts, significant data quality issues and their application remain poor at the regional and district levels and poorest at the sub-district and community levels. Recent HMIS Assessment (MOH, 2007) revealed the following:

- Lack of a clear policy and legal framework for health information and health data reporting. This has contributed to the incomplete reporting in the health sector and the lack of data management structures within the private health sector.
- The proliferation of data collection tools most of which are not used at the point of collection and hence are perceived as not very relevant.
- Lack of systematic investment in the development of data management capabilities within the health sector. Most investments continue to be programme focused and centered around the development of reporting systems based on specific indicators.

- There is lack of requisite skills at the lower levels, specifically in district data analysis.
- There is an uncoordinated information collection system, which is overwhelmed by data demands from higher levels with virtually no feedback and poor linkages between the various systems for data collection leading to duplications and data inconsistencies.

The data quality challenges identified in the assessment appears not to be different from what pertain in the Ejisu-Juaben Municipal Health Information System. The RHIS is characterized by data incompleteness, inaccuracy and timeliness which further raise doubts on whether decision- making at the various levels of health service delivery reflects what exists on the ground. The 2010 annual report on performance review of the Ejisu-Juaben Municipality revealed that, about 60% of health facilities within the municipal which are either privately owned or under Christian Health Association of Ghana (CHAG), do not submit their data on their health services to the Municipal Health Directorate for aggregation. This implies that health planning and decision making in the municipality are based on only 40% of the quantum of health facilities in the public facilities. But the level of quality of data from this 40% remains an illusion. Undoubtedly, this is likely to affect the quality and content of data and decision made with it.

1.3 Justification for study

Demand for data in response to changing health partner funding mechanisms has become very significant. There has been the need to show more precisely the commensurate achievements and benefits to vulnerable groups in particular based on partner investments in the health sector. The Ministry of Health, Ghana, is also under severe pressure to demonstrate progress towards the achievement of their target and to ensure that both multilateral and bilateral donors can show the extent to which their contributions to the health

sector have helped in health development. However, despite these demands, performance is grossly under reported with notable exclusion of key providers in the private and quasi government sectors (MOH, 2007 – 2011 Strategic Plan). Developments to improve information management also lag behind other sector improvement activities and the whole culture of information generation and use remain under developed. To improve data quality and reporting, there is the need to strengthen data collection, analysis and use at the various tiers of the health system; national, regional, district/Municipal, sub-district, community and health facility.

The study south assess quality improvement model in enhancing the effectiveness of Routine Health Information System and recommend strategies to update health service planning and management policy.

1.4 Research questions

This study sought to explore the following research questions:

1. Would improvement in RHIS determinants translate into improved RHIS performance?
2. Would improvement in RHIS Processes lead to improved RHIS performance?
3. Would the use and application of Quality Improvement Process model necessarily lead to improved RHIS?

1.5 Objectives

1.5.1 General Objective

To develop and pilot a quality improvement process (QIP) model in enhancing the effectiveness of Routine Health Information System and recommend strategies to update health service planning and management policy**.**

1.5.2 Specific Objectives

- To assess the existing routine health information management system:

    a. RHIS Determinants,
    b. RHIS Processes
    c. RHIS Performance

- To design appropriate quality improvement interventions to address any identified gaps
- To evaluate the impact of the modelled DQIP on RHIS performance

1.6a PRISM Theoretical Framework

The study examined the PRISM model to inform the conceptualisation. The PRISM framework is a paradigm shift in RHIS design and evaluation by considering RHIS as a system with a defined performance (Deming 1993), and by describing the organizational, technical and behavioural determinants and processes that influence such performance.

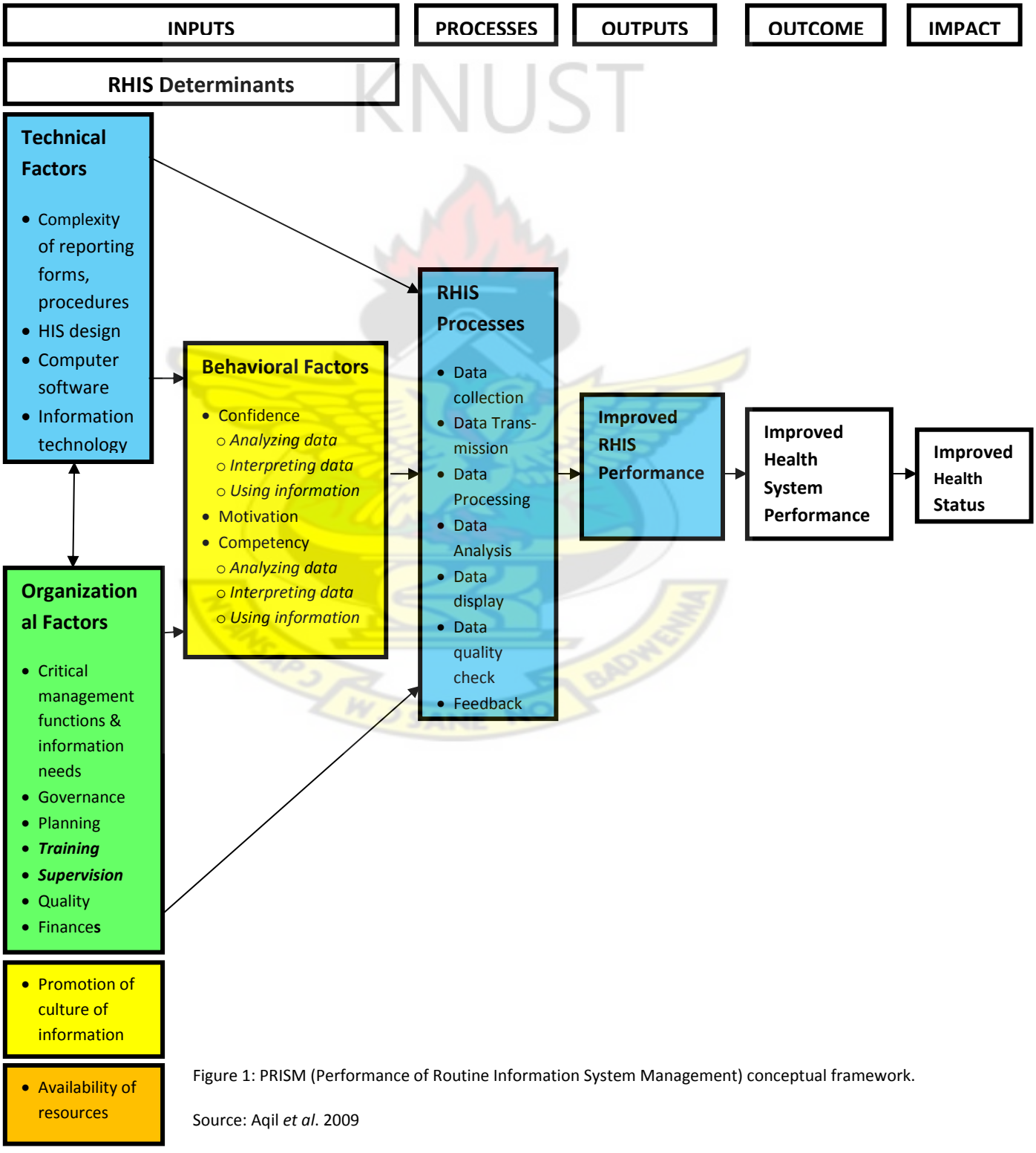


Figure 1: PRISM (Performance of Routine Information System Management) conceptual framework.

Source: Aqil *et al.* 2009

The framework suggests continuous improvement of RHIS performance by analyzing the role of each of these determinants and identifying appropriate interventions to address determinants that negatively influence RHIS performance. Through broader analysis of organizational information needs, it also hinders fragmentation of the existing RHIS and promotes a more integrated approach to information system development.

The PRISM framework states that RHIS performance is affected by RHIS processes, which in turn are affected by technical, behavioural and organizational determinants (Figure 1). It shows that behavioural determinants have direct influence on RHIS processes and performance. Technical and organizational determinants can affect RHIS processes and performance directly or indirectly through behavioural determinants. For example, the complexity of data collection forms (technical) and could affect performance directly or indirectly by lowering motivation. Thus, the PRISM framework delineates the direct and indirect relationships of the determinants on RHIS performance and measures their relative importance. The PRISM framework also opens opportunities for assessing the relationships among RHIS performance, health system performance, and health status.

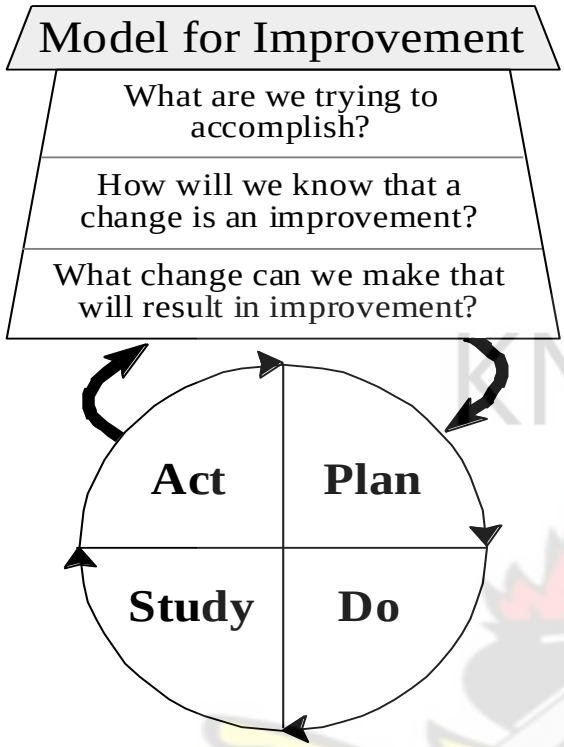
However the PRISM model only identifies the factors, gaps or challenges in the RHIS. It does not show how the underlying reasons for the gaps identified neither does it provide solutions to the problems. To overcome these limitations of the PRISM, the improvement model provides some useful directions.

1.6b Improvement Theoretical Framework

The improvement theoretical framework identifies the root cause of problems or gaps and such ways f or addressing them. Langley, and colleagues combined three questions and the

PDSA cycle to form the basis of the API Model for Improvement. The three questions define the aim, measures, and possible changes (Langley et. al., 1996, Langley et. al., 2009)

1.6b Theoretical Framework:



Source: Associate in Improvement, **Langley et al, 2009**

Seventy-two change concepts are given to provide a starting point for use of the PDSA cycle for developing, testing, implementing, and spreading changes that result in improvement. The model can be applied to the improvement of processes, products, and services in any organization, as well as improving aspects of one's personal endeavors. The model attempts to balance the desire and rewards from taking action with the wisdom of careful study before taking action. The improvement model only assesses the gaps in the process indicators but not the entire the system. It is not able to establish relationship between the outcome of the interventions.

1.6 c. RHIS QIP Theoretical Framework

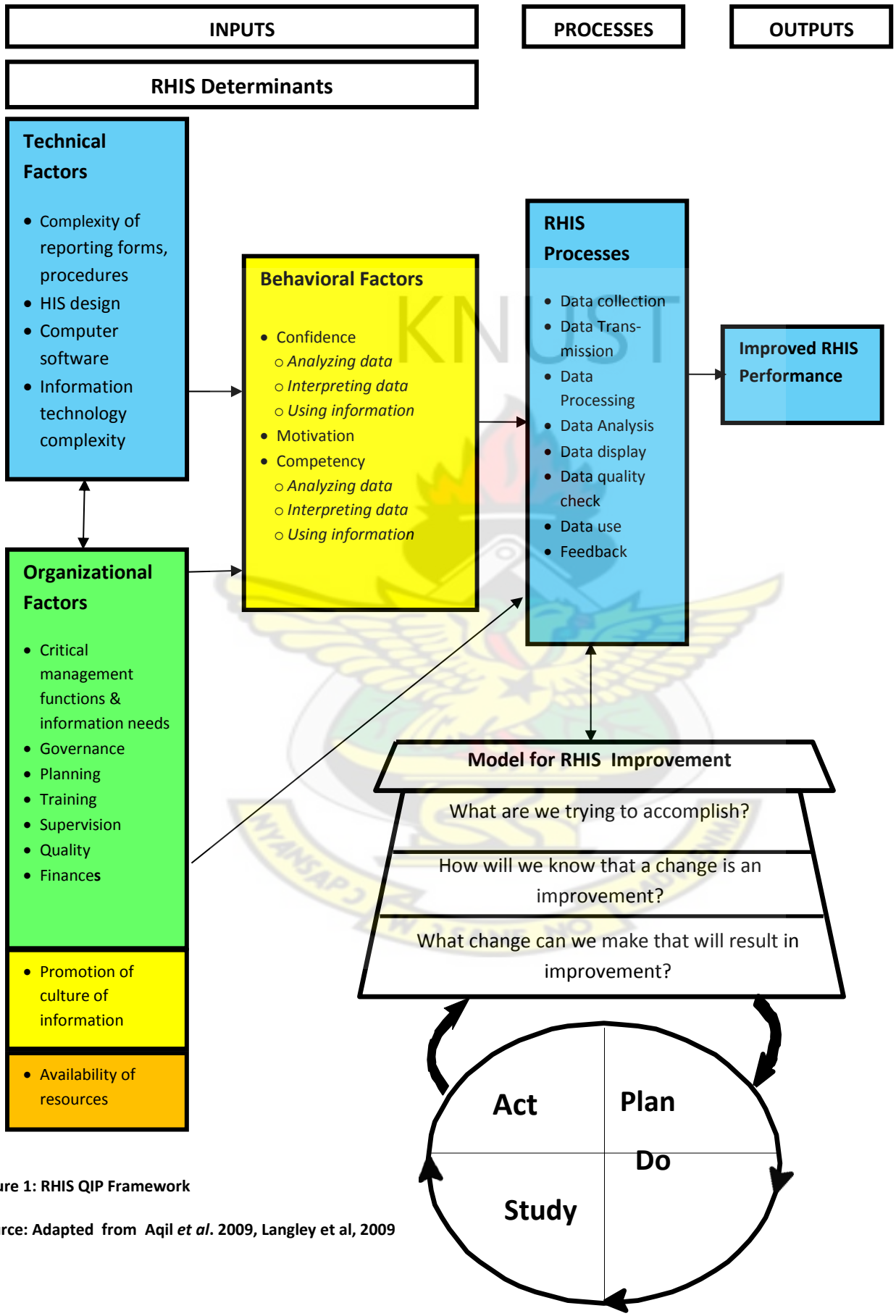


Figure 1: RHIS QIP Framework

Source: Adapted from Aqil *et al*. 2009, Langley et al, 2009

To overcome the weaknesses of the two models, this study combined the PRIMS and Improvement model to assess if improvements in RHIS determinants through application of Quality Improvement Process (QIP) would lead to improved RHIS performance. Due to time and logistical constraints, this study excluded the outcome and impact components in the original prism as a considerable time is needed to assess impact and health status.

1.7 Hypothesis

The study tested the null hypothesis which stated that, improvements in RHIS determinants through application of Quality Improvement Process (QIP) will not necessary lead to improved RHIS performance. That is the mean individual RHIS performance differences will be zero. RHIS performance is composite indicator made up of three indicators. These includes respondents' competency in performing data analysis, data interpretation and use of information indicators. The specific hypotheses for the various indicators in RHIS performance are given as:

a. The null hypothesis is that improvements in RHIS determinants through application of QIP will not necessary lead to an improved respondents' actual competency in analysis of data.

b. The null hypothesis is that improvements in RHIS determinants through application of QIP will not necessary lead to an improved respondents' actual competency in interpretation of data.

c. The null hypothesis is that improvements in RHIS determinants through application of QIP will not necessary lead to an improved respondents' actual competency in use of information.

1.8 Innovations

Unlike other research on health information system, this study assessed the existing situation with respect to routine health information, designed training modules, trained and worked with front-line health providers, administrators, leaders within Municipal Health structures in quality and use of information for decision making to improve health service delivery. Another uniqueness of this study is seen with the application of Quality Improvement (QI) methods to improve performance of RHIS. Quality Improvement is defined in this study as

"efficient use of available RHIS resources through effective and reliable processes to produce continuous improvement in the quality and use of information necessary to improve health system performance".

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The chapter presents literature review of the study with particular focus on decision making in health, Routine Health Information systems (RHIS) determinants, which include behavioural, organizational, and technical determinants. It also presents reviews on RHIS processes such as existence of procedures for data collection and transmission and consequences for not following these procedures. The literature of RHIS performance with particular emphasis on data quality and use of information is also reviewed. In addition, work related to Quality Improvement Process (QIP) such as the role of training in establishing a QIP team, implementation of quality improvement process (QIP) in the health sector, the impact of QIP on RHIS performance and RHIS and Health System Performance are reviewed. The chapter ends with discussion on knowledge gaps identified in the literature and for which reason the study was conducted to contribute to addressing.

2.2. Improved routine health information and health service planning and decision making

The operations of an organization are guided by achievement of goals which are influenced by good planning, managerial creativity and resource availability (Armstrong, 2009; Mulims, 2006). In line with this goal setting is relevant at all levels and health staff in charge of routine health information is no exception. More importantly, since resources are scarce in relation to these goals, decision ought to be made about which alternative should be pursued and using quality health information. Decision-making defines the health, productivity and ultimate survival of an organization. It involves making a choice between alternative courses of action, for instance, to employ or outsource. The use of poor quality information in

decision making lead to poor target setting, appraisal of alternative course of actions and poor planning (Rotich *et al.,* 2003; Kamadjeu 2005) In most entities including the health sector, decisions are made at three levels; strategic, operational and administrative.

Strategic level is where long-term decisions which deal with the organization's relationship with its environment, especially decisions affecting the organization's products or services and markets are considered (Mulims, 2006)., in this case the relationship between the MOH/GHS and the rest of the sectors and firms within and outside the health sector. For example a decision to make health accessible to all vis-à-vis shortage of health staff and health facilities calls for a decision to be made.

At operational level, short term decisions are made in response to operation issues such as volume of production, pricing and inventory levels (Mulims, 2006). In the case of the health sector, it involves the type of service, payment mechanisms, stores and supplies of pharmaceutics and diagnostics and for its clientele.

The administrative decision-making arise from and are subject to the conflicting demands of strategic and operating problems. For instance, in dealing with the conflicting health for all in the midst of acute shortage of health staff and facilities, an administrative decision will be the creation of Community Health Planning and Service (CHPS) compounds or use of mobile clinics or outreach services (MOH, 2007; Armstrong, 2009; Mulims, 2006).

Planning begins where decision making ends, that is, when a decision has been made about which alternatives are needed to achieve the desired outcomes or objectives. For instance, if the Ghana Health Service decides to outsource rather than train some of its critical staff, then management plans on the modalities for outsourcing. By extension, health service planning

involves forecasting, anticipating and preparing for the present to face conditions that may arise in the future. It is concerned with deciding in relevance what to do, who is to do it, how to do it, where, when and where to do it (Armstrong, 2009; Mulims, 2006).

Generally, planning is the desired future and how to bring it about. Accordingly, health service planning and management may be explained as the desired health outcomes and effective and efficient ways of realising them. Decision making in health is a function of evidence in terms of disease burden, resources and quality data. The latter is the bedrock of all the factors or functions not only in terms of analyzing past, current situation and projecting into the future but it also shows reliability and validity of this information (Armstrong, 2009; Mulims, 2006). Quality data and information on daily activities are needed for analysis, interpretation and utilization of information on past, present and future health outcomes; disease burden in the form of mortality, morbidity, cost and psychosocial burden, for health decision making, thus bolstering the significance of RHIS (Arah et. al; 2003).

Sources of information for decision making in health include research, health systems and more importantly RHIS (Aquil, et al., 2009). These sources provide diverse data and information to guide decision making. For example, the Demographic and Health Surveys from different parts of the world present the health situations of many countries and serve as comparators for other health settings. However, the strengths of RHIS is in its ability to provide local and culturally contextual relevant data which provide the true picture of what pertains in a health setting or country (Aquil, et al., 2009; (Arah et. al; 2003). Thus, its role in health service planning and management decision making cannot be overemphasized.

2.3. Theoretical Underpinnings

The study was conceptualized around two main theories; PRISM and Deming wheel and the PDSA cycle. The Performance of Routine Information System Management PRISM framework is a paradigm shift in RHIS design and evaluation by considering RHIS as a system with a defined performance (Deming 1993), and by describing the organizational, technical and behavioural determinants and processes that influence such performance (Aqil et. al., 2009). The framework suggests continuous improvement of RHIS performance by analyzing the role of each of these determinants and identifying appropriate interventions to address determinants that negatively influence RHIS performance. Through broader analysis of organizational information needs, it also hinders fragmentation of the existing RHIS and promotes a more integrated approach to information system development.

The PRISM framework states that RHIS performance is affected by RHIS processes, which in turn are affected by technical, behavioural and organizational determinants (Figure 1). It shows that behavioural determinants have direct influence on RHIS processes and performance. Technical and organizational determinants can affect RHIS processes and performance directly or indirectly through behavioural determinants. For example, the complexity of data collection forms (technical) could affect performance directly or indirectly by lowering motivation. Thus, the PRISM framework delineates the direct and indirect relationships of the determinants on RHIS performance and measures their relative importance. (Hotchkiss et. al., 2010) The PRISM framework also opens opportunities for assessing the relationships among RHIS performance, health system performance, and health status (Aqil et. al., 2009).

2.3.1 **Routine Health Information Systems (RHIS) Determinants**

Health information system strengthening has received unprecedented attention in recent years. As evidenced by the formation of the Health Metrics Network, the convening of the Global Health Information Forum in 2010 in Bangkok, and the unveiling of President Obama's Global Health Initiative, which calls for "strengthening existing public heath surveillance and other data collection systems for monitoring diseases, conditions, health service provision, and health outcomes" as part of an integrated approach to strengthening health systems (U.S. Government, 2011).

Consequently, diverse tools such as Lot Quality Assurance Sampling (LQAS), Routine Data Quality Assessment Tool, Health Metrics Network (HMN) Frame work and PRISM have been used to analyze the relationship between RHIS, health system performance and health outcomes (Aqil et. al., 2009; Glèlè et. al, 2014; Carla, 2013). These frameworks only present the relationship between RHIS performance. Unlike the other frameworks which only present the relationships between RHIS and performance, the PRISM framework moves beyond the relationship between RHIS processes and performance, and adds a new layer of individual and contextual determinants (Aqil et. Al., 2009). These determinants are captured under three categories: behavioural, organizational and technical. To keep the PRISM framework parsimonious, the study includes those determinants that are empirically tested and amenable to change specifically in the Ghanaian Ministry of Health and the Ghana Health Service.

2.3.2 **Behavioural determinants of RHIS**

RHIS users' (including health staff) demand confidence, motivation and competence to perform RHIS tasks that affect RHIS processes and performance directly (Figure 1). How an individual, for instance, health staff who deals directly with data generation, analysis and

interpretation, feels about the utility or outcomes of a task (Fishbein and Ajzen 1975; Hackman and Oldham 1980), or his confidence in performing that task (Bandura 1977), as well as the complexity of the task (Buckland and Florian 1991), all affect the likelihood of that task being performed. Limited knowledge of the usefulness of RHIS data is found to be a major factor in low data quality and information used in health facilities (Rotich *et al*. 2003; Kamadjeu *et al*. 2005; Odhiambo-Otieno 2005b). Motivating RHIS users remains a challenge despite training on data collection and data analysis. Negative attitude such as 'data collection is a useless activity or waste of health care providers' time' and hinder the performance of RHIS tasks (RHINO 2003). The PRISM framework postulates that if people such as health staff and other users of RHIS understand the utility of RHIS tasks, feel confident and competent in performing the task, and perceive that the task's complexity is challenging but not overwhelming, then they will complete the task diligently. RHIS entails solving problems using information. However, problem-solving skill development (D'Zurrila 1986) was not a large part of RHIS capacity building in the past. The situation in Ghana Health Service is not different as the current practice concentrates on facility routine data collection and onward submission to the next level.

The blind spot (Luft 1969) shows that people are unaware of a gap between their perceived and actual competence in performing a task. It is possible to use this gap for learning to change and meet expected behaviours (Perloff 1993). The PRISM framework has this unique strength of unveiling this blind spot as it relates to organizational and technical determinants.

2.3.3 **Organizational determinants**

RHIS users work in an organizational context, which influences them through organizational rules, values and practices (Figure 1). This organizational context is the health services

system and can be managed by the public or the private sector. Organizational factors such as inadequacies in human and financial resources, low management support, lack of supervision and leadership which are not new to health facilities in Ghana, affecting RHIS performance are described in the information system literature (Nsubuga *et al*. 2002; Rotich *et al*. 2003; Kamadjeu *et al*. 2005; Odhiambo-Otieno 2005b). The PRISM framework considers organizational determinants crucial in affecting performance and defines this category as all those factors that are related to organizational structure, resources, procedures, support services, and culture to develop, manage and improve RHIS processes and performance. The organizational factors affect RHIS performance directly or indirectly through behavioural factors (Figure1).

Information systems promote evidence-based decision-making, manage knowledge and create transparency and good governance without changing the organizational hierarchy. Lippeveld *et al*. (1992) suggests that information systems need to follow the existing communication channels of organizational hierarchy. In socio-technical systems (Trist and Bamforth 1951), the emphasis is on measuring organizational processes of human and technology interaction that lead to quality services and products. Similarly, Berwick (1996) stated 'Every system is designed to achieve exactly the results it achieves', indicating that performance is a system characteristic. Thus, the PRISM framework emphasizes that all components of the system including the health system and its actors, leaders and workers, are responsible for improving RHIS performance. The leadership role is seen as a role model and facilitates work processes (Deming 1993; McLaughlin and Kaluzny 1994).

The regulation of organizational processes works better by means of collective values than by means of formal structure (Kahler and Rohde 1996). In other words, people do not always act on what they are told to do but act on sharing what is important and valued in an

organization. Shared values related to information systems are alluded to as a pre-existing culture of data collection (Kamadjeu *et al*. 2005) or 'culture of information' (RHINO 2001; Hotchkiss *et al*. 2006) without specifying how these values originate and sustain themselves. In the health system, data collectors' perception is just a replica of the forgone submission. Most of the data collectors see their duties as routine without appreciating the essence and relevance of data in decision making. Studies in organizational culture (Mead 1994; Triandis 1994) help us understand how values are generated, sustained and amenable to change. Shein (1991), notes that organizational culture is a body of solutions to problems that have worked consistently. They are taught to new members as the correct way to perceive, think and feel in relation to those problems. Berry and Poortinga (1992) also showed the positive influence of values on organizational members' behaviour. Therefore, understanding collective values related to RHIS processes and tasks in the health facilities could open up opportunities for promoting values conducive to RHIS tasks and lead to better performance.

The efficacy of organizational culture in improving performance is well established (Glaser *et al*. 1987; Conner and Clawson 2004; Cooke and Lafferty 2004; Taylor 2005). Similarly, the current study postulates that promoting a culture of information would improve RHIS performance. However, despite the use of the term 'culture of information' (RHINO 2001; Hotchkiss *et al*. 2006), there is no operational definition or measurement for a culture of information. The PRISM framework proposes an operational definition (Hozumi *et al*. 2002): 'the capacity and control to promote values and beliefs among members of an organization in this instance, Ghana Health service or Ministry of Health, by collecting, analyzing and using information to accomplish the organization's goals and mission'.

To measure the culture of information, values related to organizational processes that emphasize data quality, use of RHIS information, evidence-based decision-making, problem

solving, feedback from staff and community, a sense of responsibility, and empowerment and accountability are chosen, based on the proximity principle (Ajzen 2005). Demonstrating the existence of gaps in promoting a culture of information can be used to motivate senior management in health to renew their commitment to develop strategies for promoting an information culture and strengthening its linkage with RHIS performance (Figure 1).

RHIS management (Worthley and DiSalvio1989; Odhiambo-Otieno 2005b) is crucial for RHIS performance (Figure 1). It is measured through availability of the RHIS vision statement and the establishment and maintenance of RHIS support services such as planning, training, supervision, human resources, logistics and finance. By identifying levels of support services, it is possible to develop priorities for actions.

2.3.4 **Technical determinants**

For the purpose of this study, technical determinants are defined as all the factors that are related to the specialized know-how and technology to develop, manage and improve RHIS processes and performance in the Ghana Health Service. These factors refer to development of indicators; designing data collection forms and preparing procedural manuals; types of information technology; and software development for data processing and analysis (Figure 1). These factors are also described by others as potentially affecting RHIS performance (Nsubuga *et al*. 2002; Rotich *et al*. 2003; Mapatano and Piripiri 2005; Odhiambo-Otieno 2005b). Information technology will remain the engine for information system development as computers operate and communicate faster. Thus, it is necessary that RHIS practitioners have good knowledge and information technology skills to effectively use and sustain it. However, in low technology settings, well-designed, paper-based RHIS can still achieve acceptable levels of performance provided there is regular facilitative supervision.

If indicators are irrelevant, data collection forms are complex to fill, and if computer software is not user-friendly, it will affect the confidence level and motivation of RHIS implementers. When software does not process data properly and in a timely manner, and resulting analyses do not provide meaningful conclusions for decision-making, it will affect the use of information. Therefore, technical determinants (Figure 1) might affect performance directly or through behavioural factors.

2.3.5 **Routine Health Information Systems Processes**

Processes are the backbone of performance (Donabedian 1986). However, in the PRISM framework, use of information is considered an output rather than a process (Figure 1). Also, data quality indicators such as completeness and timeliness are used for assessing processes of data collection and transmission, which create confusion between data quality as an output and RHIS processes. The PRISM framework clarifies this confusion by adding specific indicators for measuring RHIS processes, such as existence of procedures for data collection and transmission and consequences for not following these procedures.

The PRISM framework draws attention to neglected RHIS processes, such as checking data quality, displaying of information and giving feedback, and makes them part of the accepted norms. Measurement is a tool for tracking improvements (Berwick 1996). Ensuring measurement quality is not possible without establishing a formal process for checking data quality. Similarly, how well data are displayed reflects whether the data have been transformed into information (Van Lohuizen and Kochen 1986), and shows its relevance for management, monitoring or planning purposes. 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 (Knight 1995; Rothwell *et al*. 1995).

However, feedback remains a weak process of RHIS in many developing countries including Ghana (Hozumi *et al*. 2002; Nsubuga *et al*. 2002; JICA HMIS Study Team 2004; Aqil *et al*. 2005a; Boone and Aqil 2008; Gnassou *et al*. 2008). Facility staff receive feedback from self-assessing their performance using their own records and reports, and from the district management. The same process could be repeated at district or higher administrative levels. Feedback is important as it motivates staff at the lower level and also seves as response to instructions given by the top management.

2.3.6 **RHIS Performance**

2.3.6.1 Data Quality

As originally proposed, RHIS performance is defined as improved data quality and continuous use of information. Data quality is further described in four dimensions: relevance, completeness, timeliness and accuracy (Lippeveld *et al*. 2000). Relevance is assessed by comparing data collected against management information needs. Completeness is measured not only as filling in all data elements in the facility report form, but also as the proportion of facilities reporting in an administrative area (e.g. province or district). In Ghana, the health facilities are supposed to submit data to the next level by the 5th of ensuing months. At the district level, data submitted by the health facilities are supposed to be entered into the District Health Information Management System (DHIMS2) by 15th of the ensuing month. Timeliness is assessed as submission of the reports by an accepted deadline. Accuracy is measured by comparing data between facility records and reports, and between facility reports and administrative area databases, respectively.

2.3.6.2 Use of Information

Use of information in organizations such as the Ghana Health Service depends upon the decision power of the people and the importance given to other considerations despite the availability of information (Grindle and Thomas 1991; Sauerborn 2000). However, without assessing use of information, it is difficult to know whether a RHIS is meeting its intended objectives, improving evidence-based decision-making, and consequently leading to better health system performance. Therefore, in this study, efforts were made to operationalize use of information for measurement (HISP 2005; MEASURE Evaluation 2005). The PRISM framework defines use of information employing criteria such as ability to identifying problems, considering or making decisions among alternatives, and for advocacy. Based on this definition, a RHIS performance diagnostic tool is developed for measuring RHIS performance.

By defining and measuring RHIS performance, the PRISM framework draws attention to setting and achieving targets, which act as motivators (Locke *et al*. 1986) to self-regulate and continuously improve performance (McLaughlin and Kaluzny 1994). The framework identifies the location of responsibility for actions leading to better accountability. However, performance is considered a system's characteristic (Berwick 1996), thus it needs to be seen in conjunction with system processes and the determinants affecting them.

2.4 Quality Improvement Process

2.4.1 Routine Health Information Systems and Health System Performance

Measuring the impact of RHIS on health system performance is a grey area, though crucial frontier in terms of attracting more investment and countering criticism of RHIS's ability to improve health system performance. The difficulty with measurement arises from the lack of

operational definitions of health system performance that could be used for testing RHIS's impact on health systems. This study resolved this by defining health system performance restrictively and only keeping those health systems functions that are monitored through RHIS, such as health service delivery and resource management (financial, physical and human resources).

RHIS focuses mostly on the service delivery and resource management functions of the health system, and consequently affects those functions. Based on the proximity (Ajzen 2005) of RHIS and health system performance, the study proposed an operational definition of health system performance as 'maintaining or improving service coverage and making necessary adjustments or improvements in financial and human resources in relation to services provided.' It is understood that this definition has limitations but it captures the major functions, which are common to various frameworks (Harrel and Baker 1994; Handler *et al*. 2001; HMN Secretariat 2006; Institute of Medicine 2006) for measuring health system performance and are incorporated into RHIS. Thus, the PRISM framework makes it possible to test the hypothesized relationship that an increased level of RHIS data quality and/or information use is associated with improved service coverage and associated resources.

2.5 Model for Improvement

In 1886 Imai stated the Japanese executives recast, the Deming wheel from the 1950 Japanese Union of Scientists and Engineers (JUSE) seminar into the Plan-Do-Check-Act (PDCA) cycle. Imai shows the correlation between the Deming wheel and the PDCA cycle in Figure 2.

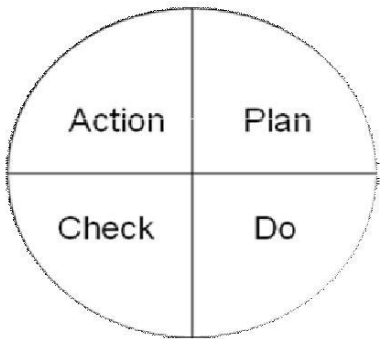
Figure 2: Correlation between the Deming Wheel and the Japanese PDCA Cycle

1. Design – Plan	Product design corresponds to the planning phase of management
2. Production -- Do	Production corresponds to doing-making, or working on the product that was designed
3. Sales – Check	Sales figures confirm whether the customer is satisfied
4. Research --Action	In case of a complaint being filed, it has to be incorporated into the planning phase, and action taken for the next round of efforts

Imai didn't provide any details as to who and how the executives translated the Deming Wheel into the PDCA Cycle.

The resulting PDCA cycle is shown in Figure 3. The four step cycle for problem solving includes planning (definition of a problem and a hypothesis about possible causes and solutions), doing (implementing), checking (evaluating the results), and action (back to plan if the results are unsatisfactory or standardization if the results are satisfactory). The PDCA cycle emphasized the prevention of error recurrence by establishing standards and the ongoing modification of those standards. Even before the PDCA cycle is employed, it is essential that the current standards be stabilized. The process of stabilization is often called the SDCA (standardize-do-check-action) cycle. Ishikawa (Ishikawa, 1985) stated: "If standards and regulations are not revised in six months, it is proof that no one is seriously using them."

Figure 3 – Japanese PDCA Cycle, 1951



Ishikawa redefines the PDCA cycle to include determining goals and target and methods for reaching the goals in the planning step. In the do step, he includes training and education to go with the implementation. He say good control means allowing standards to be revised constantly to reflect the voices of consumers and their complaints was well as the requirements of the next process. The concept behind the term control (kanri) is deployed throughout the organization.

By the 1960's the PDCA cycle in Japan had evolved into an improvement cycle and a management tool. Lilrank and Kano (Lillrank and Kano,1989) state the 7 basic tools (check sheet, histograms, Pareto chart, fishbone diagram, graphs, scatter diagrams, and stratification) highlight the central principle of Japanese quality. These tools together with the PDCA cycle and the QC story format became the foundation for improvement (kaizen) in Japan.

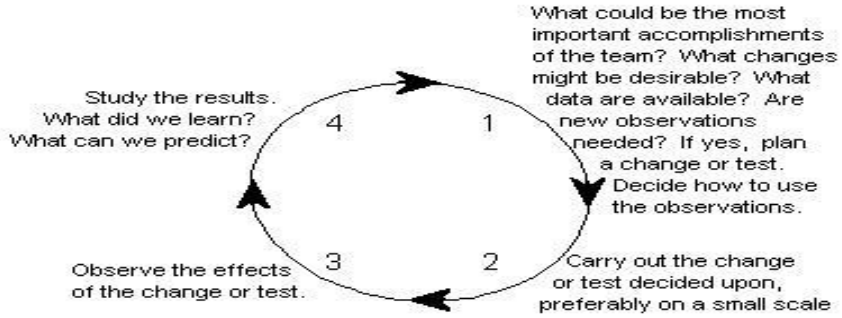
2.5.1 Deming Develops the PDSA Cycle

Deming (Deming, 1986) reintroduces the Shewhart cycle in 1986. He states that it came directly from the 1950 version. Figure 4 illustrates this procedure to follow for improvement. He states:

> *"Any step may need guidance of statistical methodology for economy, speed, and protection from faulty conclusions from failure to test and measure the effects of interactions".*

In his 4-day seminars in the 1980's, Deming presented this version. Also, he warned Western audiences that the plan, do, check, and act version is inaccurate because the English word "check" means "to hold back." Deming stated (Deming, 1990) in the Moen, Nolan, and Provost (Moen, 1991) manuscript, "… be sure to call it PDSA, not the corruption PDCA."

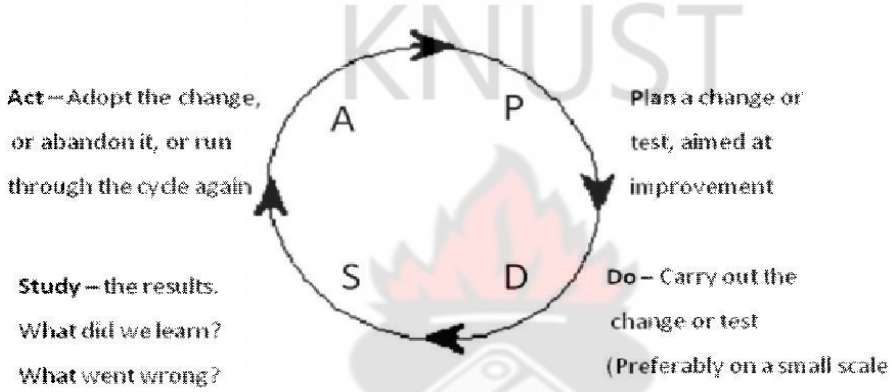
Figure 4 – Shewhart Cycle: Deming, 1986



Step 5. Repeat Step 1, with knowledge accumulated.
Step 6. Repeat Step 2, and onward.

Deming (Deming, 1993) again modified the Shewhart cycle in 1993 and called it the Shewhart cycle for learning and improvement- the PDSA cycle. He described it as a flow diagram for learning, and for improvement of a product or of a process. It is illustrated in Figure 5.

Figure 5 – PDSA Cycle: Deming, 1993



In 1987 Moen and Nolan (Moen and Nolan, 1987) presented an overall strategy for process improvement with a modified version of Deming's cycle of 1986. The planning step of the improvement cycle required prediction and associated theory. The third step compared the observed data to the prediction as a basis for learning.

Langley, Nolan, and Nolan (Langley et. al., 1994) refined the improvement cycle and called it the PDSA Cycle. This Associates in Process Improvement (API), 1994 version is given in Figure 6. The use of the word "study" in the third phase of the cycle emphasizes that the purpose of this phase is to build new knowledge. It is not enough to determine that a change resulted in improvement during a particular test. As you build your knowledge, you will need to be able to predict whether a change will result in

improvement under the different conditions you will face in the future. In addition, they added three basic questions to supplement the PDSA cycle:

1. What are we trying to accomplish?
2. How will we know that a change is an improvement?
3. What changes can we make that will result in improvement?

2.5.2 *The PDSA Cycle Grows a Framework*

Langley, Moen, Nolan, Nolan, Norman, and Provost (Langley et. al., 1996, Langley et. al., 2009) combined the three questions and the PDSA cycle to form the basis of the API Model for Improvement (see Figure 7). The three questions define the aim, measures, and possible changes. Seventy-two change concepts are given to provide a starting point for use of the PDSA cycle for developing, testing, implementing, and spreading changes that result in improvement. The model can be applied to the improvement of processes, products, and services in any organization, as well as improving aspects of one's personal endeavors. The model attempts to balance the desire and rewards from taking action with the wisdom of careful study before taking action.

Figure 6 – PDSA Cycle, 1994

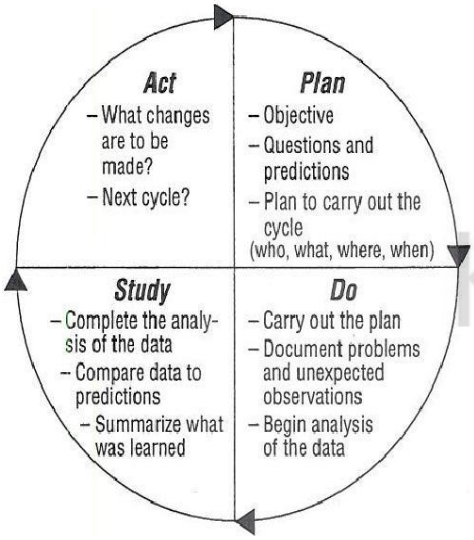
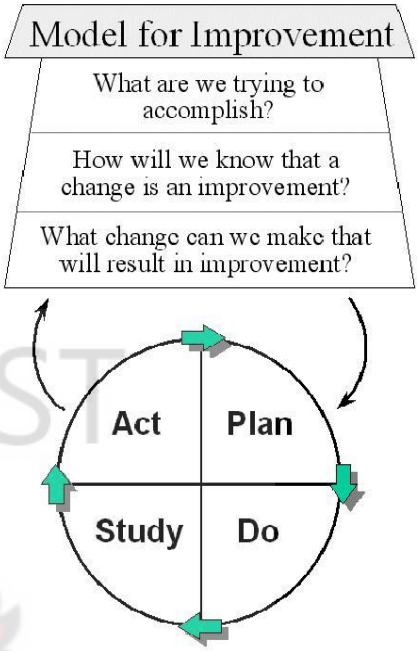


Figure 7 – Model for Improvement, 1996, 2009



The model is both widely applicable and easy to learn and use. The model supports improvement efforts in a full range from the very informal to the most complex (e.g. introduction of a new product line or service for a major organization).

In conclusion the PDCA, PDSA, and the Model for Improvement have their roots in the scientific method and the philosophy of science that has evolved for more than 400 years. APIs believe that the Model for Improvement is an important evolution of the PDCA cycle.

Experience with the model since its development in 1994 shows that it:

- Is applicable to all types of organizations and to all groups and levels in an organization
- Provides a framework for the application of improvement methods and

tools guided by theory of knowledge:

- Encourages planning to be based on theory
- Theory leads to appropriate questions which provide the basis for learning.
- Questions lead to predictions which guide the user in identifying the necessary data, methods and tools to answer the questions relative to the theory in use.
- Emphasizes and encourages the iterative learning process of deductive and inductive learning.

- Allows project plans to adapt as learning occurs

- Provides a simple way for people to empower themselves to take action that leads to useful results in the pragmatic tradition of learning.

- Facilitates the use of teamwork to make improvements

2.5.3 Use of PDSA cycles in healthcare

Delivering improvements in the quality and safety of healthcare remains an international challenge (Michael et. al., 2013). In recent years, quality improvement (QI) methods such as Plan–Do–Study–Act (PDSA) cycles have been used in an attempt to drive such improvements. The method is widely used in healthcare improvement.

Despite increased investment in research into the improvement of healthcare, evidence of effective QI interventions remains mixed, with many systematic reviews concluding that such interventions are only effective in specific settings (Schouten, 2008). To make sense of these findings, it is necessary to understand that delivering improvements in healthcare requires the alteration of processes within complex social systems that change over time in predictable and unpredictable ways (Berwick, 1998; Nicolay et al., 2012).

2.6 Knowledge gaps

A cursory review of the literature revealed that QIP has been extensively applied in other spheres of life but little is known in its application in the health sector. Specifically, there is scanty information on role of training in establishing QIP team, implementation of QIP in the health sector, and more importantly the impact of QIP on RHIS performance. The implication is that health service planning and management may be done without the inclusion of quality routine health information and thus making such planning unreliable. As a contribution to the acceleration of the achievement of the Millennium Development Goals and beyond, this knowledge gaps need to be filled. Hence the main goal of this study is to contribute to filling this gap.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methods and procedures used in the study. The chapter details a study design. Assessment phase which comprised meetings with Municipal Health Directorate (MHD), baseline survey, development of training modules, and dissemination of baseline results at MHD and presentation of abstracts at international conference are described in this chapter.

Quality Improvement Methods such as the Model for Improvement and Learning Networks where frontline data quality improvement teams were convened at Learning Sessions to accelerating peer-to-peer learning among health staff in the municipality have been presented. Activities such as formation of data quality improvement team (DQIT), training of DQIT, implementation of interventions, onsite coaching and mentoring are detailed in this chapter.

This chapter also details profile of the study area, study population, sample size, sample technique, data collection techniques and tools. It also presents measurements and data analysis, ethical considerations, assumptions of the study as well as reliability and validity of data collection process.

3.1 Study design

The research employed quasi-experimental, uncontrolled before and after design. Uncontrolled before and after studies measure provider RHIS performance before and after the introduction of an intervention (e.g. designed training modules, trained and worked with front-line health providers) in the same study site and any observed differences in RHIS performance are assumed to be due to the intervention. The details of how the study was conducted are explained in the various phases of the study as follows:

3.1.1 Baseline Assessment Phase

The baseline phases spanned from March 2012 to December 2012. In March 2012, a meeting was held at the Municipal Health Directorate (MHD) to discuss the research proposal with the Metropolitan Health Management Team (MHMT). After the meeting the MHD gave approval for the study to be carried out in the metropolis as it fitted into one of their major challenges in health care delivery. The Metropolitan Health Director then circulated memos to all facilities within its catchment area informing them about the project and urging them to support the research team.

To assess the current situation pertaining to RHIS, a cross sectional study was conducted to provide information to inform the intervention. In June 2012, three Research Assistants were recruited and trained on basic research methods and interpretation of research protocols and tools. After a successful training and role plays, the research team embarked on pre-test of the data collection tools and subsequent baseline data collection

in July 2012. Data entry screen was developed soon after the pre-test to allow for immediate data entry after the completed questionnaires are verified and validated.

Based on the baseline results, in August 2012, a training module was designed consisting of four modules:

- Module 1: Review of RHIS principles, Assumptions and benefits
- Module 2: Improving RHIS data quality
- Module 3: Data analysis, Interpretation and use of RHIS
- Module 4: Model for Improvement, & Application of QI tools

The module was pre-tested and updated in September 2012.

In January 2013, the baseline findings were disseminated to stakeholders made up of health facilities representatives and the MHMT at the MHD. The hospital representatives were tasked to nominate DQIT from their facilities to act as champion in RHIS improvement process.

In April 2013, an abstract entitled "Competencies Gap Analysis of Health Staff Performance in Health Information System Tasks: The case of Ejisu-Juaben Municipal in the Ashanti Region of Ghana"- which was an excerpt from the baseline findings- was accepted and presented at Academy for Healthcare Improvement Conference with the theme "Doing Research at the Front Line of Improving Health Care" in Arlington, Virginia, 2013.

Quality Improvement Methods

Three principal improvement methods were used to improve data quality and use: the Model for Improvement and Learning Networks among health staff in the municipality.

Model for Improvement

The project used the primary health systems intervention, the "Model for Improvement" (Langley et al, 2009: Figure 7).

The Model for Improvement is a structured approach to help organizations that seek to improve assess and identify opportunities to enhance their current performance, offering a process for generating new ideas and better practices.

The Model asks health facilities these questions:

What were we trying to accomplish?

The study intended to improve data quality and use in Ejisu Juaben Municipal Health System to promote evidence-based decision making which is an ingredient for health service planning and decision making. The study guided each local QI team from sub-municipal health directorate and health facilities to develop their own specific aims and sub-aims to meet this overall project aim during initial Learning Network meetings. The study worked closely with the local QI teams to ensure that their aims and sub-aims set during learning sessions were focused and accomplished by applying the model for improvement.

How would we know that a change is an improvement?

Improvement depends on timely, accurate and reliable data. A robust system that allows for timely and accurate collection, transmission (to central data assembly points), collation, translation and feedback of data is a critical component of an effective improvement intervention. A set of measures that track the data elements were outlined and developed during the intervention stage of the study. Working primarily with an element and indicator set that is already in place within the Municipal Health System, the study worked with facilities to collect high-quality data with specific focus on key maternal and child health programs. The study also developed a set of quarterly project reports for the municipal health leadership as well as site-specific process performance reports (line charts and bar charts) to guide activities of the nursing supervisors and clinics staff.

What changes could we make that would result in improvement?

A key tool to improving systems of care is to provide "process maps" that allow clinic staff and supervisors to understand the dependent actions that are required to improve routine health information system (example shown in Figure 1). Each process and the steps between processes represent a potential failure point, or an opportunity for improvement. Data systems were designed to track each of the processes at each site to identify these failure points. Data Quality Improvement Process team and key contacts in the clinics and hospitals were trained by *the project* to interpret process performance data,

how to solicit change ideas from the front-line staff to improve those processes, and how to lead rapid iterative Plan-Do-Study-Act (PDSA) cycles to test those change ideas.

3.1.2 Intervention Phase

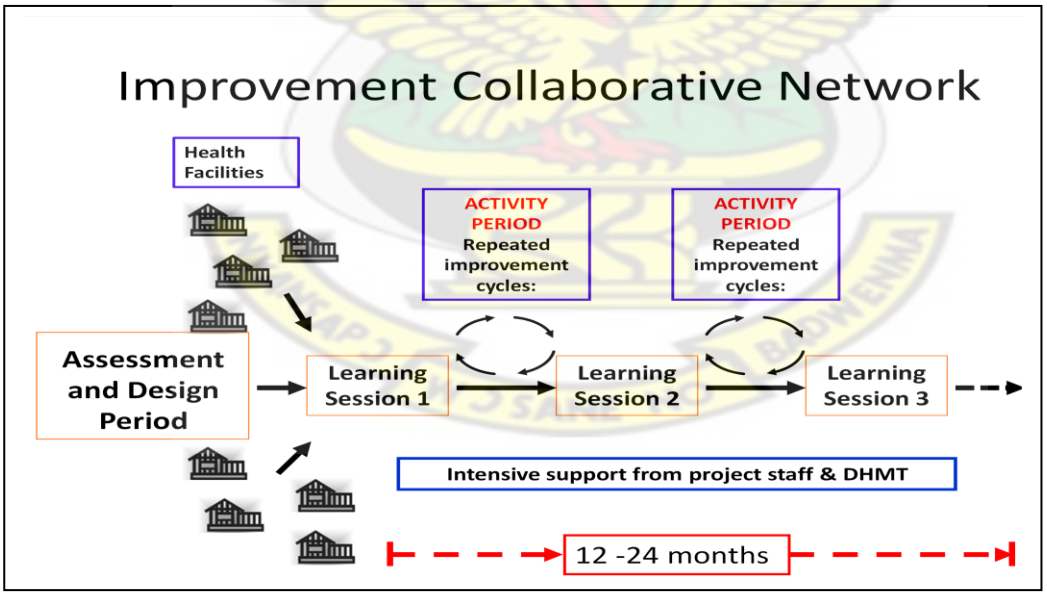
The intervention lasted for 12 months; from January 2013-December 2013. Data Quality Improvement Team (DQIT) made up of four-member each were selected from Municipal Health Directorate and five Sub-municipal Health Directorates. In January 2013, the DQIT were trained using the project designed training module. The objective was to build capacity of DQIT to enhance their knowledge and skills to undertake RHIS improvement projects, with particular reference to competencies in checking data quality, perform calculations, interpret results, and use results.

The DQITs were given additional training in applying QI tools such as Model for Improvement (PDSA), and Process Mapping. They were also trained on how to define data quality, measure data quality using Lot Quality Assurance Sampling (LQAS); identify causes of gaps using the cause and effect diagram. The skills acquired supposed to empower them to apply the quality improvement process to address gaps in the RHIS performance. They were tasked to perform RHIS tasks in their respective facilities while a Researcher, in collaboration with the MHD follow-up using observation checklist to offer support through both mobile mentoring (mobile phone calls) and onsite coaching and mentoring. In June 2013, first learning session was held at the MHD where each DQIT presented progress of their RHIS improvement work. During the learning session,

participants shared experiences. Lessons learnt were used to redesign strategies to either maintain achievements and also to improve performance through the improvement cycle (i.e. **P**lan – **D**o – **S**tudy – **A**ct).

Improvement Collaborative Network

A Collaborative Network is a means of accelerating peer-to-peer learning and large-scale improvement. Frontline data quality improvement teams were convened at Learning Sessions (LS) every four months to acquire QI knowledge and skills and to share with, and learn from one another, progress in testing data quality improvement change ideas. LSs were interspersed with Activity Periods (APs) during which the MQITs, with support from their managers and the project staff, developed, tested and assessed change ideas to improve RHIS processes as indicated in Figure 8. Figure 8



Source: Project Fives Alive!, 2008

3.1.3 Endline Assessment Phase

The Endline assessment lasted for 3 months; January 2014-March 2014. In January 2014, endline, a meeting was held at the Municipal Health Directorate to discuss endline research proposal. The Metropolitan Health Director then circulated memos to all facilities within its catchment area for support during the evaluation.

In February 2014, endline data collection tools were reviewed and updated based on feedback from the baseline assessment to ensure validity and consistency. Three Research Assistants were recruited and trained for three days as was done during the baseline. After a successful training, the research team pre-tested the tools and revised the data collection tools prior to endline data collection. Data entry screen was modified to accommodate both the baseline and endline data for easy comparative analysis. In March 2014, endline, analysis was carried out to determine change in performance of RHIS indicators in both the baseline and endline surveys.

3.2 Profile of Study Area

The study was carried out in the Ejisu-Juaben Municipality in the Ashanti Region. Ejisu-Juaben Municipal is one of the 27 districts and municipals in Ashanti Region. It is located in the South-Eastern part of the Region and shares boundaries with Kwabre, Afigya-Sekyere, Sekyere East and West to the North; Asante Akim North and South Municipal to the East, Bosomtwe District to the South and Kumasi Metropolis to the West. The municipal has a projected population of 146,762 based on 2010 population and housing

census with growth rate of 3.4% per annum (Population and Housing Census, Ghana Statistical Service, 2010). There are 91 communities. The road network is fairly good with few tarred roads. The rest are mainly feeder roads, some of which are not motorable especially during the rainy season. Some of the communities are extremely hard to reach during the rainy season. The only means by which these communities could be reached is by boat, swimming and walking.

For the purpose of Health Administration the municipal has been divided into five sub-municipals namely; Achiase, Bomfa, Ejisu, Juaben and Kwaso. All the communities within the municipal have Community-Based Surveillance Volunteers (CBSVs). The total number of CBSVs is 200. The total staff strength is 247. There are Twenty-Six health facilities with eighty-one outreach points. The distribution of the various types of health facilities in the municipal is described in Table 1.1 below.

TABLE 3.1: HEALTH FACILITIES

TYPE	NUMBER
Hospital	8 (Government -3 & Private -5)
Health Centres	4
Government Maternity Home & Clinic	3
Private Maternity Homes	5
Clinics	5 (Mission- 4 & Private-1)
Community-based Health Planning & Services (CHPS) Compound	1

Source: Annual Report, Ejisu-Juaben Municipal Health Directorate, 2012

3.3 Study Population

The study population comprised health staff and management who collect or use data routinely in all health facilities: both private and public, in the Ejisu-Juaben Municipality. The staff were mainly females, 65% and males 35%. Majority, 70% had worked in Ghana Health Service for an average of 4.8 years. All facilities including private, mission and public health facility staff who had worked for at least 6 months, involved in data generation, processing and use, working in the study area and consented to participate were included. Potential participants who did not meet the inclusion criteria were excluded.

3.3.1 Sample Size

Total number of 151 health staffs were recruited into the study. However, only 141 consented to participate. Thus all analysis and conclusions are based on the 141 and not 151.

3.3.2 Sample size calculation

The null hypothesis is that the mean of individual differences in RHIS performance level will be zero. If the effect of the Quality Improvement Process (QIP) is as large as a mean difference of -15, then the study wished to have power of 0.95 for rejecting the null hypothesis. Because study expect an improvement in RHIS performance, a one-sided test with $\alpha = 0.025$ was used. From past studies, the standard deviation of the difference in RHIS performance levels is estimated as 51. STATA statistical software (version 11)

was then used to estimate sample size for one-sample comparison of mean to hypothesized value as follows:

Test Ho: m = 0, where m is the mean in the population

Assumptions:

alpha = 0.0250 (one-sided)

power = 0.9500

alternative m = -15

standard deviation = 51

Therefore estimated required sample size:

n = 151

Hence the sample size used for the study is 151 participants

3.3.3 **Sampling Technique**

All health facilities; both private and public, in the Ejisu-Juaben Municipality were included in the study. The sample size of 151, which represent 75 percent of the total number of staff who were engaged in RHIS processes. The same percentage was used to calculate the sample size for each facility.

3.3.4 **Recruitment process**

In order to give equal opportunity to all the eligible staff to participate in the study, a simple random sample was used to select participant. At each facility numbers from 1 to the last number of total staff who were engaged in RHIS process was written in piece of

paper and folded into a bowl. The bowl was then shaken until the papers mixed up to ensure the numbers were arranged in random order. Then each staff was asked to pick a paper from the bowl without replacement and the recruiter record the assigned number on the paper. This process continued until all staffs are covered. When this was done, staff who picked the numbers within their sample size were enrolled as potential participants in the study. For instance in Ejisu Government Hospital 75 percent of the 28 eligible participants was 21 and so staffs who picked numbers from 1 through 21 were enrolled as potential participants in the study.

The selected staff who voluntarily consented to participate, were included in the study and they constituted data quality improvement team in their respective facilities.

Table 3.2: Summary of sampling

Health facility	Total staff[1]	No. sampled
Achiase Health Centre	5	4
Bomfa Health Centre	5	4
Nobewam SDA Clinic	12	9
Apromase Government Clinic	4	3
Bonwire Clinic	5	4
Bonwire Maternity	2	2
Dakopon Hospital	6	5
Ejisu Government Hospital	28	21
Fumesua Clinic	4	3
Global Evangelical Hospital	18	14
Humble Maternity Home	3	2
Madona Clinic	5	4
Paradyse Hospital	8	6

[1] The total number of staff refers to staff and management who handled routine data collection, analysis and use of RHIS for decision making. The numbers were quoted by facility management and could not be verified at the Municipal Health Directorate.

Supercare Hospital	6	5
Divine Hospital	15	11
Yaa Asantewaa Clinic	5	4
Juaben Hospital	35	26
Church of God	7	5
Kwaso Health Centre	7	5
Onwe Government Hospital	16	12
Reverend Walker Medical Centre	5	4
Total	200	151

Source: Annual Report, Ejisu-Juaben Municipal Health Directorate, 2012

They were then taken through an informed consenting process and those who voluntarily consented were enrolled. These steps were repeated in all health facilities till the required sample size was arrived at. Health facilities and staff in the study area who refused to consent and those outside the study area were excluded.

3.4 Data Collection Techniques and Tools

Data were obtained from health facilities and staff surveys administered in Ejisu-Juaben Municipality. The survey instruments used were adapted from those in the PRISM tool package (Hozumi *et al*. 2002; JICA HMIS Study Team 2004), Uganda (Aqil 2004; Aqil *et al*. 2008) and further refined in China (Aqil *et al*. 2007a,b).

In order to measure RHIS performance, processes and determinants and their relationships described under the PRISM framework, four tools were developed and standardized; (1) the RHIS performance diagnostic tool; (2) the RHIS overview tool; (3) the RHIS management assessment tool; and (4) the organizational and behavioural

assessment tool. The research used varying techniques such as interviews, observations and pencil paper tests techniques to collect data.

3.4.1 **RHIS performance diagnostic tool**

This tool was used to determine the overall level of RHIS performance, looking separately at quality of data and use of information. The tool specifically measured: (a) RHIS performance; (b) status of RHIS processes; (c) the promotion of a culture of information; (d) supervision quality; and (e) technical determinants. The tool collected data based on records observation, which is considered the gold standard and therefore confirms its validity. The tool provided opportunities to compare RHIS performance with status of RHIS processes and other determinants, as well as to identify strengths and gaps for appropriate actions/interventions in the municipality.

3.4.2 **RHIS overview tool**

This tool was used in mapping sections of the RHIS overview to provide information on all existing routine information systems, their interaction and overlaps. Thus, it identified redundancies, workload, fragmentation and level of integration, which created demand for integrated information systems development. The review also provided information on the complexity and user-friendliness of the registers and forms. Lastly, an information flow chart provided information about horizontal and vertical transmission and decision-making nodal points.

The office/facility checklist assessed resource availability at the facility and higher levels. The tool was used to collect data based on records observation and interviews. A comparison of resources availability (human, equipment, logistics) with RHIS performance provided information on whether resources were appropriate and creating their intended effects. The level of integration of various information systems was then highlighted.

3.4.3 **RHIS management assessment tool (MAT)**

This tool was used to take stock of RHIS management practices (Aqil et al. 2009). Since RHIS resource availability is assessed under the RHIS overview tool, it is not included under this tool. The practices measured relate to different functions such as: (a) governance; (b) planning; (c) training; (d) supervision; (e) use of performance improvement tools; and (f) finances. The RHIS management assessment tool is part of the organizational determinants (Figure 1). The tool was used to collect data from records observations. Besides providing information on the level of RHIS management functions, it indirectly showed senior management's commitment to an efficient and effective RHIS and premise that it is unlikely that poor RHIS management practices will lead to better RHIS performance.

3.4.4 **RHIS organizational and behavioural assessment tool (OBAT)**

This tool was used to identify organizational and behavioural factors that affect RHIS performance (Figure 1). It was used to measure the level and role of behavioural factors

such as motivation, confidence levels, demand for data, task competence and problem-solving skills, while organizational variables included promotion of a culture of information and rewards (Aqil et al. 2009). The tool was self-administered by respondents in a paper and pencil test. The OBAT compared RHIS knowledge, skills and motivation with actual performance, and identified the strengths and weaknesses of these behavioural factors. Similarly, it was possible to determine to what extent organizational factors influence performance directly or indirectly through behavioural factors (Figure 1).

3.4.5 **Limitations of Data Collection Tools**

With regards to assessment of RHIS performance, the data quality and information use indicators are not all inclusive. The diagnostic tool should be adapted to meet the needs of the RHIS in a given country to reflect their particular objectives and data processes. Before implementing the adapted questionnaires, there is the need to pre-test them and make final adjustments.

In assessing RHIS management, missing information and/or unavailable details may make it difficult to map all information systems. However, the emphasis should be on essentials details and finding commonalities. If more details are needed/become available the sheet can be modified to include them.

With regards to RHIS Organizational and Behavioural assessment, the tool addresses major knowledge, skills and perceptions of the promotion of a culture of information on a

broad scale, and needs to be adapted to include other important areas as identified by senior management.

3.5 Study Variables

Objective	Dependent Variable	Independent variables	Conceptual Definition of independent variable	Scale of measurement	Data Collection Method	Type of statistical analysis
To assess the existing routine health information management system	RHIS Processes	Data Recording	Up-to-date record keeping of the monthly reports at the facility level	Ordinal	Questionnaire, review of facility records, observations	series of continuous or Likert scale indicators For each dimension, all indicators and their ratings were added together and then divided by the total number of indicators and multiplied by one hundred to obtain a percentile score. Descriptive analysis
		Data Accuracy Check	Comparing reported figures with the primary source (e.g. registers) to see if they are same	Ordinal		
		Data Completeness	Availability of monthly reports on all services provided at the facility & completeness of data on all services without blank space.	Ordinal		
		Data Transmission /Data Processing/Analysis	Existence of a database /register/notebook to enter data and transmission to the monthly summary reports. & evidence of data analysis	Ordinal		
		RHIS Report Production	Confirmation of whether the facility put together data generated into a Report	Ordinal		
		Display of information	Evidence of display of charts of key indicator on a dashboard	Ordinal		
		Discussion and	Evidence of	Ordinal		

Objective	Dependent Variable	Independent variables	Conceptual Definition of independent variable	Scale of measurement	Data Collection Method	Type of statistical analysis
		Decision on RHIS information	whether a routine meeting mechanism exists at the facility level where RHIS is discussed and decision made based on RHIS			
		Supervision by the municipal/sub-municipal health office	Frequency of supervisory visits by municipal/sub-municipal offices to facilities in a year .	Ordinal		
	RHIS Determinants (Culture of information) Self - Confidence in performing RHIS tasks	Promotion of use of RHIS information	Evidence of promoting the use of information. Management must show staff that they value the use of information and they will create mechanisms and processes to do that	Ordinal		
		Promotion of evidence-based decision-making	Evidence of decision-making based on RHIS. Management must encourage staff to make evidence base decision-making	Ordinal		
		Promotion of rewards for better performance	Enabling organization environment that reward staff for better performance	Ordinal		
		Promotion of feedback	Structural feedback system from supervisors to providers on how to improve RHIS.	Ordinal		
		Promotion of problem-solving		Ordinal		
		Promotion of a sense of responsibility		Ordinal		
		Promotion of accountability/empowerment	Empowerment of staff to take their own decision and made accountable for any	Ordinal		

Objective	Dependent Variable	Independent variables	Conceptual Definition of independent variable	Scale of measurement	Data Collection Method	Type of statistical analysis
			consequences			
		Motivation		Ordinal		
		Perceived self-efficacy in analysing data	Level of confidence in calculation of percentages/rates correctly, and plotting of charts	Interval	Questionnaire	Cronbach's alpha Pearson correlation coefficients t-tests
		Perceived self-efficacy in interpreting data	Level of confidence in explaining findings and their implication	Interval		
		Perceived self-efficacy in using information	Level of confidence in using data for making various types of decision and providing feedback	interval		
To evaluate the impact of the modelled DQIP on RHIS performance	RHIS Performance	Actual self-efficacy in analysing data	calculation of percentages/rates correctly, and plotting of charts	Interval	measured by a pencil and paper test that measured the ability of respondents to perform calculations, and to interpret and use RHIS results	Cronbach's alpha Pearson correlation coefficients t-tests
		Actual self-efficacy in interpreting data	By explaining findings and their implication	Interval		
		Actual self-efficacy in using information	using data for making various types of decision and providing feedback	interval		

3.6 Measurements and Data Analysis

3.6.1 Measurements

A key measurement issue of the study concerns the multidimensional nature of most of the RHIS determinants depicted in the conceptual framework. As described above, most inputs of RHIS performance (technical, organizational, and behavioral factors) are measured through a series of continuous or Likert scale indicators, which are then used to generate indices following the PRISM analysis guidelines [Aqil et al. 2007b].

The self-efficacy scale (behavioural) incorporated four dimensions: collection, analysis, interpretation and use of data. Each dimension was based on two to four indicators, as specified in the results section. The respondents were asked to rate their self-efficacy for various RHIS tasks on a scale of zero to one hundred. For each dimension, all indicators and their ratings were added together and then divided by the total number of indicators and multiplied by one hundred to obtain a percentile score.

The scale of the index of motivation (behavioural) was based on seven items and a percentile score was calculated using the same procedure described above for the culture of information score. The scale incorporated indicators on a variety of dimensions, including perceptions of whether RHIS data were: satisfying; needed to monitor facility performance; and appreciated by fellow workers and superiors. RHIS task competence (behavioural) was also measured by a pencil and paper test that measured the ability of respondents to perform calculations, and to interpret and use RHIS results.

In assessing whether health facilities promote a culture of information, the construct was operationalized as having five dimensions - the promotion of: 1) data quality; 2) evidence based decision making and accountability; 3) reward mechanisms for good work; 4) the use of information; and 5) efforts and activities to change things for the better. Each dimension was measured by two to eight items describing behaviours that are thought to directly or indirectly promote a culture of information. Each action statement or item related to these dimensions was assessed using a Likert scale of agreement, ranging from one (very weak) to seven (very strong). All items belonging to a specific dimension and

their ratings were added together and divided by the total number items and multiplied by one hundred to create an overall percentile score.

Each of action statement was dichotomized as “Yes/No” based on their ordinal response. All items belonging to a specific dimension and their ratings were added together and divided by the total number items and multiplied by one hundred to create an overall percentile score.

To measure the two components of RHIS performance - data quality and the use of information - indices were constructed based on indicators common to the 2012 and 2013 surveys. Observation of records for checking data quality was considered the gold standard for measuring RHIS performance and their validity has been well established [Odhiambo-Otieno, 2005]. To measure the availability and accuracy of RHIS data, this study compared the data contained in monthly RHIS reports with those of facility registrars for two types of services: Maternal and Child Health Services. For each service, percentile scores were generated to measure data availability and accuracy.

Similarly, the use of information was observed through a review of documents that verified whether and how RHIS data were used in decision-making processes. The use of RHIS information was operationalized by a series of dichotomous indicators, including: whether RHIS information was discussed at staff meetings; whether RHIS information was used to help make decisions; whether RHIS information was used to help take follow-up actions or to refer issues for action; and whether updated information on various topics was displayed.

Following the PRISM analysis guidelines, these indicators were aggregated to generate a composite continuous index of the use of RHIS information [Bandura, 1977]. This approach gave equal weight to each of the indicators used in the index.

Specifically, data were collected only on whether RHIS information was displayed through maps, charts and tables, and not on whether RHIS information was used in decision-making processes. To create an index of the use of RHIS information for data analysis, study created a dichotomous indicator of whether a facility had on display a map, chart or table based on RHIS data at the time of the survey.

The study tested whether this assumption made a difference in the analysis by applying principal components analysis (PCA) to generate the index. PCA is a well-established method to create summary indices using weighted sums [Berry, Poortinga; 1992]. The PCA generated the weights that maximized the variance of the resulting composite index for the RHIS data use, the advantage of the PCA approach over the simple addition approach is that it imposes fewer restrictions - the PCA approach generates weights while the simple aggregation approach is just a weighted sum where all weights are restricted to have the value of one.

3.6.2 **Inferential Statistics**

The internal consistency of the self-efficacy scale and the seven dimensions of the culture of information scale were estimated using Cronbach's alpha. Separate sets of Cronbach's alpha coefficients were calculated for the baseline and endline samples. The test-retest reliability and sensitivity of the scale scores on self-efficacy, motivation and culture of

information was assessed by conducting t-tests on the equality of the means from the baseline and endline surveys. Typically, test-retest reliability is conducted by comparing the scores of each scale among a matched sample of individuals over a short time interval. However, our data were gathered 12 months apart and consisted of individuals who may or may not be the same, but could not be matched.

This prevents the study from generating correlation coefficients of reliability using matched respondents. As a result, the study took an alternative approach by conducting test-retest analysis based on group means, along the lines suggested by Cooke and Szumal (1993) [Berwick, 1996]. One potential threat to the internal validity of these test-retest results is that there may have been RHIS interventions introduced during the period between the surveys that contributed to real changes in the levels of the scales investigated. The study explored this issue in the discussion section. The analysis was carried out using Stata Statistical Software: Release 11 [Boone, Aqil; 2008].

3.6.3 **Hypothesis testing**

The **ttesti** command in STATA statistical software version 11 was used to perform one-sample means-comparison tests for equality of means. ttest performs t tests on the equality of means. In the first form, ttest tests that variable name (varname) has a mean of number (#). In the second form, ttest tests that varname1 and varname2 have the same mean, assuming unpaired data. In the third form, ttest tests that varname1 and varname2 have the same mean, assuming paired data. In the fourth form, ttest tests that varname has the same mean within the two groups defined by group variable (groupvar). ttesti is the

immediate form of ttest. An immediate command is a command that obtains data not from the data stored in memory but from numbers typed as arguments. Immediate commands, in effect, turn Stata into a glorified hand calculator. At STATA command prompt you type: ***ttesti n1 mean1 sd1 n2 mean2 sd2***

Assumptions

Let diff be the difference between means of information use in the baseline and endline assessment

Let mean(x) be the mean of endline assessment

Let mean(y) be the mean of baseline assessment

Then diff = mean(x) - mean(y)

Hypothesis testing for respondents' actual competency in analysis of data

Null Hypothesis is given by: Ho: $diff_{\boldsymbol{analysis}} = 0$

Alternative Hypothesis is given by: Ha: $diff_{\boldsymbol{analysis}} < 0$

Assumption: 95% confidence level (i.e. the null hypothesis is rejected when $\boldsymbol{p > 0.005}$)

Hypothesis testing for respondents' actual competency in interpretation of data

Null Hypothesis is given by: Ho: $diff_{\boldsymbol{interpret}} = 0$

Alternative Hypothesis is given by: Ha: $diff_{\boldsymbol{interpret}} < 0$

Assumption: ***95%*** confidence level (i.e. the null hypothesis is rejected when $\boldsymbol{p > 0.005}$)

Hypothesis testing for respondents' actual competency in use of information

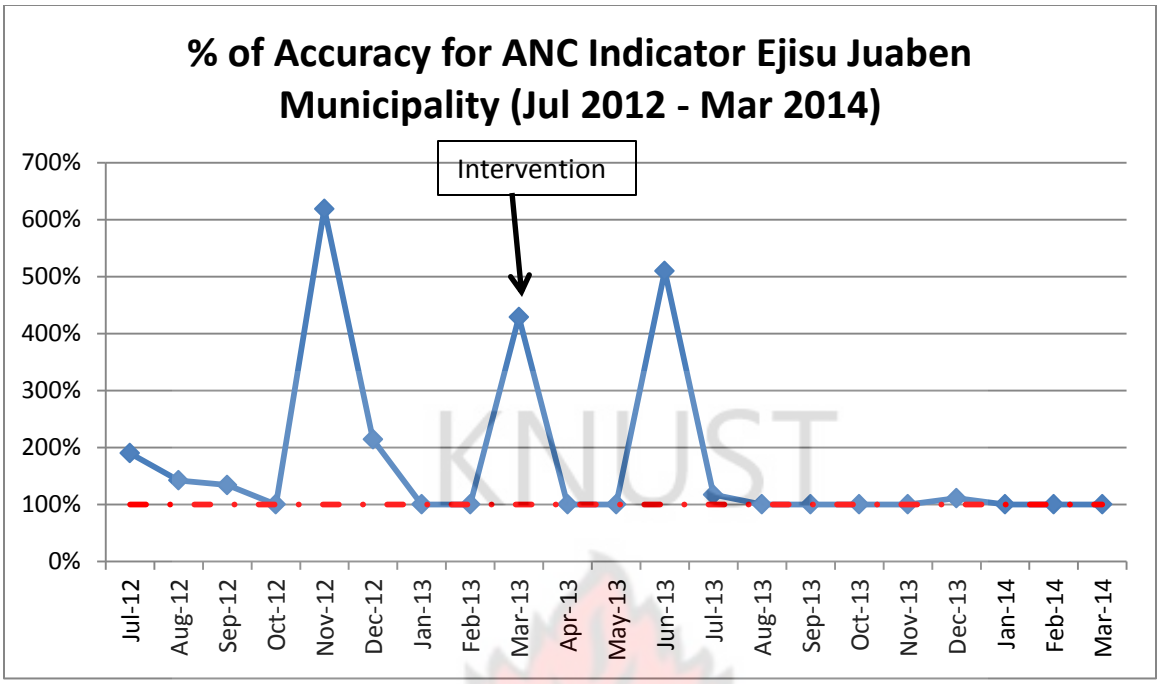
Null Hypothesis is given by: Ho: $diff_{\boldsymbol{interpret}} = 0$

Alternative Hypothesis is given by: Ha: $diff_{\boldsymbol{interpret}} < 0$

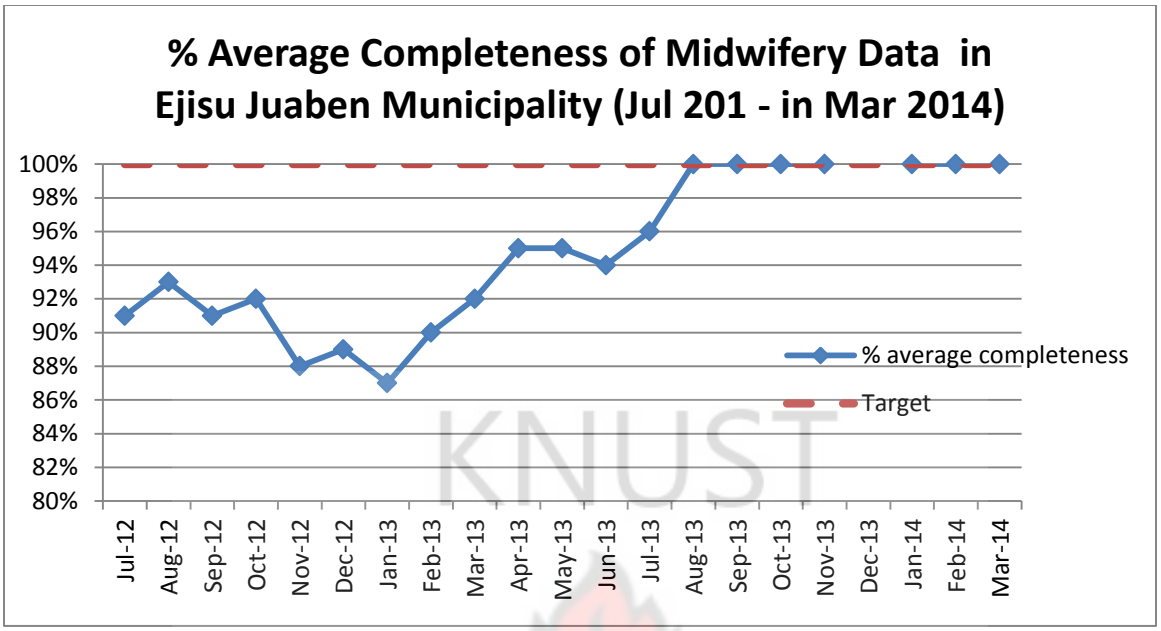
Assumption: ***95%*** confidence level (i.e. the null hypothesis is rejected when $\boldsymbol{p > 0.005}$)

3.6.4 **Control Chart**

Control charts were used to perform time series analysis for monitoring monthly changes in data quality improvement in some selected key MCH indicators. **Control charts**, also known as **Shewhart charts** or **process-behaviour charts**, in statistical process control are tools used to determine whether or not a business process, in this case, RHIS process, is in a state of statistical control. For instance the control chart was used to monitor performance of percentage of ANC data accuracy by comparing reported figures with that of the register overtime, as indicated in graph below. Data accuracy is given by the difference between reported figures and reconstructed figures in the register multiply by 100%. If reported figure equals that of the register then we have 100% accuracy. On the other hand if percentage of accuracy exceeds 100% then we have over reporting. Under reporting occur when percentage of accuracy is below 100%. Chart 1 shows an improvement in ANC data accuracy from July 2013 to March 2014 after intervention was introduced in March 2013.



Data completeness means that health institutions (sub-municipalities/facilities) are submitting each required summary sheet to the Municipal Health Management Team (MHMT) every month and that all required data elements are completed on Midwife Returns Forms submitted. For instance control chart used to monitor data completed in the midwifery return forms indicated improvement of data completeness over a period after intervention in March 2013.



3.7 Ethical Considerations

The study protocol was submitted to the Committee for Human Research Publications and Ethics (CHRPE) of Kwame Nkrumah University of Science and Technology for clearance. Permission was also sought from the Municipal Health Directorate to implement the study. The research team was introduced to all the municipal and Sub-municipal health facilities by the Municipal Director of Health. The heads of the Sub-Municipalities health facilities in consultation with the Municipal Health Director helped the research team to recruit the study participants for implementation of the study.

The selected participants were briefed about the study's objectives, potential risks, benefits, the role of the participants and their freedom to participate and withdraw at any stage of the study. Participant information leaflet were distributed to potential participants

to read and ask questions or make comments. Those who agreed to participate were asked to sign an informed consent form to confirm their willingness to be part of the study. The contact address of the Research Team was given to participants for future contacts if they so wished.

3.8 Assumptions of Study

This study assumed that once staff are trained in data quality improvement protocol they would apply the principles continuously to improve their data and also use the improved data for planning and decision-making. Data quality improvement team in the municipal would embark on quarterly data quality assessment at the facility level. Resources such as motorbike/vehicle or fuel would be made available for quality improvement team for field visits on quarterly basis. The study further assumed that data quality improvement issues would be incorporated into the municipal health directorate weekly meetings

3.9 Reliability and Validity

Questionnaires for the study were pre-tested at Mampong in Sekyere West Municipality, which is not part of the study area but has common characteristics with Ejisu-Juaben Municipality. Based on feedback from the field pre-test, the tools were modified to ensure its suitability for the study. Research Assistants were given 3-day training on the research protocol and data collection tools. This was important to make them familiar with the tools and the expected way of questionnaire administration to reduce inconsistencies and biases. To ensure data quality, data verification was conducted for

randomly selected administered questionnaires. Also, data validation checks were included in the data entry software to minimize data entry errors. Data quality assessment protocol was used to assess data quality to ensure reliable procedure for data quality improvement at the health facilities.

3.10 Internal consistency

In adapting the PRISM data collection instruments, face and content validity were assessed through a review and consultation with DHMTs, RHMT and CHIM. The diagnostic tool that checks data quality and information use through record review and observation is considered to be gold standard for assessing accuracy, as is the facility checklist which is used to measure the availability of infrastructure and equipment through observation. Thus, the validity of these tools is well-established. On the other hand, the reliability and validity of the organizational and behavioural assessment tool, which comprised scales of the promotion of a culture of information, motivation, and self-efficiency, was assessed through analysis of internal consistency and by testing the hypothesized relationships depicted in the PRISM conceptual framework. Cronbach's alpha was used to measure the internal consistency of these scales, all hypothesized to be determinants of RHIS performance (Table 4.4.1). In exploratory research, alpha scores of 0.6 or higher are typically accepted as showing adequate reliability and alpha score 0.7 or higher as showing high reliability (Baal et al. 2007; Buckland and Florian, 1991).

3.11 Limitations of the study

The study did not include CBSV in the intervention as they need special attention and time which at the instance of the study could not be catered for. It was expected that the Municipal Data Quality team would embarked on facility level data quality assessment quarterly but this was done regularly due to lack of resources. Arrangement for resources like fuel and bicycle to move to the sub-municipalities was not adequately done. Data quality issue would be discussed at the municipal weekly meetings but this was not also done regularly. Health staff took the opportunity of their outreach programmes to supervise though this was not enough. These notwithstanding the scientific rigor processes followed by the research team insulated the findings in terms of validity and reliability.

Uncontrolled before and after studies are relatively simple to conduct and are superior to observational studies; however, they are intrinsically weak evaluative designs, (Russell and Grimshaw, 1992) as secular trends or sudden changes make it difficult to attribute observed changes to the intervention (Cook and Campbell, 1979). Furthermore, in such studies, the intervention is confounded by the Hawthorne effect [the non-specific beneficial effect on performance of taking part in research] (Moser and Kalton, 1979) which could lead to an overestimate of the effectiveness of an intervention. There is also some evidence to suggest that the results of uncontrolled before and after studies may overestimate the effects of interventions.

The simple random sample used is only practicable when the population is relatively small and concentrated in a small geographical area and where the sampling frame is complete.

CHAPTER FOUR

RESULTS

4.0 Introduction

The role of health information in health service planning and management is huge. However, most health staff designated to generation and management of health information may either not have the requisite know-how or have their knowledge rusty due to lack of consistent training. A study was to determine the role of quality improvement process (QIP) Model in enhancing the effectiveness of Routine Health Information System in health service planning in the Ejisu-Juaben Municipality. The following are the results from the baseline and post intervention involving 141 health staff.

4.1 Characteristics of Respondents

Table 1a and Table 1b present the background characteristics of respondents respectively. The study begins by briefly describing descriptive characteristics of sample respondents selected in baseline and endline for the self-administered organizational and behavioural questionnaire. Female respondents were more than male. For instance in baselines, 65 percent of respondents were females while 33 percent were males, and 2 percent missing values. Again, in endline, females constituted about 65 percent whereas 35 percent were male. In baseline, 73 percent of respondents had Post Senior High level of education compared to 77 percent in endline.

Table 4.1.1: Characteristics of Respondents

Age Distribution of Respondents				
	Baseline (2012)		Endline (2014)	
Age group	Number	Percentage	Number	Percentage
21-30	97	69	107	76
31-40	12	9	21	15
Above 40	12	9	13	9
Missing	20	14	0	0
Total	141	100	141	100
	Mean: 29.0 **Std Dev:** 8.4 **Range:** 21 – 63		**Mean: 29.6** **Std Dev:** 8.0 **Range:** 21 – 64	
Sex Distribution of Respondents				
Sex	Number	Percentage	Number	Percentage
Male	47	33	49	35
Female	91	65	92	65
Missing	3	2	0	0
Total	141	100	141	100

Source: *2012 and 2014 Survey*

Table 4.1.2: Characteristics of Respondents

Years of Working Experience of Respondents				
	Baseline (2012)		Endline (2014)	
Years	Number	Percentage	Number	Percentage
1-2	46	33	49	35
3-4	36	26	49	35
5+	32	23	43	30
Missing	27	19	0	0
Total	141	100	141	100
	Mean: 4.8 **Std Dev: 5.8** **Range:** 1-36		**Mean:** 5.0 **Std Dev:** 5.4 **Range:** 1 – 37	
Educational Distribution of Respondents				
Level	Number	Percentage	Number	Percentage
JHS	2	1	4	3
SHS	18	13	28	20
Post SHS	103	73	109	77
Missing	18	13	0	0
Total	123	100	141	100

Source: *2012 and 2014 Survey*

Another 13 percent and 20 percent respectively in baseline and endline had Senior High School level of education. The remaining 1 percent and 3 percent respectively in baseline and endline had Junior High School level of education. The mean age of the respondents was 29 years in baseline (varying from 21 to 63 years). Also the mean working experience of respondents in baseline was 4.8 years (varying from 1 to 36 years). On the other hand, the mean age of the respondents in endline was 29.6 years (varying from 21 to 64 years). Again, the mean working experience of respondents in endline was 5 years (varying from 1 to 37 years). The results of the background characteristics suggest no significant difference in sample characteristics in the baseline and endline surveys. With regard to whether respondents had received training in RHIS in the past six months prior to the time of the survey, about 30 percent in baseline compared to 70 in endline respectively claimed they had received some training while 70 percent and 30 percent respectively also said they had not during the same period.

4.2 Routine Health Information Systems Determinants

In assessing whether health facilities in Ejisu-Juaben Municipal Health Service promote a culture of information, the construct was operationalized as having six dimensions - the promotion of:

1) Evidence-based decision-making; 2) Use of RHIS information;

3) Feedback; 4) Problem solving; and 5) sense of responsibility – i.e. efforts and activities to change things for the better; 6) accountability/empowerment, Table 4.2.1.

Table 4.2.1: Item Response Characteristics, Baseline and Endline

Composite indicator	Questions	Responses			
		Baseline (2012)		Endline (2014)	
		No (%)	Yes (%)	No (%)	Yes (%)
Culture of information scales					
Promotion of use of RHIS information	Health department seeks feedback from concerned persons	18 (13)	122 (87)	18 (13)	123 (87)
	Health department emphasizes data quality in monthly report	58 (41)	82 (59)	54 (38)	87 (62)
	Health department discuss conflict openly to resolve them	33 (25)	98 (75)	32 (23)	109 (77)
	Health department seeks feedback from concerned community	31 (22)	108 (78)	31 (22)	110 (78)
	All Above	***35 (25)***	***105 (75)***	***34 (24)***	***107 (76)***
Promotion of evidence-based decision-making	Health department encourages staff to use data to monitor changes in health service indicators	38 (27)	101 (73)	37 (26)	104 (74)
	Health department check data quality at the facility and higher level regularly	28 (20)	112 (80)	26 (18)	115 (82)
	Health department provide regular feedback to staff through regular report based on evidence	43 (31)	96 (69)	42 (30)	98 (70)
	All Above	***36 (26)***	***103 (74)***	***35 (25)***	***106 (75)***
Promotion of rewards for better performance	Health department encourages supervisors to reward good work	-	-	10 (7)	131 (93)
	Health department make staff feel important by recognizing their work	-	-	11 (8)	130 (92)
	All Above	-	-	***11 (8)***	***131 (93)***
Overall promotion of culture of information		**36 (26)**	**103 (74)**	**29 (21)**	**112 (79)**

Source: *2012 and 2014 Surveys*

As indicated in Table 4.2.1, the culture of information at baseline and endline is presented. Each dimension was measured by two to eight items describing behaviours that are thought to directly or indirectly promote a culture of information.

From Table 4.2.1, promotion of evidence-based decision-making was measured by seven items describing behaviours such as: personal liking; superior's directives;

evidence/facts; political interferences; comparing strategic objectives; community health needs; and considering cost. In baseline, 61 percent of respondents perceived promotion of evidence-based decision in the municipal health directorate compared to 57 percent in endline. This change could be partly attributed to the intervention implemented. The results further indicated that decision-makings based on individuals personal liking, superior's directives and political interference reduced from 29, 66, and 23 to 25, 28, and 11 respectively.

The promotion of use of RHIS information was measured by three items describing behaviours such as: staffs are rewarded for good work; use of RHIS for day to day management of the facility; and facilities are directed by management to display data for monitoring their set targets. This indicator recorded 73 percent in baseline and 85 percent in endline, showing about 12 percent improvement in RHIS information usage.

Promotion of feedback which was measured by three items describing behaviours such as: whether the health facilities seek feedback from concerned persons; discuss conflicts openly to resolve them; and seeking feedback from concerned communities served by the facilities. Again, this indicator recorded improvement from 72 percent in baseline to 82 percent in endline, indicating 10 percent increase over the period.

In the case of promotion of problem solving, the study measured it by four items describing behaviours such as: respondents can gather data to find the root cause (s) of

problem; staff can develop appropriate criteria for selecting intervention for a given problem; staff can evaluate whether the target/outcomes have been achieved. There was marginal improvement from 86 percent in baseline to 87 percent in endline. The baseline figure could be attributed to high perceived performance exhibited by respondents with corresponding low self-efficacy at the baseline. The corresponding improvement in staff understanding of RHIS performance indicators after the intervention might have guided their perception objectively in endline.

Promotion of sense of responsibility was measured by four items describing behaviours such as: staff are punctual at work; staff document their activities and keep up-to-date records; and staff feel committed to improving the health status of the targeted population. Post intervention results indicate 9 percent improvement in promotion of sense of responsibility behaviour, 89 percent in baseline and 98 percent in endline.

Promotion of staff accountability/empowerment was measured by five items describing behaviours such as: staff are empowered to make decisions; staff are able to say no to superiors and colleagues for demand or decisions not supported by evidence; staff are made accountable for poor performance; staff feel guilty for not accomplishing the set target performance; and staff admit mistakes for corrective actions. Again, this indicator recorded improvement from 65 percent in baseline to 74 percent in endline, indicating 9 percent increase over the period.

On the dimension of overall perceived promotion of culture of information, the results indicates 74 percent and 79 percent of respondents perceived that the Municipal Health Service promotes culture of information in baseline and endline respectively; showing overall average improvement of 5 percent.

Perceived motivation scale which was measured by six items describing behaviours such as:, collecting information not used for decision making discourage me; collecting information makes me feel bored; collecting information is a meaningful work for me; collecting information give me the feeling that data is needed for monitoring facility performance; collecting information gives me the feeling that it is forced on me; and collecting information is appreciated by co-workers and my superiors. About 59 percent and 60 percent of respondents perceived that the Municipal Health Service motivate staff to perform RHIS related task in baseline and endline respectively. The results show abysmal performance in perceived motivation indicator which suggests more work needs to be done for staff to perform RHIS related tasks.

Table 4.2.1: Item Response Characteristics, Baseline and Endline (Continued)

Composite indicator	Questions	Responses			
		Baseline (2012)		**Endline (2014)**	
		No (%)	Yes (%)	No (%)	Yes (%)
Expanded culture of information scale					
Promotion of evidence-based decision-making	Personal liking	100 (71)	40 (29)	106 (75)	35 (25)
	Superior's directives	47 (34)	92 (66)	102 (72)	39 (28)
	Evidence/facts	37 (27)	102 (73)	10 (8)	131 (92)
	Political interference	105 (77)	31 (23)	125 (89)	16 (11)
	Comparing Strategic objectives	22 (16)	115 (84)	22 (16)	119 (84)
	Community health needs	14 (10)	121 (90)	14 (10)	127 (90)
	Considering cost	48 (36)	87 (64)	39 (28)	102 (72)

	All above	***53 (39)***	***84 (61)***	***60 (43)***	***81 (57)***

Source: *2012 and 2014 Surveys*

Table 4.2.1: Item Response Characteristics, Baseline and Endline (Continued)

Composite indicator	Questions	Responses			
		Baseline (2012)		**Endline (2014)**	
		No (%)	Yes (%)	No (%)	Yes (%)
Expanded culture of information scale					
Promotion of use of RHIS information	Are rewarded for good work	51 (38)	85 (62)	51 (36)	90 (64)
	Use RHIS data for day to day management of the facility	33 (25)	100 (75)	5 (4)	136 (96)
	Facilities are directed to display data for monitoring their set targets	26 (19)	114 (81)	5 (4)	136 (96)
	All above	***37 (27)***	***100 (73)***	***20 (15)***	***121 (85)***
Promotion of feedback	Seek feedback from concerned persons	18 (13)	122 (87)	10 (7)	131 (93)
	Discuss conflicts openly to resolve them	58 (41)	82 (59)	25 (18)	116 (82)
	Seek feedback from concerned community	43 (31)	96 (69)	40 (28)	101 (72)
	All above	***40 (28)***	***100 (72)***	***25 (18)***	***116 (82)***
Promotion of problem-solving	Can gather data to find the root cause(s) of the problem	25 (18)	115 (82)	10 (7)	131 (93)
	Can develop appropriate criteria for selecting intervention for a given problem	32 (23)	106 (77)	20 (14)	121(86)
	Can develop appropriate outcomes of a particular intervention	32 (24)	125 (91)	20 (14)	121(86)
	Can evaluate whether the targets/outcomes have been achieved	32 (23)	134 (95)	22 (16)	119 (84)
	All above	***30 (22)***	***120 (86)***	***18 (13)***	***123 (87)***
Promotion of a sense of responsibility	Are punctual	13 (9)	125 (91)	5 (4)	136 (96)
	Document their activities and keep records	7 (5)	134 (95)	0 (0)	141(100)
	Feel committed to improving health status of the targeted population	26 (19)	109 (81)	6 (3)	135 (97)
	All above	***15 (11)***	***123 (89)***	***4 (2)***	***137 (98)***
Promotion of accountability/empowerment	Are empowered to make decisions	50 (36)	88 (64)	25 (18)	116 (82)
	Able to say no to superiors and colleagues for demand/decisions not supported by evidence	68 (50)	67 (50)	60 (43)	81 (57)
	Are made accountable for poor performance	38 (28)	77 (72)	30 (21)	111 (79)
	Feel guilty for not accomplishing the set/target performance	46 (35)	85 (65)	46 (33)	95 (67)
	Admit mistakes for taking corrective actions	30 (25)	92 (75)	20 (14)	121(86)
	All above	***46 (35)***	***82 (65)***	***36 (26)***	***105 (74)***

Overall perceived culture of information	***36 (26)***	***103 (74)***	***30 (21)***	***111 (79)***

Source: *2012 and 2014 Surveys*

Table 4.2.1: Item Response Characteristics, Baseline and Endline (Continued)

Composite indicator	Questions	Responses			
		Baseline (2012)		**Endline (2014)**	
		No (%)	Yes (%)	No (%)	Yes (%)
Expanded culture of information scale					
Motivation scale	Collecting information not used for decision making discourages me	72 (53)	65 (47)	46 (33)	95 (67)
	Collecting information make me feel bored	108 (79)	29 (21)	141 (100)	0 (0)
	Collecting information is a meaningful work for me	16 (11)	125 (89)	0 (0)	141(100)
	Collecting information gives the feeling that Data is needed for monitoring facility performance	9 (6)	130 (94)	4 (3)	137 (97)
	Collecting information gives me the feeling that it is forced on me	109 (78)	31 (22)	141 (100)	0 (0)
	Collecting information is appreciated by co-workers and superiors	27 (19)	114 (81)	7 (5)	134 (95)
Overall perceived motivation	**All above**	**57 (41)**	**82 (59)**	**56 (40)**	**85 (60)**
Respondents, n	***141***				
Facilities, n	***20***				

Source: *2012 and 2014 Surveys*

4.2.1 **Data Recording**

The overall performance of data recording was 55 percent and 100 percent in baseline and endline respectively. Thus, 75 percent of the health facilities surveyed kept copies of RHIS monthly reports sent to municipal or sub-municipal in baseline as against 100 percent in endline. Fifty percent and 100 percent of facilities had kept copies of their RHIS reports sent to Health Directorate 12 months prior to the baseline and endline

surveys respectively while about 40 percent and 100 percent respectively kept up-to-date OPD register during the same period.

4.3 Routine Health Information Systems Processes

Table 4.3.1: Performance of Facility Routine Health Information System Processes

RHIS Processes	**Baseline (2012)**		**Endline (2014)**	
	Yes	*No*	*Yes*	*No*
Data Recording				
Does this facility keep copy of RHIS monthly reports sent to the municipal/sub-municipal office?	15 (75%)	5 (25%)	20 (100%)	0 (0%)
Number of facilities that had recorded their RHIS monthly reports up to date for the last 12 months	10 (50%)	10 (50%)	20 (100%)	0 (0%)
Does this facility keep outpatient register?	8 (40%)	12 (60%)	20 (100%)	0 (0%)
Overall Data Recording Performance	***11 (55%)***	***9 (45%)***	***20 (100%)***	**0 (0%)**
Data Accuracy Check				
Number of facilities that had their 2 months reported figures in monthly midwifery returns (e.g. ANC registrants, 1st trimester registrants, 4th ANC visits, IPT3) matching the figures in the ANC register.	3 (15%)	17 (85%)	18 (90%)	2 (10%)
Did you receive a directive from the Senior Management/municipal/sub-municipal office to:				
Check the data accuracy at least once in three months?	3 (15%)	17 (85%)	18 (90%)	2 (10%)
Fill the monthly/quarterly report form completely	2 (10%)	18 (90%)	17 (85%)	3 (15%)
Submit report by declared deadline	10 (50%)	10 (50%)	20 (100%)	0 (0%)
Did you receive a directive from the Senior Management/municipal/sub-municipal office that there will be consequences:				
if you do not check the data accuracy	0 (0%)	20 (100%)	20 (100%)	0 (0%)
If you do not fill the monthly reporting form completely	0 (0%)	20 (100%)	20 (100%)	0 (0%)
If you do not submit the monthly report by declared deadline	8 (40%)	12 (60%)	20 (100%)	0 (0%)
Overall Data Accuracy Check Performance	***4 (20%)***	***16 (80%)***	***19 (95%)***	***1 (5%)***

Source: *2012 and 2014 Surveys*

Table 4.3.1: Performance of Facility Routine Health Information System Processes (Continued)

RHIS Processes	Baseline (2012)		Endline (2014)	
	Yes	*No*	*Yes*	*No*
Data Completeness				
Number of facilities that reported the number of data items in the RHIS monthly report that facility need to report in the last two months (this excludes the number of data items for services not provided by this health facility).	8 (40%)	12 (60%)	20 (100%)	0 (0%)
Number of facilities that filled all monthly report without leaving any blank space in at least one of the reports.	0 (0%)	20 (100%)	18 (90%)	2 (10%)
Overall Data Completeness Performance	***4 (20%)***	***16 (80%)***	***19 (95%)***	***1 (5%)***
Data Transmission /Data Processing/Analysis				
Does data processing procedures/tally sheet exist?	20 (100%)	0 (0%)	20 (100%)	0 (0%)
Does the facility produce the following?				
Calculate indicators facility catchment area	20 (100%)	0 (0%)	20 (100%)	0 (0%)
Comparisons with municipal/sub-municipal /national targets	0 (0%)	20 (100%)	18 (90%)	2 (10%)
Comparisons among types of services coverage	6 (30%)	14 (70%)	20 (100%)	0 (0%)
Comparisons of data over time (monitoring over time)	6 (30%)	14 (70%)	20 (100%)	0 (0%)
Does the procedure manual for data collection/definitions exist?	0 (0%)	20 (100%)	10 (100%)	10 (0%)
Overall Transmission/Data Processing/Analysis Performance	***6 (30%)***	***14 (70%)***	***18 (90%)***	***2 (10%)***
RHIS Report Production				
Does this facility compile RHIS Data?	20 (100%)	0 (0%)	20 (100%)	0 (0%)
Does the facility compile any report containing RHIS information?	20 (100%)	0 (0%)	19 (95%)	1 (5%)
Did the facility receive any feedback report from municipal/sub-municipal office on their performance for the last three months?	0 (0%)	20 (100%)	18 (90%)	2 (10%)
Overall RHIS Report Production Performance	***13 (65)***	***6 (35)***	***19 (95%)***	***1 (5%)***

Source: *2012 and 2014 Surveys*

Table 4.3.1: Performance of Facility Routine Health Information System Processes (Continued)

RHIS Processes	Baseline (2012)		Endline (2014)	
	Yes	*No*	*Yes*	*No*
Display of information				
Does the facility display the following data? Please indicate types of data displayed and whether the data are updated for the last reporting period.				
Related to mother health (Table, Graph/Chart)	2 (10%)	18 (90%)	19 (95%)	1 (5%)
Related to child health (Table, Graph/Chart)	5 (25%)	15 (75%)	19 (95%)	1 (5%)
Facility Utilization (Table, Graph/Chart)	2 (10%)	18 (90%)	19 (95%)	1 (5%)
Disease surveillance (Table, Graph/Chart)	2 (10%)	18 (90%)	19 (95%)	1 (5%)
Does the facility have a map of catchment area?	9 (45%)	11 (55%)	20 (100%)	0 (0%)
Does the office display a summary of demographic information such as population by target groups?	9 (45%)	11 (55%)	20 (100%)	0 (0%)
Overall* Display of *Information Performance	***5 (25%)***	***15 (75%)***	***19 (95%)***	***1 (5%)***
Is feedback, quarterly, yearly or any other report on RHIS data available, which provides guidelines/ recommendations for actions?	20 (100%)	0 (0%)	20 (100%)	0 (0%)
If yes, what kinds of decisions are made in reports of RHIS data/information for actions? Please check on types of decision based on types of analyses present in reports.				
Types of decisions based on types of analyses				
Review strategy by examining service performance target and actual performance on month to month comparisons	4 (20%)	16 (80%)	17 (85%)	3 (15%)
Review facility personnel responsibilities by examining service target and actual performance on month to month comparisons	3 (15%)	17 (85%)	16 (80%)	7 (35%)
Mobilization/shifting of resources based on comparison by services	4 (20%)	16 (80%)	19 (95%)	1 (5%)
Advocacy for more resources by comparing performance by targets and showing gaps	7 (35%)	13 (65%)	19 (95%)	1 (5%)

Source: *2012 and 2014 Surveys*

Table 4.3.1: Performance of Facility Routine Health Information System Processes (Continued)

RHIS Processes	Baseline (2012)		Endline (2014)	
	Yes	*No*	*Yes*	*No*
Discussion and Decision on RHIS information				
Does the facility have routine meetings for reviewing managerial or administrative matters?	20 (100%)	0 (0%)	20 (100%)	0 (0%)
Number of facilities that meet at least once during the last three months?	20 (100%)	0 (0%)	20 (100%)	0 (0%)
Is an official record of management meetings maintained?	20 (100%)	0 (0%)	20 (100%)	0 (0%)
If yes, please check the meeting records for the **last three months** to see if the following topics were discussed:				
Discussion on Management of RHIS, such as data quality, reporting, or timeliness of reporting	2 (10%)	18 (90%)	20 (100%)	0 (0%)
Discussion on RHIS findings such as patient utilization, disease data, or service coverage, medicine stockout	3 (15%)	17 (85%)	20 (100%)	0 (0%)
Discussion on any decisions made based on the above discussions?	0 (0%)	20 (100%)	20 (100%)	0 (0%)
Discussion on any follow-up action taken place on the decisions made during the previous meetings?	0 (0%)	20 (100%)	20 (100%)	0 (0%)
Promotion and Use of RHIS information by the sub-municipal/municipal/higher level				
Number of facilities that received annual/monthly planned targets based on RHIS information	2 (10%)	18 (90%)	20 (100%)	0 (0%)
Did records of facility of last three months show that municipal/sub-municipal /senior management issued directives on use of information	0 (0%)	20 (100%)	20 (100%)	0 (0%)
Did facility receive municipal/sub-municipal /national RHIS office newsletter/report in last the three months showing success stories of use of information	0 (0%)	20 (100%)	0 (0%)	20 (100%)
Did documentation exist to show use of information for various types of advocacy?	0 (0%)	20 (100%)	19 (95%)	1 (5%)
Did the person in charge of the facility participate in meetings at municipal/sub-municipal level to discuss RHIS performance for the last three months?	0 (0%)	20 (100%)	20 (100%)	0 (0%)
Overall Use of Information Performance	***6 (30%)***	***14 (70%)***	***18 (90%)***	***2 (10%)***

Source: *2012 and 2014 Surveys*

Table 4.3.1: Performance of Facility Routine Health Information System Processes (Continued)

RHIS Processes	Baseline (2012)		Endline (2014)	
	Yes	*No*	*Yes*	*No*
Supervision by the municipal/sub-municipal health office				
Did the municipal/sub-municipal supervisor visit your facility at least once during the last three months? (check the answer)	10 (50%)	10 (50%)	20 (100%)	0 (0%)
Did you observe supervisor having a checklist to assess the data quality?	0 (0%)	20 (100%)	17 (85%)	3 (15%)
Did supervisor check the data quality?	4 (20%)	16 (80%)	20 (100%)	0 (0%)
Did the municipal/sub-municipal supervisor discuss performance of health facilities based on RHIS information when he/she visited your facility?	4 (20%)	16 (80%)	20 (100%)	0 (0%)
Did the supervisor help you make a decision based on RHIS information?	2 (10%)	18 (90%)	17 (85%)	3 (15%)
Did the supervisor send a report/feedback/note on the last two supervisory visits?	0 (0%)	20 (100%)	16 (80%)	4 (20%)
Overall level of Supervision Performance	***3 (15%)***	***17 (85)***	***18 (90%)***	***2 (10%)***

Source: *2012 and 2014 Surveys*

4.3.1 **Data Accuracy Check**

A number of measures were employed to measure data accuracy check performance including matching two months reported figures for ANC with the ANC register, receiving directives with consequences from senior management (on data accuracy check, completeness of reports and submission deadlines). The overall data accuracy performance was 20 percent in baseline and 95 percent in endline showing, significant improvement. While none of the participating facilities received directive from senior management to check data accuracy and completeness in baseline survey, the endline result suggests that all the 20 facilities received such instructions prior to endline

assessment. This achievement could be attributed to management's new orientation and growing interest towards quality data.

4.3.2 **Data Completeness**

The overall data completeness performance for all the facilities was 20 percent in baseline compared with 95 percent in endline. However, 40 percent and 100 percent of the facilities respectively in baseline and endline reported the required number of the RHIS monthly report that the facilities needed to report in the last two months prior to the assessment (this excludes the number of data items for services not provided by this health facility). However, in terms of filling out all monthly reports without leaving any blank space in at least one of the reports, none of the facilities achieved this in baseline whereas 90 percent of facilities were able to achieve it in endline.

4.3.3 **Data transmission, Data processing and Analysis Performance**

The overall data transmission, processing and analysis performance of the facilities was 30 percent in baseline compared to 90 percent in endline. All facilities surveyed in baseline and endline had data processing procedures or tally sheets available and staff calculate indicators for their facility catchment area. However, none had procedure manual for data collection. Also none of the facilities compared their performance outcomes with sub-municipal, municipal or national targets whereas in endline, 90 percent of facilities did compare. The higher figure in endline came as a result of the

intervention through training using the training module adapted and used by the project. Thus, facilities had taken interest in comparative analysis to assess their performance against municipal and national targets.

4.3.4 **RHIS Report Production**

The overall report production performance for all facilities surveyed was 65 percent in baseline compared to 95 percent in endline. All twenty facilities surveyed in baseline and endline had a compilation of RHIS data and also report same. However, none of the facilities in baseline and 95 percent in endline respectively received feedback report from either the municipal or sub-municipal health management team on their performance for the last three months preceding the survey.

4.3.5 **Display of Information**

Data display among the facilities studied during the baseline was very poor, only 10 percent displayed data related to mother health, 25 percent displayed data on child health, 10 percent on facility utilization and 10 percent on disease surveillance in the baseline. Forty-five percent of these facilities, however, had maps of their catchment areas. A similar proportion of facilities also displayed a summary of demographic information such as population by target group during baseline.

However, endline survey revealed that 90 percent of facilities displayed data related to mother health; child health; facility utilization; and disease surveillance. Also all the facilities in endline had maps of catchment areas showing improvement of 55 percent

over the baseline. Generally there was improvement in display of data on key indicators at the facilities in endline compared to baseline.

4.3.6 **Decision types based on types of analysis**

Twenty percent (20%) of facilities reviewed their strategies by examining service performance target and actual performance on month to month comparisons, fifteen (15%) reviewed their personnel responsibilities by examining service targets and actual performance monthly, 20% mobilized or shifted resources based on the review and comparison of services and 35% advocated more resources by comparing performance by targets and showing gaps.

4.3.7 **Discussion and Decision on RHIS Information**

All the facilities surveyed in baseline and endline respectively indicated that they met at least once during the last three months preceding the survey to review managerial or administrative matters. However, 20 percent and 100 percent of the facilities in baseline and endline respectively maintained an official record of the meetings; even though 2 out of 18 facilities in endline did not have up to date meeting records.

Among the facilities that kept official records of their meetings 10% discussed matters related to management of RHIS such as data quality, reporting or timeliness of reporting. In the baseline, about 15 percent of facilities surveyed discussed RHIS findings such as

patient utilization, disease data, or service coverage, medicine stock-out, etc., but the figure rose astronomically to 100 percent in endline. However, none of the facilities in the baseline had any discussion on any decisions made based on the above discussions. Again, none of the facilities in the baseline discussed any follow-up action taking place on the decisions made during the previous meetings as compared to 100 percent of facilities in endline.

4.3.8 **Promotion and Use of RHIS Information**

The overall performance on the use of RHIS information at the facility level was 30 percent in baseline and 90 percent in endline of which 10 percent and 100 percent of the facilities indicated that they received annual or monthly planned targets based on RHIS information in baseline and endline respectively. Available three months records of the facilities showed that none of the facilities in baseline and at least 95 percent of facilities in endline:

- Received directives on information use from municipal, sub-municipal or senior management;
- Received RHIS office newsletter or report showing success stories on information use;
- Had documentation to show use of information for various types of advocacy
- Had facility managers participate in meetings at the municipal/sub-,municipal level to discuss RHIS performance

4.3.9 **Supervision by the Municipal/Sub-Municipal Health Office**

The overall level of supervision performance was 15 percent in baseline and 90 percent in endline. However, 50 percent and 100 percent in baseline and endline respectively of the facilities reported that sub-municipal/municipal level supervisors visited their facilities once during the last three months prior to the surveys. Twenty percent and 100 percent of the facilities in baseline and endline respectively reported that the supervisors performed some data quality checks during supervisory visits. Similar percentages also indicated that the municipal/sub-municipal supervisor discussed performance of the health facility based on RHIS information when the visit was made. Some 10 percent and 85 percent of facilities in baseline and endline respectively reported that the supervisors helped them make decisions based on the RHIS information. Nonetheless, all the facilities indicated that none of the supervisors had a checklist to assess data quality in baseline but in endline, 80 percent of the facilities indicated that a supervisor came along with checklist. Also baseline results indicated that none of the supervisors sent a report or feedback to the facility on the previous two supervisory visits. However, the situation has improved in endline as 80 percent of the facilities confirmed that supervisors sent them feedback after each supervisory visit.

4.4 Routine Health Information Systems Performance

In this sub-section, results on the routine health information system performance are presented, Table 4.4.1.

4.4.1 Internal Consistency

To assess the internal consistency on questions of self-confidence, the confident level of respondents in carrying out RHIS tasks was categorized with multiple indicators under the dimension of data analysis, data interpretation and data use. The indicators for each dimensions had alpha scores above 0.75 in both baseline and endline respectively, indicating a high level of reliability. For the overall self-efficacy scale for RHIS tasks, the alpha level in baseline and endline were 0.88 and 0.94, indicating a high level of reliability.

Table 4.4.1: Composite indices for measuring underlying constructs of the determinants of RHIS performance, baseline and endline

Composite indicator	Questions	Cronbach's alpha	
		Baseline (2012)	Endline (2014)
Self - Confidence scales			
Perceived self-efficacy in analyzing data	I can check data accuracy I can calculate percentage/rate correctly I can plot data by months or year	**0.78**	**0.81**
Perceived self-efficacy in interpreting data	I can compute trend from bar chart I can explain findings and their implications	**0.76**	**0.92**
Perceived self-efficacy in using information	I can use data for identifying gaps and setting targets I can use data for making various types of decisions and providing feedback I can use data for monitoring change in indicators I can use data for advocacy	**0.83**	**0.89**
Overall perceived self-efficacy	I can check data accuracy I can calculate percentage/rate correctly I can plot data by months or year I can compute trend from bar chart I can explain findings and their implications I can use data for identifying gaps and setting targets I can use data for making various types of decisions and providing feedback	**0.88**	**0.94**
Culture of information			

scales			
Promotion of use of RHIS information	Health department seeks feedback from concerned persons Health department emphasizes data quality in monthly report Health department discusses conflict openly to resolve them Health department seeks feedback from concerned community	**0.58**	**0.67**
Promotion of evidence-based decision-making	Health department encourages staff to use data to monitor changes in health service indicators Health department checks data quality at the facility and higher level regularly Health department provide regular feedback to staff through regular report based on evidence	**0.62**	**0.76**
Promotion of rewards for better performance	Health department encourages supervisors to reward good work Health department makes staff feel important by recognizing their work	**-**	**0.70**
Overall promotion of culture of information	Health department seek feedback from concerned persons Health department emphasizes data quality in monthly report Health department discusses conflict openly to resolve them Health department seeks feedback from concerned community Health department encourages staff to use data to monitor changes in health service indicators Health department checks data quality at the facility and higher level regularly Health department provides regular feedback to staff through regular report based on evidence Health department encourages supervisors to reward good work Health department makes staff feel important by recognizing their work	**0.71**	**0.86**

Source: *2012 and 2014 Surveys*

The promotion of a culture of information is measured with a scale that includes self-reported perceptions on four dimensions: the promotion of data quality, the use of RHIS information, evidence-based decision-making and accountability, and the presence of rewards for better performance. The second block of information in Table 4.4.1 present the results. With the exception of promotion of use of RHIS information with alpha score 0.58 in baseline; alpha score for the remaining dimensions emerged as 0.6 or higher, indicating high reliability for the baseline and endline samples. For the overall culture of information scale, the alpha levels are 0.71 and 0.86 in baseline and endline respectively, indicating high reliability.

Table 4.4.1: Composite indices for measuring underlying constructs of the determinants of RHIS performance, Baseline and Endline

Composite indicator	Questions	Cronbach's alpha	
		Baseline (2012)	Endline (2014)
Expanded culture of information scale			
Promotion of evidence-based decision-making	Personal liking Superior's directives Evidence/facts Political interference Comparing Strategic objectives Community health needs Considering cost	**0.43**	**0.56**
Promotion of use of RHIS information	Are rewarded for good work Use RHIS data for day to day management of the facility Facilities are directed to display data for monitoring their set targets	**0.31**	**0.35**
Promotion of feedback	Seek feedback from concerned persons Discuss conflicts openly to resolve them Seek feedback from concerned community	**0.58**	**0.53**
Promotion of problem-solving	Can gather data to find the root cause(s) of the problem Can develop appropriate criteria for selecting intervention for a given problem Can develop appropriate outcomes of a particular intervention	**0.68**	**0.70**
Promotion of a sense of responsibility	Are punctual Document their activities and keep records Feel committed in improving health status of the targeted population Feel guilty for not accomplishing the set/target performance	**0.85**	**0.80**
Promotion of accountability/empowerment	Are empowered to make decisions Able to say no to superiors and colleagues for demand/decisions not supported by evidence Are made accountable for poor performance Admit mistakes for taking corrective actions	**0.64**	**0.60**
Overall perceived culture of information	All above	**0.86**	**0.88**
Motivation scale	Collecting information not used for decision making discourages me Collecting information make me feel bored Collecting information is a meaningful work for me Collecting information gives the feeling that Data is needed for monitoring facility performance Collecting information gives me the feel that it is forced on me Collecting information is appreciated by co-workers and superiors	**0.57**	**0.58**
Respondents, n		***140***	

Source: *2012 and 2014 Surveys*

The second block of information in Table 4.4.1 presents the results. With exception of promotion of use of RHIS information with alpha score 0.58 in baseline; alpha score for the remaining dimensions emerged as 0.6 or higher, indicating high reliability for the baseline and endline samples. For the overall culture of information scale, the alpha levels are 0.86 and 0.88 in baseline and endline respectively, indicating high reliability. As shown in the third block of the information in Table 4.4.1, the alpha level for the scale of the overall culture of information, use of information, problem-solving and sense of responsibility dimensions are above 0.80, indicating high reliability. However, dimensions such as "Promotion of evidence-based decision-making", "Promotion of use of RHIS information", and "Promotion of feedback" fell under 0.6 the threshold for adequate reliability. A scale was also constructed of "motivation for performing RHIS tasks". As shown by the fourth block of the information in Table 4.4.1, alpha level for the scale is 0.57 and 0.58 in baseline and endline respectively, falling just below the 0.6 threshold for adequate reliability.

4.4.2 **Construct validity**

To ascertain relationship between health worker-level associations and indices identified through Cronbach's alpha analysis, the study conducted bivariate analysis to investigate the hypothesized associations as depicted in the conceptual framework. Table 4.4.2 presents Pearson correlation coefficients of the associations between indices identified through Cronbach's alpha analysis for baseline. The unit of analysis is the health worker.

Table 4.4.2a: Pearson correlation coefficients (p-values) of health worker -level associations between indices identified through Cronbach's Alpha Analysis, Baseline (2012)

Index	Self-Confidence	Culture of information scale1	Culture of information scale2	Motivation	Competence to perform Analysis	Competence to interpret results	Competence to use results
Self-Confidence	1.0000						
Culture of information scale 1	0.1419 (0.0932)	1.0000					
Culture of information scale 2	**0.3158 (0.0001)**	**0.4861 (0.0000)**	1.0000				
Motivation	-0.0213 (0.8018)	0.1890 (0.0248)	**0.3497 (0.0000)**	1.0000			
Ability to perform Analysis	**0.6062 (0.0000)**	0.0802 (0.3605)	**0.2489 (0.0040)**	0.0073 (0.9341)	1.0000		
Ability to interpret Results	**0.7998 (0.0000)**	0.0298 (0.7411)	0.1680 (0.0611)	-0.0840 (0.3514)	**0.5278 (0.0000)**	1.0000	
Ability to use Results	**0.8272 (0.0000)**	0.1238 (0.1672)	**0.2924 (0.0009)**	-0.1391 (0.1204)	**0.4834 (0.0000)**	**0.5889 (0.0000)**	1.0000

Source: *2012 and 2014 Surveys*

The baseline results suggested that the "culture of information scale 2" is significantly associated with the RHIS tasks confidence level), but not with respondents' RHIS tasks competence. Also a "culture of information scale2" index is found to be significantly associated with the index measuring motivation to perform RHIS tasks. In addition, there is a statistically significant association between RHIS confidence level and RHIS competence indices.

Table 4.4.2b: Pearson correlation coefficients (p-values) of health worker -level associations between indices identified through Cronbach's Alpha Analysis, Endline (2014)

Index	Self-Confidence	Culture of information scale1	Culture of information scale2	Motivation	Competence to perform Analysis	Competence to interpret results	Competence to use results
Self-Confidence	1.0000						
Culture of information scale 1	**0.4309 (0.0000)**	1.0000					
Culture of information scale 2	**0.2750 (0.0010)**	**0.4437 (0.0000)**	1.0000				
Motivation	-0.1420 (0.0929)	0.0274 (0.7470)	0.0015 (0.9855)	1.0000			
Ability to perform Analysis	**0.6062 (0.0000)**	0.0275 (0.7464)	0.1053 (0.2141)	**0.3470 (0.0000)**	1.0000		
Ability to interpret Results	**0.7998 (0.0000)**	-0.0606 (0.4750)	0.0928 (0.2737)	0.2541 (0.0024)	**0.5307 (0.0000)**	1.0000	
Ability to use Results	**0.4535 (0.0000)**	**0.3108 (0.0002)**	0.2469 (0.0032)	-0.0437 (0.6071)	**0.2693 (0.0000)**	**0.4899 (0.0000)**	1.0000

Source: *2012 and 2014 Surveys*

The endline results suggested that the "culture of information scales 1 & 2" are significantly associated with the RHIS tasks confidence level), but not with respondents' RHIS tasks competence, even though it appears to be significantly associated with respondents' ability to use RHIS results. In addition, there is a statistically significant association between RHIS confidence level and RHIS competence indices.

Both baseline and endline results indicate positive relationships among the indices, as hypothesized by the PRISM framework, and are found to be significant, as hypothesized in the conceptual framework, indicating construct validity.

4.4.3 **Test-Retest Reliability**

Table 4.4.3 shows the test-retest analysis findings for the scale of the use of information, promotion of a culture of information, self-efficacy, motivation, and RHIS task competence. The use of RHIS information is measured by a dichotomous indicator of whether RHIS information was displayed in the facility at the time of survey. The results indicated that the overall performance of use of RHIS information at the facility in baseline and endline are 30 percent and 90 percent ($n_1=20$, $Mean_1=0.3$, $SD_1=0.10$; $n_2=20$, $Mean_2=0.9$, $SD_2=0.60$) respectively. The results suggest that the use of RHIS information changed significantly from baseline to endline.

Regarding the potential determinants of RHIS performance, the results suggested that the mean levels of the indices measuring a promotion of a culture of information, motivation to perform RHIS tasks and RHIS task competence were significantly higher in endline compared to the situation in baseline. However, with the exception of perceived using of RHIS, the index of perceived self-efficacy in analysis and interpreting RHIS information was not significantly higher in endline compared to baseline.

Table 4.4.3: Test-retest comparisons of indicators of PRISM inputs and outputs, Baseline and Endline

Variable	Baseline (2012) (Mean, SD, n)	Endline (2014) (Mean, SD, n)	Standard Error of Difference (2012-2014)	T of Difference (p value)
Use of information (facility level)	0.30 (0.10) 20	0.90 (0.06) 20	0.02	-23.00 (0.00)
Culture of information (Overall)	0.73 (0.04) 141	0.79 (0.03) 141	0.00	-14.24 (0.00)
Promotion of use of RHIS information	0.73 (0.04) 141	0.85 (0.03) 141	0.00	-28.49 (0.00)
Promotion of evidence-based decision-making	0.38 (0.04) 141	0.57 (0.50) 141	0.04	-4.49 (0.00)
Reward	0.62 (0.04) 141	0.64 (0.04) 141	0.00	-4.19 (0.00)
Perceived Competency in performing RHIS tasks				
Analyzing	73.33 (20.97) 141	78.59 (15.87) 141	2.21	2.37 (0.01)
Interpreting	68.96 (21.99) 141	74.35 (14.58) 141	2.22	2.42 (0.01)
Using	65.00 (21.49) 141	80.34 (12.93) 141	2.11	7.26 (0.00)

Source: *2012 and 2014 Surveys*

Table 4.4.3: Test-retest comparisons of indicators of PRISM inputs and outputs, Baseline and Endline

Variable	Baseline (2012) (Mean, SD, n)	Endline (2014) (Mean, SD, n)	Standard Error of Difference (2012-2014)	T of Difference (p value)
Motivation	27.20 (4.29) 141	34 (6.33) 141	0.64	10.55 (0.00)
Actual Competency in performing RHIS tasks (Self-Efficacy)				
Analyzing	36.41 (7.83) 141	82.19 (4.82) 141	0.77	59.12 0.00
Interpreting	26.80 (5.29) 141	84.14 (6.42) 141	0.70	81.84 0.00
Using	20.41 (5.50) 141	82.83 (6.77) 141	0.73	84.97 0.00

Source: *2012 and 2014 Surveys*

Actual Competency (Self-Efficacy) in performing RHIS tasks

Respondents' actual competency in analysing data

A two-sided paired t-test of the null hypothesis that the mean change in use of information (Ho: diff = 0) yielded a paired t-statistic value of 59.12 and associated two sided p-value = 0.0000. This is statistically significant. The null hypothesis is rejected. The study concludes that these data provide statistically significant evidence that there is a change in respondents' actual competency in analysing (***i.e. calculation of percentages/rates correctly, and plotting of charts***) between the baseline and endline of measurement.

Respondents' actual competency in interpreting data

A two-sided paired t-test of the null hypothesis that the mean change in use of information (Ho: diff = 0) yielded a paired t-statistic value of 81.84 and associated two sided p-value = 0.0000. This is statistically significant. The null hypothesis is rejected. The study concludes that these data provide statistically significant evidence that there is a change in respondents' actual competency in interpreting data (***i.e.by explaining findings and their implication***) between the baseline and endline of measurement.

Respondents' actual competency in the use of information

A two-sided paired t-test of the null hypothesis that the mean change in use of information (Ho: diff = 0) yielded a paired t-statistic value of 84.97 and associated two sided p-value = 0.0000. This is statistically significant. The null hypothesis is rejected. The study concludes that these data provide statistically significant evidence that there is a change in actual information use (***i.e. using data for making various types of decision and providing feedback***) between the baseline and endline of measurement.

CHAPTER FIVE

DISCUSSIONS

5.0 Introduction

The role of RHIS in decision making is of paramount importance. Yet, there are gaps and other challenges in data generation, analysis and use. Consequently, the role of RHI in decision making is under estimated. The study hypothesized that improvement in the determinants of RHIS improve routine health information performance. Using PRISM model, a training module was piloted to measure the improvement in performance. This chapter presents discussion of the results in line with literature, chapter 2. It further analyses the implications of the findings in relation to similar work or research done by others, highlighting similarities and differences and their implications on health service delivery, especially in Ghana.

5.1 Characteristics of Respondents

Female respondents were more than male. For instance baseline analysis indicated that two-third of respondents were females while almost one-third percent were males, and 2 percent did not indicate their gender. Again in endline, females constituted about two-third percent whereas one-third percent were males. The results revealed that more female are engaged in RHIS tasks in the municipality.

In terms of level of education the study also revealed that majority of cadre of staff who engaged in RHIS tasks possessed Post Senior High qualification. For instance in baseline, 73 percent of respondents had Post Senior High level of education, compared to three-fourths in endline.

The mean age of the respondents was 29 years in baseline (varying from 21 to 63 years). Also the mean working experience of respondents in baseline was 4.8 years (varying from 1 to 36 years). On the other hand, the mean age of the respondents in endline was 29.6 years (varying from 21 to 64 years). Again the mean working experience of respondents in endline was 5 years (varying from 1 to 37 years). This confirmed evidence in the field during follow-up visits at the intervention period. Experienced staffs normally leave responsibility of data collation and reporting to the young and inexperienced ones and sometimes student nurses on rotation attachments without given them requisite orientation. This results in generation of poor RHIS for management planning and decision-making with its dare consequent in quality health service delivery.

With regard to whether respondents had received training in RHIS during the past six months prior to the time of the surveys, analysis indicated that about 30 percent in baseline compared to 70 in endline respectively claimed they had received some training while 70 percent and 30 percent respectively also said they had not during the same period. Limited knowledge of the usefulness of RHIS data is found to be a major factor in low data quality and information use in health facilities (Rotich *et al*. 2003; Kamadjeu *et al*. 2005; Odhiambo-Otieno 2005b). Training is crucial for providing quality data, and basic training should cover the information system itself. Data collection instruments,

data processing, analysis and decision-making should form important part of the municipal training programmes (Boadu et *al*. 2004).

With the exception of training in RHIS, the results of the background characteristics suggest no significant difference in sample characteristics in the baseline and endline surveys.

5.2 Routine Health Information Systems Determinants

5.2.1 Behavioural determinants of RHIS

Literature indicates RHIS users' demand, confidence, motivation and competence to perform RHIS tasks, affect RHIS processes and performance directly (Figure 1) (Aqil *et al*. 2009). A baseline result shows high confidence among respondents in performing RHIS tasks. For instance, respondents had mean confidence score of 73, 69 and 65 in analyzing, interpreting and using RHIS for decision -making respectively; compared to 79, 74 and 80 in endline. However, their actual competencies in baselines showed mean scores of 36, 27 and 20 in analyzing, interpreting and using RHIS for decision -making respectively compared to 82, 84 and 83 in endline. The baseline results represented a huge gap among respondents in performing RHIS related tasks. This confirmed the statement that "The blind spot (Luft 1969) shows that people are unaware of a gap between their perceived and actual competence in performing a task". As indicated by Aqil *et al*. 2009, the PRISM framework has this unique strength of unveiling this blind spot as it relates organizational and technical determinants. It is possible to use quality

improvement approach to bridge this gap by applying QI tools such as Model for Improvement" (Langley et al, 2009: Figure 2), process map, peer-to-peer learning, mentoring and coaching through well-designed training modules to train and work with staff and management within municipal structures. This attests to the enormous improvement in self-efficacy of staff in performing RHIS tasks as proved by the endline evaluation results.

The study agrees with the assertion that "How an individual feels about the utility or outcomes of a task (Fishbein and Ajzen 1975; Hackman and Oldham 1980), or his confidence in performing that task (Bandura 1977), as well as the complexity of the task (Buckland and Florian 1991), all affect the likelihood of that task being performed". The baseline results from Ejisu-Juaben Municipal also showed inadequate training for staff in RHIS tasks, where about 70 percent of respondents had no training in RHIS for the past 6 months prior to the baseline assessment. As indicated by previous studies (Rotich *et al.* 2003; Kamadjeu *et al*. 2005; Odhiambo-Otieno 2005b), this study supports the assertion that limited knowledge of the usefulness of RHIS data is a major factor in low data quality and information use.

5.2.2 **Organizational determinants**

On the dimension of overall perceived promotion of culture of information, the baseline and endline results showed that about 74 percent and 79 percent respectively of respondents perceived that the municipal health service promotes culture of information. This includes promotion of the use of RHIS, promotion of evidence-based decision-

making, promotion of feedback from staff and community, promotion of problem-solving, promotion of a sense of responsibility and promotion of accountability/empowerment. Once again studies in organizational culture (Mead 1994; Triandis 1994) help us to understand how values are generated, sustained and amenable to change. Shein (1991), notes that organizational culture is a body of solutions to problems that have worked consistently. The baseline and endline results suggest good improvement in the RHIS in the Ejisu-Juaben Municipal Health Service as previous studies had established relationship between the efficacy of organizational culture and improved RHIS performance (Glaser *et al*. 1987; Conner and Clawson 2004; Cooke and Lafferty 2004; Taylor 2005; Aqil *et al*. 2009). This implies planning and management decision-making that rely on RHIS at operational and management level will be better and more reliable than ever before which will lead to improvement in health service delivery to the population.

5.2.3 **Technical determinants**

For the purpose of this study, technical determinants were defined as all the factors that are related to the specialized know-how and technology to develop, manage and improve RHIS processes and performance. As indicated in chapter 2, these factors refer to development of indicators; designing data collection forms and preparing procedural manuals; types of information technology; and software development for data processing and analysis (Figure 1).

The study revealed that the above mentioned technical determinants are handled by divisions and units within the Ghana Health Service and coordinated by the Policy Planning and Monitoring and Evaluation (PPME) Unit in Ghana Health Service (**Source:** 2012 and 2014 Surveys).

The study further indicated that data collection forms were available at all the facilities whilst computers were also available in the hospital for data entry and processing. Monthly return forms were submitted to the Municipal Health Directorate for data quality checks and entry into the District Health Information Management System (**Source:** 2012 and 2014 Surveys). The DHIMS is a national web-based routine health information system database managed by the Center for Health Information Management (CHIM) under PPME. DHIMS2 is characterized by some challenges such as irregular electricity supply, unreliable internet connectivity, completeness and timeliness of data and lack of personnel, especially at the hospital settings. These factors are not different from what have been described by others (Nsubuga *et al*. 2002; Rotich *et al*. 2003; Mapatano and Piripiri 2005; Odhiambo-Otieno 2005b) and can potentially affect RHIS performance. Apart from health information officers who managed the DHIMS, majority of RHIS users did not have good knowledge and information tools and skills and so all the facilities apart from the hospitals still operated RHIS activities manually. As far as information technology remains the engine of information system development it is necessary that RHIS users have good knowledge of information technology tools and skills to effectively use and sustain it. However, it is argued that in low technology settings, well-designed, paper-based RHIS is still relevant in achieving acceptable levels of performance (Aqil *et al*. 2009). Although Ghana Health Services (GHS, 2014)

through the support of development partners are doing well in improving the efficiency of DHIMS2 and some specific program level reporting registers, there is the need for GHS to general overview of RHIS tools such as registers and monthly return forms to ensure clarity in their (tools) administration and definitions of indicators. Its acknowledgeable that GHS has recently developed Standard Operating Procedures (SOPs) on health RHIS, much should be channeled towards orientation and implementation of these SOPs. When this is done the electronic-based (DHIMS2) and the paper-based RHIS will work to achieving acceptable level of performance as indicated by Agil.

5.3 Routine Health Information Systems Processes

The overall performance of data recording in baseline was 55 percent compared to 100 percent in endline. This indicator measured the facility's ability to keep copies of all RHIS monthly reports sent to the Municipal Health Directorate for at least 12 consecutive months prior to the study. Fifty percent and 100 percent of facilities kept up-to-date routine health service delivery performance data. This implies there will be high quality and reliable RHIS for planning and decision-making at facility, management and policy level.

5.3.1 **Data completeness and accuracy**

The overall data accuracy performance was 20 percent in baseline and 95 percent in endline. This was measured by comparing figures reported to the health directorate and that of the midwifery registers with particular emphasis on ANC registrants, number of first trimester registrants, and number of pregnant women who had visited ANC for the fourth time.

On the other hand, the overall data completeness performance for all the facilities was 20 percent in baseline and 95 percent in endline. Thus, 90 percent of the facilities reported all the required number of the RHIS monthly reports that the facilities needed to report in the last two months prior to the assessment (this excludes the number of data items for services not provided by this health facility) compared to zero percent in the baseline.

Uncompleted data leave room for proxy measurement which is based on assumption. This affects the quality of planning and decision-making that uses the proxy indicators provided, especially when the assumption(s) fail. For that matter, it is imperative to have completed datasets that represent the realities on the ground. Thus, the improvement in the completeness will lead to high quality and reliable RHIS for planning and decision-making at facility, management and policy level.

5.3.2 **Data transmission, processing and analysis performance**

Question was asks whether a database exists to enter data from the monthly reports. It could be in the form of a notebook where each facility's data is entered, or it could take

the form of computer software. Respondents were asked whether data processing procedures or a tally sheet exists. The rationale for this question was to assess whether facilities receive guidelines for processing data, such as a tally sheet for the simple addition of numbers, or a method for calculating indicators

Data transmission, processing and analysis performance of the facilities was 30 percent in baseline compared to 90 percent in endline although facilities performance in terms of report production was 65 percent and 95 percent in the baseline and endline respectively. Surprisingly, during the baseline none of the facilities received feedback report from either the municipal or sub-municipal supervisors on their performance for the last three months preceding the survey. Interestingly, this behaviour changed in endline where 85 percent of facilities reported that they received feedback and were supported by supervisors to make decisions based on the RHIS information. There is evidence to suggest that 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 (Knight 1995; Rothwell *et al*. 1995). However, the study agrees with previous studies that feedback remains a weak process of RHIS in many developing countries including Ghana (Hozumi *et al*. 2002; Nsubuga *et al*. 2002; JICA HMIS Study Team 2004; Aqil *et al*. 2005a; Boone and Aqil 2008; Gnassou *et al*. 2008). This study is inclines to the notion that as facility staff receive feedback from the Municipal Health Directorate as shown in the endline results about their RHIS performance, they are more likely to learn from it and use it to improve their data quality (accuracy, completeness and timeliness) and service delivery performance thereby improving health system performance.

5.3.3 **Data Display**

As indicated in Table 4.3.1 data display among the facilities studied has improved significantly with percentage of 95 in endline compared with abysmal percentage of 25 in baseline. The results from endline survey suggest that data generated in most of the health facilities were used in planning and decision making. Thus, the study supports van Lohuizen and Kochen assertion 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 (Van Lohuizen and Kochen 1986). Also it suggests improvement in the overall use of information performance from 30 percent to 90 percent in baseline and endline respectively.

5.3.4 **Supervision**

In terms of supervision conducted by the municipal and sub-municipal health officers to the facilities, the study recorded improvement in performance from 15 percent to 90 percent. The performance of supervision by the district/sub-district supervisors is measured by supervisory visit to the facility at least once in a quarter, and supervisors having checklists to assess the data quality. The supervisors are also supposed to discuss performance of the health facilities based on RHIS information whenever he/she visited the facility. The supervision indicator also measured supervisor's assistance to the facility to make a decision based on RHIS information, and supervisor sending a report/feedback/note to the facility on the last two supervisory visits. This spectacular

performance demonstrates quality of supervision and leadership exhibited by the Ejisu-Juaben Municipal Health Directorate following the study intervention which might have impact on RHIS performance as described in the information system literature (Nsubuga *et al*. 2002; Rotich *et al*. 2003; Kamadjeu *et al*. 2005; Odhiambo-Otieno 2005b).

5.4 Data Quality

As discussed under routine health information system processes, the overall data accuracy performance improved from 20 percent in baseline to 95 percent in endline. This indicates that data obtained from the facilities could be used for management decision-making with high level of accuracy and confidence.

On the other hand, the overall data completeness performance of data from all the studied health facilities also improved from 20 percent in baseline to 95 percent in endline. The endline study shows that 90 percent of the facilities report all the required number of the RHIS monthly reports to the District Health Information Management System (this excludes the number of data items for services not provided by this health facility) timely. The outstanding performance of the quality of data generated at the Ejisu-Juaben Municipal Health Service conformed to Lippeveld and colleagues' (2000) definition which described data quality in four dimensions: relevance, completeness, timeliness and accuracy. However, this study did not assess the relevance of information generated at the municipal health directorate because all the information generated are requirements of

the national health information system which is determined by the Policy Planning, Monitoring and Evaluation (PPME) unit of the Ghana Health Service.

5.5 Improved RHIS Performance

As indicated above, improvement in RHIS is a composite indicator which is measure by individual indicators such as Respondents' actual competencies in analysing data (i.e. calculation of percentages/rates correctly, and plotting of charts), interpreting data (***i.e.by*** explaining findings and their implication) and information use (i.e. using data for making various types of decision and providing feedback) between the baseline and endline of measurement. Improvement in these indicators ultimately will lead the overall improvement in the RHIS performance (Aqil et al. 2009) as depicted in table 4.4.3.

Statistical tests in all the three indicators indicated that improvements in RHIS determinants through application of Quality Improvement Process (QIP) will significantly lead to improved RHIS performance. That is the mean individual RHIS performance differences will not be zero.

5.6 Improved routine health information and health service planning and decision making

Decision making and planning in the health system is dependent on quality RHI. The study analysed the various stages in planning in the context of improving the quality of RHI for planning and decision making. Planning variables used in the study were needs

assessment, target setting, monitoring, feedback, identification of challenges for further needs assessment, revision of objectives for another planning cycle. It is important to note that the study showed some improvement in the process of health service planning at all the levels, strategic, operational and administrative and as in the national, regional, district or municipal, sub-district and CHPS zones (Armstrong, 2009; Mulims, 2006, MOH 2014) by improving RHI needed for planning (Table 4.4.1).

As per the Ministry of Health Ghana planning tenets, the study showed that about a fourth and three-quarters of health staff could identify the health needs of the community in the baseline and endline respectively (Table 4.2.1). They further indicated that they had seen changes in the Municipal Health Directorate's promotion of problem-solving as it encourages more staff to identify their needs using routine health information (RHI) to set objectives, targets and monitor changes, identify challenges for revision of the objectives to start another planning cycle (MOH 2004). Hence the study prepared health staff in terms of skills and knowledge needed for improved RHI for health service planning and decision making (Armstrong, 2009; MOH 2007; Mulims, 2006).

The relationship between RHI, quality improvement and health service planning decision making was further heightened as about a fifth and 8 in 10 health staff in the baseline and endline respectively indicated that Municipal Health Directorate sought feedback from all the levels with regards to services rendered to them (Table 4.2.1). The suggestions and feedback from the community were incorporated into planning to improve service delivery.

Another relationship between RHI, quality improvement and health service planning and decision making was seen in target setting and comparing actuals with targets to ascertain deviations to inform planning process. The study achieved some 15 – 20% improvement in strategy reviewing by and examining service performance target and actual performance on monthly comparisons. Fifteen percent reviewed their personnel responsibilities by examining service targets and actual performance monthly while a fifth mobilized or shifted resources based on the review and comparison of services and a little over a third advocated more resources by comparing performance by targets and showing gaps (Table 4.2.1), as in per the MOH, Ghana requirements (MOH; 2004, MOH 2007).

The place of quality RHI in health service planning was articulated when the study showed a huge improvement in processing RHI for planning decision making from the baseline to the intervention. In the baseline, about 15 percent of facilities discussed RHIS findings such as patient utilization, disease data, or service coverage, medicine stock-out and others, but the figure rose astronomically to 100 percent in the endline (Table 4.3.1). However, none of the facilities in the baseline had any discussion on any decisions made based. The study further showed that none of the facilities in the baseline discussed any follow-up action taking place on the decisions made during the previous meetings compared to 85 percent of facilities in the endline (Table 4.3.1).

For planning purposes, the study equipped staff with skills for identification of key challenges and problem areas in service delivery and plan on how to solve them.

Promotion of problem solving, an important element in the planning process was measured by four items describing behaviours such as: respondents can gather data to find the root cause(s) of problem; staff could develop appropriate criteria for selecting intervention for a given problem; staff could evaluate whether or not the target/outcomes have been achieved (Table 4.2.1). The study however achieved marginal improvement from 86 percent in baseline to 87 percent in endline. The baseline figure could be attributed to high perceived performance exhibited by respondents with corresponding low self-efficacy at the baseline. The corresponding improvement in staff understanding of RHIS performance indicators after the intervention might have guided their perception objectively in endline (Aquil, et al., 2009).

5.7 **Contribution to Existing Knowledge**

The main contribution made by this study to existing knowledge is the application of Quality Improvement Model and PRISM framework in assessing RHIS performance gaps and developing training module for training frontline providers to enhance RHIS performance needed for health service planning and decision making.

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CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The conclusions from the findings of the study at baseline and endline are presented in this chapter.

6.1 Background characteristics of respondents

The background characteristic comprised age, sex and education distribution of respondents as well as their years of working experience. The following are snapshot of respondents' background characteristics:

- Female respondents were more than male in both baseline [female: 65%, male: 33, non-response: 2%] and endline [female: 65%, male: 35] surveys.
- In baseline, 73, 13, and 1 percent of respondents had post Senior High School, Senior High School, and Junior High School whilst 13 percent did not respond.
- In endline, 77, 20, 1 and 3 percent of respondents had post Senior High School, Senior High School, and Junior High School.
- The mean age of the respondents was 29 years in baseline (varying from 21 to 63 years). On the other hand, the mean age of the respondents in endline was 29.6 years (varying from 21 to 64 years).

- The mean working experience of respondents in baseline was 4.8 years (varying from 1 to 36 years). Again, the mean working experience of respondents in endline was 5 years (varying from 1 to 37 years).
- Respondents who had received training in RHIS during the past six months prior to the time of the surveys improved from 30 percent in baseline to 70 percent in endline.

- With the exception of training in RHIS, the results of the background characteristics suggest no significant difference in sample characteristics in the baseline and endline surveys.

6.2 Routine Health Information Systems Determinants

RHIS determinants were captured under three categories: behavioural, organizational and technical.

6.2.1 Behavioural determinants of RHIS

The behavioural determinants of RHIS identified were staff confidence and competency (in analyzing data, interpreting data, and using RHIS information) as well as motivation to RHIS related tasks

The use of QIP leads to high confidence and competency level among health workers in performing RHIS tasks such as analyzing, interpreting and using RHIS for decision

making. However, the competencies developed from performing RHIS are a function of training and close supervision. Likewise, staff motivation improved significantly.

6.2.2 **Organizational determinants**

The organizational determinants of RHIS identified were promotion of the use of RHIS, promotion of evidence-based decision-making, promotion of feedback from staff and community, promotion of problem-solving, promotion of a sense of responsibility and promotion of accountability/empowerment. The proportion of respondents overall perceived promotion of culture of information improved from 74 percent to 79 percent. The improvement in performance appeared to have triggered improved staff RHIS competencies and adoption of QIP for improving RHIS.

6.2.3 **Technical determinants**

The study revealed technical determinants of RHIS as development of indicators; designing data collection forms and preparing procedural manuals; types of information technology; and software development for data processing and analysis. These are handled by divisions and units within the Ghana Health Service and coordinated by the Policy Planning and Monitoring and Evaluation (PPME).

6.3 Routine Health Information Systems Processes

RHIS processes are Facility-based data transmission, processing and analysis. Overall RHIS processes performance improved from 30 percent in baseline to 90 percent in the endline. Data recording improved from 55 percent at the baseline to 100 percent at the endline of the project. Also data backup at the facility improved from 55 percent to 100 percent.

Data displayed at the health facilities which indicate data use improved from 25 percent to 95 percent.

Supervision conducted by the municipal and sub-municipal health offices to the facilities improved significantly from 15 percent to 90 percent.

Feedback from supervisors to facility staff during supervision has improved significantly from zero to 85 percent

6.4 Data Quality

The study assessed data quality in three dimensions: completeness, accuracy, and timeliness. Completeness is measured not only as filling in all data elements in the facility report form, but also as the proportion of facilities reporting in the municipality. Accuracy was measured by comparing data between facility records and reports, and between facility reports and municipal databases (DHIMS2), respectively. Timeliness was assessed as submission of the reports by 5th of ensuing month.

Application of quality improvement processes improved data completeness from 20 percent to 95 percent while data accuracy also improved from 15 percent to 90 percent. Timeliness could not be measured due to poor registration of reports submitted into logbook.

6.5 Routine Health Information Systems Performance

There is a relationship between health worker-level (behavioural determinants) and RHIS processes and performance. Technical and organizational determinants can affect RHIS processes and performance directly or indirectly through the health worker (behavioural determinants), as indicated in Table 4.4.2a and Table 4.4.2b respectively.

Nevertheless, both baseline and endline results indicate positive relationships among the indices, as hypothesized by the PRISM framework, and are found to be significant, as hypothesized in the conceptual framework, indicating construct validity.

This study suggested that "culture of information" is significantly associated with the RHIS tasks confidence level. Also a "culture of information" index is found to be significantly associated with the index measuring motivation to perform RHIS tasks.

The study further suggested that the "culture of information" is significantly associated with respondents' ability to use RHIS results. In addition, there is a statistically significant association between RHIS confidence level and RHIS competence indices.

6.6 4.4.3 Test-Retest Reliability and Sensitivity

Test-retest analysis was done on the scale of the use of information, promotion of a culture of information, self-efficacy, motivation, and RHIS task competence. The application of QIP leads to significant improvement in the performance use of RHIS from 30 percent to 90 percent.

Regarding other potential determinants of RHIS performance, the results suggested that the mean levels of the indices measuring a promotion of a culture of information, motivation to perform RHIS tasks and RHIS task competency were significantly higher in endline compared to in baseline.

However, with the exception of confidence level in using of RHIS, the index of confidence level in analysis and interpreting RHIS information were not significantly higher in endline compared to the baseline.

6.7 Recommendations

Ministry of Health/Ghana Health Service

Short(1-3 years) to Medium term (3-5 years)

- Standardise RHIS supervision practices – develop supervisory checklists. Supervision should be conducted on a regular schedule with feedback provided to the facilities. Performance data (data quality and use indicators) should be collected, monitored and reviewed regularly.
- Link RHIS data with programme monitoring – integrate RHIS quality control activities into integrated supervisory visits. That is, if an EPI supervisor visits a facility they should be able to conduct the supervision for RHIS at the same time.
- Expand remote access to the processed data set to health offices to facilitate timely use of information for decision making at local level. Roll out the DHIMS2 (mobile version) to the clinic and CHPS zone level.
- Establish a standardized RHIS feedback mechanism between levels. Electronic RHIS provides an opportunity for generating automated report from the RHIS software that should be forwarded to reporting sites at regular intervals.
- Create linkages with service delivery managers – i.e. the facility in-charge should be integrated into the monitoring of RHIS performance.
- Review the existing training materials on use of information and revise accordingly. Conduct on the job training on data analysis, interpretation and continuous use of information at all levels.

- Conduct training/re-training for health staff and Community Health Volunteers on data recording, analysis and use procedures
- Develop mechanisms to integrate data needed by different programs – ensure RHIS data are used to generate reports for the vertical programmes (HIV/AIDS, TB, malaria, nutrition etc.).
- Empower staff to apply the quality improvement process to address gaps in the RHIS performance.
- Use of mobile mentoring (mobile phone calls) to augment training follow-ups
- Onsite coaching and mentoring
- Institute learning session at the MHD where each DQIT presents progress of their RHIS improvement work to their peers. During the learning session, participants should share experiences.
- Application of Continuous Quality Improvement (QI) methods to improve performance of RHIS
- Institute and standardize report submission logbook to track timeliness of data at the DHMT
- Encourage the use of dashboard system at the facility level to promote data use

Long term:(5 or more years)

- Establish systematic periodic assessments of RHIS performance in terms of data quality, data use and management functions on periodic basis.

- Promote transparency and accountability of RHIS data. For example – institutionalize the use of RHIS information to make everyone accountable to health system performance.
- Create procedures for dealing with non-compliance with performance targets
- MOH/GHS should make it a policy for all stakeholders and donors to depend on RHIS (DHIM2) as official sources of information instead of creating parallel system of collecting information
- MOH/GHS should make it mandatory for all donor supported projects to contribute funds to the improvement of RHIS.

Development partners:

- Donors and Development partners should tie assistance with quality RHIS
- Development/Donor partners should integrate data quality improvement interventions in their programs

Data collectors:

- Self-data accuracy should be conducted by comparing figures in the registers and reports before submission to the next level.
- Monthly report forms should be completely filled. Blank spaces should not be left without indicating "0" or "not applicable (N/A)" as the case may be. Also all required number of reports should be compiled and submitted.

- Reports should be submitted to the next level by the declared deadline. This can be achieved by compiling reports daily or weekly instead of waiting till the end of the reporting month
- Copies of RHIS monthly reports sent to the municipal/sub-municipal office should be kept for references.
- Key facility indicators should be analysed and displayed at the facility

6.8 Areas for further research

- Would improvement in RHIS Performance necessarily lead to improved health system performance?
- Would improvement in health system performance necessarily lead to improved health status of the population?
- Studies include Community Based Surveillance Volunteers as they play key role generating community health information could be helpful.
- Future studies explore the relationship resource availability supervision and improvement in routine health information would be needed.
- Action research to explore innovative approaches that encourage discussion of Data quality issue meetings to improve RHI could be helpful.
- A repeat of this study using varying research designs as uncontrolled before and after studies are intrinsically weak evaluative designs, sudden changes make it difficult to attribute observed changes to the intervention.

6.9 Concluding remarks

Quality Improvement Process (QIP) plays key role in enhancing the effectiveness of RHIS. Improvement in RHIS determinants through application of QIP model will necessarily leads to improved RHIS performance, on the assumption that once staff are trained in routine health information process protocol they will apply the principles continuously to improve their RHIS and also use the improved data for planning and decision-making. Standardising supervision practices integrated with RHIS quality control activities conducted on a regular schedule with feedback provided to the facilities will undoubtedly help sustain continuous RHIS improvement.

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APPENDIX

Appendix A: Data Collection Instruments

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY/COLLEGE OF HEALTH SCIENCES/SCHOOL OF MEDICAL SCIENCES/DEPARTMENT OF COMMUNITY HEALTH

The role of quality improvement process (QIP) in enhancing the effectiveness of Routine Health Information System in health service planning in the Ejisu-Juaben Municipal

QUESTIONNAIRE FOR MUNICIPAL/SUB- MUNICIPAL OFFICE

Introduction

Good morning/afternoon. I am with Department of Community Health, KNUST. I will be conducting several meetings with people like you in EJISU-JUABEN MUNICIPALITY to find out your views and ideas about "**The role of quality improvement process (QIP) in enhancing the effectiveness of Routine Health Information System in health service planning in the Ejisu-Juaben Municipal".** Your opinion is highly essential at the same time vital as it will help us to improve the kind of service we provide to our patients. Whatever you say will be treated confidential, so feel at ease to express your candid opinion**.** Be assured that your responses will not in any way be linked to your identity. You are kindly requested to answer the questions below by indicating a tick or writing the appropriate answer when needed. **THANK YOU**

RHIS Performance Diagnostic Tool

Quality of Data Assessment: Municipal/Sub-municipal Office Form

Name of the district/sub-district:		Date of Assessment:		
Name of the Assessor:		Title of person Interviewed:		
Data Transmission				
DQ 1	Does the district/sub-district office keep copy of RHIS monthly reports sent by health facilities?	1.Yes	0.No	

DQ 2	What is the number of facilities in the district/sub-district that are supposed to be reporting to (enrolled in) RHIS?							
DQ 3	What is the number of facilities in the district/sub-district that are actually reporting to (enrolled in) RHIS?							
DQ 4	Count number of monthly reports for the last two months available at the district/sub-district office				a.month	b.month		
DQ 5	What is the deadline for the submission of the RHIS monthly report by facility?							If no deadline is set, write no and go to Q8
DQ 6	Does the district/sub-district office record receipt dates of RHIS monthly report?				1.Yes	0.No		If receipt dates are not recorded, go to Q8
DQ 7	If DQ6 yes, check the dates of receipts for the last two months (same as in Q4).							
		a. Month (specify)		b. Month (specify)				
	Item	1. Before deadline	2. After deadline	3. Before deadline	4. After deadline			
	Number of facilities							
DQ 8	Does district/sub-district have a record of people who receive monthly report data by a certain deadline after receiving monthly report from the facilities?				1.Yes	0.No		
DQ 9	Does district/sub-district have a record of submitting data on time to regional/national level?				1.Yes	0.No		

Data Accuracy

DQ 10	Manually count the number of following data items from the RHIS monthly reports for the last two months. Compare the figures with the reports from the computer.							
	Item	a. Month (specify)			b. Month (specify)			
		# from report	# from computer	Reconciled figure	# from report	# from computer	Reconciled figure	
DQ A	ANC registrants							
DQ B	1st trimester registrants							

DQ C	4th ANC visit							
DQ D	IPT3							
	Data Processing/Analysis							
DQ 11	Does database/format exist to enter and process data?	0. No	1. Yes, by manual	2. Yes, by computer				
DQ 12	Does the database/format produce the following?							
DQ 12A	Calculate indicators for each facility catchment area	1.Yes	0.No					
DQ 12B	Data summary report for the district/sub-district	1.Yes	0.No					
DQ 12C	Comparisons among facilities	1.Yes	0.No					
DQ 12D	Comparisons with district/sub-district /national targets	1.Yes	0.No					
DQ 12E	Comparisons among types of services coverage	1.Yes	0.No					
DQ 12F	Comparisons of data over time (monitoring over time)	1.Yes	0.No					
DQ13	Do you think that RHIS procedure manual is user-friendly?	1.Yes	0.No					
DQ 14	Do you think that monthly report form is complex and difficult to follow?	0.yes	1.no					
DQ 15	Do you find the data software (DHIMS2) user-friendly?	1.Yes	0.No					
DQ 16	Do you find that information technology is easy to manage?	1.Yes	0.No					
DQ 17	Do you think that information system design provide comprehensive picture of health system performance?	1.Yes	0.No					
DQ 18	Do you think RHIS has information (indicators) that is spread over in different information system (forms)?	1.Yes	0.No					
DQ 19	Does the RHIS software (DHIMS2) integrate data from different information systems?	1.Yes	0.No					
DQ 20	Does the information technology (LAN or wireless or phone) exist to provides access to information to all district/sub-district managers and senior management	1.Yes Partially	2.Yes completely	0.No				

RHIS Performance Diagnostic Tool

Use of Information Municipal/Sub-municipal Assessment Form

	Name of assessor:				
District/Sub-district:	Title of person Interviewed:				
	RHIS report production				
DU1	Does this district/sub-district office compile RHIS Data submitted by facilities?		1.Yes	0.No	
DU2	Does the district/sub-district issue any report containing RHIS information?		1.Yes	0.No	If no , go to U4
DU3	If yes, Please list reports that contain data/information generated through RHIS. Please indicate frequency of reports and the number of times the report was actually issued for the last 12 months. Please confirm the issuance of the report by counting them.				
	1. Title of the report	2.No. of times this report is supposed to be issued per year	3. No. of times that report are actually issued for the last 12 months		
DU3a					
DU3b					
DU3c					
DU3d					
DU3e					
DU4	Did the district/sub-district office send a feedback report using RHIS information to facilities for the last three months?		1.Yes	0.No	
	Display of information				
DU5	Does the district/sub-district office display the following data? Please indicate types of data displays and whether the data are updated for the last reporting period.				If no go to U6
	1.Indicator	2.Type of display (Please tick)		3. Updated	
DU5a	Related to mother health	Table		1.Yes 0.No	

		Graph/Chart				
		Map/other				
DU5b	Related to child health	Table		1.Yes	0.No	
		Graph/Chart				
		Map/other				
DU5c	Facility Utilization	Table		1.Yes	0.No	
		Graph/Chart				
		Map/other				
DU5d	Disease surveillance	Table		1.Yes	0.No	
		Graph/Chart				
		Map/other				
DU6	Does the office have a map of catchment area?			1.Yes	0.No	
DU7	Does the office display a summary of demographic information such as population by target groups?			1.Yes	0.No	
DU8	Is feedback, quarterly, yearly or any other report on RHIS data available, which provides guidelines/ recommendations for actions?			1.Yes	0.No	If no go to U10
DU9	If yes to DU8, what kinds of decisions are made in reports of RHIS data/information for actions? Please check types of decision based on types of analysis present in reports.					
	Types of decisions based on types of analysis					
DU9a	Appreciation and acknowledgement based on Number/percentage of facilities showing performance within control limits over time (month to month comparisons)			1.Yes	0.No	
DU9b	Mobilization/shifting of resources based on comparison by facilities			1.Yes	0.No	
DU9c	Advocacy for more resources by comparing performance by areas (sub-districts, clinics, communities), human resources and logistics			1.Yes	0.No	
DU9d	Development of policies by comparing types of services			1.Yes	0.No	
	Discussion and decisions on use of information					
DU10	Does the district/sub-district office have routine meetings for			1.Yes	0.No	

	reviewing managerial or administrative matters?			
DU11	How frequently is the meeting supposed to take place?			
DU12	How many times did the meeting take place during the last three months?			
DU13	Is an official record of management meetings maintained?	1.Yes	0.No	If no, go to U15
DU14	If yes, please check the meeting records for the last three months to see if the following topics were discussed:			
DU14a	Management of RHIS, such **as data quality, reporting, or timeliness of reporting**	1.Yes, observed	0. No	
DU14b	Discussion on RHIS findings such as patient utilization, disease data, or service coverage, medicine stockout	1.Yes, observed	0. No	
DU14c	Have they made any decisions based on the above discussions?	1.Yes, observed	0. No	
DU14d	Has any follow-up action taken place on the decisions made during the previous meetings?	1.Yes, observed	0. No	
DU14e	Are there any RHIS related issues/problems referred to regional/national level for actions?	1.Yes, observed	0. No	
	Promotion of Use of RHIS information at district/sub-district			
DU15	Did district/sub-district annual action plan showed decisions based on HIS information?	1.Yes	0.No	
DU16	Did records of district/sub-district office of last three months show that district/sub-district /senior management issued directives on use of information	1.Yes	0.No	
DU17	Did district/sub-district /national RHIS office publish newsletter/report in last three months showing success stories of use of information	1.Yes	0.No	
DU18	Does documentation of use information for various types of advocacy exist?	1.Yes	0.No	
DU19	Does the district/sub-district staff meeting records show attendance of persons in charge of the facilities for discussion on RHIS performance?	1.Yes	0.No	
DU20: Please describe examples of how the district/sub-district office uses RHIS information for health system management		0. No examples	1. Yes (details follows)	
DU21		1.Yes	0.No	

DU22		1.Yes	0.No	
DU23		1.Yes	0.No	
DU24		1.Yes	0.No	
DU26		1.Yes	0.No	

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The role of quality improvement process (QIP) in enhancing the effectiveness of Routine Health Information System in health service planning in the Ejisu-Juaben Municipal

QUESTIONNAIRE FOR HEALTH FACILITY

Introduction

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RHIS Performance Diagnostic Tool **Quality of Data Assessment: Health Facility Form**				
Date of Assessment:	Name of the Assessor:		Title of person Interviewed:	
District Sub-district	Facility		Type	
Data Recording				

FQ1	Does this facility keep copy of RHIS monthly reports sent to the district/sub-district office?					1.Yes	0.No	If no, go to Q5	
FQ 2	Count the number of RHIS monthly reports that are kept at the facility for the last 12 months								
FQ 3	Does this facility keep registers?					1.Yes	0.No	If no, go to Q5	
Data Accuracy Check									
FQ 4	Find the following information for the two months in the ANC register. If the facility does not keep the copy of the monthly report, obtain the copy at the district/sub-district office and complete the exercise. Compare the figures with the reports from the DHIMS.								
	Item	a. Month (specify)			b. Month (specify)				
		# from register	# from report	Reconciled figure	# from register	# from report	Reconciled figure		
4A	ANC registrants								
4B	1st trimester registrants								
4C	4th ANC visits								
4D	IPT3								
FQ 5	Did you receive a directive from the Senior Management/district/sub-district office to:								
	5A Check the data accuracy at least once in three months?					1.Yes, Observed	0. No		
	5B Fill the monthly/quarterly report form completely					1.Yes, Observed	0. No		
	5C Submit report by declared deadline					1.Yes, Observed	0. No		
FQ 6	Did you receive a directive from the Senior Management/district/sub-district office that there will be consequences:								
	6A if you do not check the data accuracy					1.Yes, Observed	0. No		
	6B If you do not fill the monthly reporting form completely					1.Yes, Observed	0. No		
	6C If you do not submit the monthly report by declared deadline					1.Yes, Observed	0. No		
	Data Completeness								

FQ 7	What is the number of data items in the RHIS monthly report that facility need to report? Excludes the number of data items for services not provided by this health facility.			
FQ 8	Count the number of data items that are supposed to be filled by this facility but left blank without indicating "0" in the last month report.			
Data Transmission /Data Processing/Analysis				
FQ 9	Does data processing procedures/tally sheet exist?	1. Yes, Observed	0. No	
FQ 10	Does the facility produce the following?			
FQ A	Calculate indicators facility catchment area	1. Yes, Observed	0. No	
FQ B	Comparisons with district/sub-district /national targets	1. Yes, Observed	0. No	
FQ C	Comparisons among types of services coverage	1. Yes, Observed	0. No	
FQ D	Comparisons of data over time (monitoring over time)	1. Yes, Observed	0. No	
FQ 11	Does the procedure manual for data collection/definitions exist?	1. Yes, Observed	0. No	

RHIS Performance Diagnostic Tool

Use of Information: Health Facility Assessment Form

Date:	Name of assessor:			
Facility Name:	Title of person Interviewed::			
Facility Type:	District:	Sub-district:		
	RHIS report production			
FU1	Does this facility compile RHIS Data?	1.Yes	0.No	
FU2	Does the facility compile any report containing RHIS information?	1.Yes	0.No	If no , go to FU4
FU3	If yes, Please list reports that contain data/information generated through RHIS. Please indicate frequency of reports and the number of times the report was actually issued for the last 12 months. Please confirm the issuance of the report by observing it.			
	1. Title of the report (e.g. Immunization, Child health, CD2, Family planning, Midwifes, Malaria, TB, Hiv/Aids etc.)	2. No. of times this report is supposed to be	3. No. of times that report are actually issued for	

			issued per year	the last 12 months		
FU3a						
FU3b						
FU3c						
FU3d						
FU4	Did the facility receive any feedback report from district/sub-district office on their performance for the last three months?			1.Yes	0. No	
	Display of information					
FU5	Does the facility display the following data? Please indicate types of data displays and whether the data are updated for the last reporting period.					If no go to FU6
	1. Indicator	2. Type of display (Please tick)		3. Updated		
FU5a	Related to mother health	Table		1.Yes	0.No	
		Graph/Chart				
		Map/other				
FU5b	Related to child health	Table		1.Yes	0.No	
		Graph/Chart				
		Map/other				
FU5c	Facility Utilization	Table		1.Yes	0.No	
		Graph/Chart				
		Map/other				
FU5d	Disease surveillance	Table		1.Yes	0.No	
		Graph/Chart				
		Map/other				
FU6	Does the facility have a map of catchment area?			1.Yes	0.No	
FU7	Does the office display a summary of demographic information such as population by target groups?			1.Yes	0.No	
FU8	Is feedback, quarterly, yearly or any other report on RHIS data available, which provides guidelines/ recommendations for actions?			1.Yes	0.No	If no go to FU10
FU9	If yes, what kinds of decisions are made in reports of RHIS data/information for actions? Please check on types of decision based on types of analyses present in					

	reports.			
	Types of decisions based on types of analyses			
FU9a	Review strategy by examining service performance target and actual performance on month to month comparisons	1.Yes	0.No	
FU9b	Review facility personnel responsibilities by examining service target and actual performance on month to month comparisons	1.Yes	0.No	
FU9c	Mobilization/shifting of resources based on comparison by services	1.Yes	0.No	
FU9d	Advocacy for more resources by comparing performance by targets and showing gaps	1.Yes	0.No	
	Discussion and Decision on RHIS information			
FU10	Does the facility have routine meetings for reviewing managerial or administrative matters?	1.Yes	0.No	If no, go to FU15
FU11	How frequently is the meeting supposed to take place?			
FU12	How many times did the meeting take place during the last three months?			
FU13	Is an official record of management meetings maintained?	1.Yes	0.No	If no, go to FU15
FU14	If yes, please check the meeting records for the **last three months** to see if the following topics were discussed:			
FU14a	Management of RHIS, such as data quality, reporting, or timeliness of reporting	1.Yes, observed	0. No	
FU14b	Discussion on RHIS findings such as patient utilization, disease data, or service coverage, medicine stockout	1.Yes, observed	0. No	
FU14c	Have they made any decisions based on the above discussions?	1.Yes, observed	0. No	
FU14d	Has any follow-up action taken place on the decisions made during the previous meetings?	1.Yes, observed	0. No	
FU14e	Are there any RHIS related issues/problems referred to regional/national level for actions?	1.Yes, observed	0. No	
	Promotion and Use of RHIS information by the sub-district/district/higher level			
FU15	Observed facility received annual/monthly planned targets based on RHIS information	1.Yes	0.No	

FU16	Did records of facility of last three months show that district/sub-district /senior management issued directives on use of information	1.Yes	0.No	
FU17	Did facility receive district/sub-district /national RHIS office newsletter/report in last three months showing success stories of use of information	1.Yes	0.No	
FU18	Did documentation exist to show use information for various types of advocacy exist?	1.Yes	0.No	
FU19	Did the person in charge of the facility participate in meetings at district/sub-district level to discuss RHIS performance for the last three months?	1.Yes	0.No	
FU20: Please describe examples of how the facility uses RHIS information for health system management 0. No examples 1. Yes (details follows)				
	Supervision by the district/sub-district health office			
FU21	How many times did the district/sub-district supervisor visit your facility during the last three months? (check the answer)	0. 1. 2 3. 4. >3		If zero, go to FU26
FU22	Did you observe supervisor having a checklist to assess the data quality?	1.Yes	0.No	
FU23	Did supervisor check the data quality?	1.Yes	0.No	
FU24	Did the district/sub-district supervisor discuss performance of health facilities based on RHIS information when he/she visited your facility?	1.Yes	0.No	
FU25	Did the supervisor help you make a decision based on RHIS information?	1.Yes	0.No	
FU26	Did the supervisor send a report/feedback/note on the last two supervisory visits?	1.Yes	0.No	

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QUESTIONNAIRE FOR HIS OFFICER

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Routine Health Information System Overview **Overview of Information Systems in Health Sector** *(Interview HIS Officer at district and facility level)*	
Level:	□ District □ Facility Name (of sub-district, facility) _____
Respondent's ID:	
Function/Title:	
Institution:	
Department:	

Mapping existing routine information systems in health sector (OPTIONAL)

Using the sheet 1: "Information system mapping", list all routine information systems existing in the country/region/district.

This exercise will help you to understand types of health sector information that are included (or not included) by information systems. It will also help to identify duplication of information systems.

1) Write down specific names of the information systems.
2) Identify types of information covered by each system and check relevant boxes. You may also write comments in the box. For example, an information system for EPI may handle information on drug supplies but it might be limited to vaccines. You can indicate "vaccine only" in the box. Similarly, MCH specific information systems may collect information on service utilization of MCH services only.
3) Please describe how information from different information systems are shared. For example, between TB programs and HIV/AIDS programs

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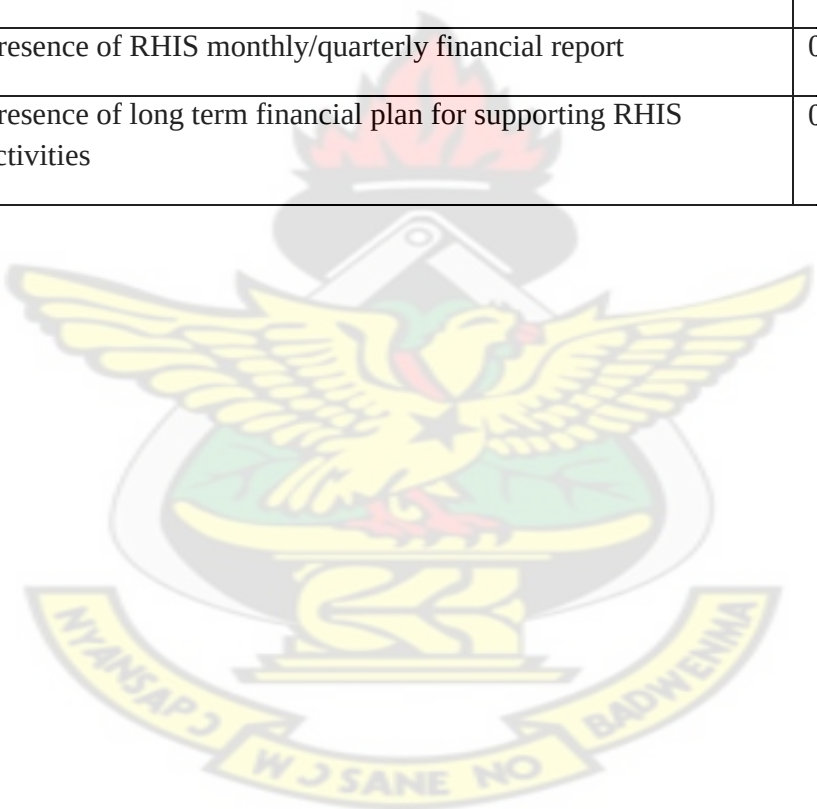
QUESTIONNAIRE FOR OBSERVATION AT FACILITY

RHIS Management Assessment Tool *(Observation at facility)*			
MAT1. Name of the facility		MAT2. Name of the Assessor	
MAT3. Name of the district /Sub-district		MAT4: date of assessment	
MATG1	Presence of RHIS Mission displayed at prominent position(s)	0 No	1 Yes
MATG2	Presence of management structure for dealing with RHIS related strategic and policy decisions at district and higher levels	0 No	1 Yes
MATG3	Presence of an updated (last year) district health management organizational chart, showing functions related to RHIS/health information	0 No	1 Yes
MATG4	Presence of distribution list and documentation of RHIS past monthly/quarterly report distribution	0 No	1 Yes
MATP1	Presence of RHIS situation analysis report less than 3 year old	0 No	1 Yes
MATP2	Presence of RHIS 5 year plan at district or higher level	0 No	1 Yes
MATP3	Presence of RHIS targets at facility and higher level	0 No	1 Yes
MATQ1	Presence of a copy of RHIS standards at district or higher levels	0 No	1 Yes
MATQ2	Presence of a copy of RHIS standards at facility	0 No	1 Yes
MATQ3	Presence of performance improvement tools (flow chart, control chart etc.) at the facility or district	0 No	1 Yes
MATT1	Does facility/district have a RHIS training manual?	0 No	1 Yes

MATT2	Presence of mechanisms for on-job RHIS training (see documentation)			0 No	1 Yes
MATT3	Presence of schedule for planned training	0 No	1. Yes, for one year	2. Yes, 2 years or more	
MATS1	Presence of RHIS supervisory checklist			0 No	1 Yes
MATS2	Presence of schedule for RHIS supervisory visit			0 No	1 Yes
MATS3	Presence of supervisory reports			0 No	1 Yes
MATF1	Presence of RHIS related expense register			0 No	1 Yes
MATF2	Presence of mechanisms for generating funds for RHIS			0 No	1 Yes
MATF3	Presence of RHIS monthly/quarterly financial report			0 No	1 Yes
MATF4	Presence of long term financial plan for supporting RHIS activities			0 No	1 Yes



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The role of quality improvement process (QIP) in enhancing the effectiveness of Routine Health Information System in health service planning in the Ejisu-Juaben Municipal

QUESTIONNAIRE FOR STAFF AND MANAGEMENT

Organizational and Behavioural Assessment Tool

(To be filled by staff and management at all levels)

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_____

IDI. Name of facility

ID2. District/Sub-district

DD1. Title of the person filling the questionnaire (circle answer)

1. Doctor
2. Pharmacist
3. Medical Assistant
4. Nurses
5. Midwife
6. Public Health Nurse
7. Community Health Nurse
8. Nutrition Officers
9. Disease Control Officer
10. District Health Information Officer
11. Hospital Health Information Office
12. Biostatistician
13. Dispensary Technician
14. Laboratory Technologist/Technician
15. Other Facility Staff (specify) ----------

DD2. Age of the person ----------

DD3. Sex 1. Male 2.Female

DD4. Education

1. 10 years 2. Intermediate (11-12) 3. Bachelor (13-14) 4. Master
5.Professional diploma/degree (specify)----------
6. Other (specify) ----------.

DD5. Years of employment ----------

DD6. Did you receive any training in HMIS related activities in last six months? 0. No 1.Yes

We would like to know your opinion about how strongly you agree with certain activities carried out by _____. There are no right or wrong answers, but only expression of your opinion on a scale. The scale is about assessing the intensity of your belief and ranges from strongly disagree (1) to strongly agree (7). You have to determine first whether you agree or disagree with the statement. Second decide about the intensity of agreement or disagreement. If you disagree with statement then use left side of the scale and determine how much disagreement that is – strongly disagree (1), somewhat disagree (2) or disagree (3) and circle the appropriate answer. If you are not sure of the intensity of belief or think that you neither disagree nor agree then circle 4. If you agree with the statement, then use right side of the scale and determine how much agreement that is – agree (5), somewhat agree (6) or strongly agree (7) and circle the appropriate answer. Please note that you might agree or disagree with all the statements and similarly you might not have the same intensity of agreement or disagreement and thus variations are expected in expressing your agreement or disagreement. We encourage you to express those variations in your beliefs.

This information will remain confidential and would not be shared with anyone, except presented as an aggregated data report. Please be frank and choose your answer honestly.

Strongly disagree	somewhat disagree	disagree	Neither disagree nor agree	agree	somewhat agree	Strongly agree
1	2	3	4	5	6	7

To what extent, do you agree with the following on a scale of 1-7?

In health department, decisions are based on

	Strongly disagree	Somewhat disagree	disagree	Neither disagree nor agree	Aagree	Somewhat agree	Strongly agree
D1. Personal liking	1	2	3	4	5	6	7
D2. Superiors' directives	1	2	3	4	5	6	7
D3. Evidence/facts	1	2	3	4	5	6	7
D4. Political interference	1	2	3	4	5	6	7
D5. Comparing data with strategic health objectives	1	2	3	4	5	6	7
D6. Health needs	1	2	3	4	5	6	7
D7. Considering costs	1	2	3	4	5	6	7

	Strongly disagree	Somewhat disagree	disagree	Neither disagree nor agree	Agree	Somewhat agree	Strongly agree
In health department, superiors							
S1. Seek feedback from concerned persons	1	2	3	4	5	6	7
S2. Emphasize data quality in Quaterly/monthly reports	1	2	3	4	5	6	7
S3. Discuss conflicts openly to resolve them	1	2	3	4	5	6	7
S4. Seek feedback from concerned community	1	2	3	4	5	6	7
S5. Use HMIS data for setting targets and monitoring	1	2	3	4	5	6	7
S6. Check data quality at the facility and higher level regularly	1	2	3	4	5	6	7
S7. Provide regular feedback to their staff through regular report based on evidence	1	2	3	4	5	6	7
S8. Report on data accuracy regularly	1	2	3	4	5	6	7
In health department, staff							
P1. Are punctual	1	2	3	4	5	6	7
P2. Document their activities and keep records	1	2	3	4	5	6	7
P3. Feel committed in improving health status of the target population	1	2	3	4	5	6	7

P4. Set appropriate and doable target of their performance 1 2 3 4 5 6 7

P5. Feel guilty for not accomplishing the set target/performance 1 2 3 4 5 6 7

P6. Are rewarded for good work 1 2 3 4 5 6 7

	Strongly disagree	Somewhat disagree	disagree	Neither disagree nor agree	Agree	Somewhat agree	Strongly agree
In health department, staff							
P7. Use HMIS data for day to day management of the facility and district	1	2	3	4	5	6	7
P8. Display data for monitoring their set target	1	2	3	4	5	6	7
P9. Can gather data to find the root cause(s) of the problem	1	2	3	4	5	6	7
P10. Can develop appropriate criteria for selecting interventions for a given problem	1	2	3	4	5	6	7
P11. Can develop appropriate outcomes for a particular intervention	1	2	3	4	5	6	7
P12. Can evaluate whether the targets or outcomes have been achieved	1	2	3	4	5	6	7
P13. Are empowered to make decisions	1	2	3	4	5	6	7
P14. Able to say no to superiors and colleagues for demands/decisions not supported by evidence	1	2	3	4	5	6	7
P15. Are made accountable for							

poor performance	1	2	3	4	5	6	7
P16. Use HMIS data for community education and mobilization	1	2	3	4	5	6	7
P17. Admit mistakes for taking corrective actions	1	2	3	4	5	6	7
P18. Are told that their efforts makes difference In improving population health status	1	2	3	4	5	6	7
P19. Health department encourages supervisors to reward good work	1	2	3	4	5	6	7

Personal

BC1. Collecting information which is not used for decision making discourages me	1	2	3	4	5	6	7
BC2. Collecting information makes me feel bored	1	2	3	4	5	6	7

Strongly disagree	Somewhat disagree	disagree	Neither disagree nor agree	Agree	Somewhat agree	Strongly agree

BC3. Collecting information is meaningful for me	1	2	3	4	5	6	7
BC4. Collecting information gives me the feeling that data is needed							

for monitoring facility performance	1	2	3	4	5	6	7
BC5. Collecting information give me the Feeling that it is forced on me	1	2	3	4	5	6	7
BC6. Collecting information is appreciated by Co-workers and superiors	1	2	3	4	5	6	7

U1.Describe at least three reasons for collecting data on monthly basis on the followings:

U1A. Diseases
1.
2.
3.

U1B. Immunization
1.
2.
3.

U1C. Why is population data of the target area needed?
1.
2.
3.

U2. Describe at least three ways of checking data quality.

1.
2.
3.

Dr. Kwame Adu, Esewani Health Directorate, read a recent district report on data quality and felt very disturbed by it. "I need to take actions", he said aloud. He paced back and forth thinking about his next steps to improve data quality. After some time, he calmed down and wrote his action plan. Please describe how Dr. ROB defined the problem and what major activities Dr. ROB must have included in his action plan for improving data quality…

PSa. Definition of the problem

PSb. Major activities
1. 6.

2. 7.
3. 8.
4. 9.
5. 10.

SELF-EFFICACY

This part of the questionnaire is about your perceived confidence in performing tasks related to health information systems. High Confidence indicates that person could perform the task, while low confidence means room for improvement or training. We are interested in knowing how confident you feel in performing HMIS-related tasks. Please be frank and rate your confidence honestly.

Please rate your confidence in percentages that you can accomplish the HMIS activities.

Rate your confidence for each situation with a percentage from the following scale

0 10 20 30 40 50 60 70 80 90 100

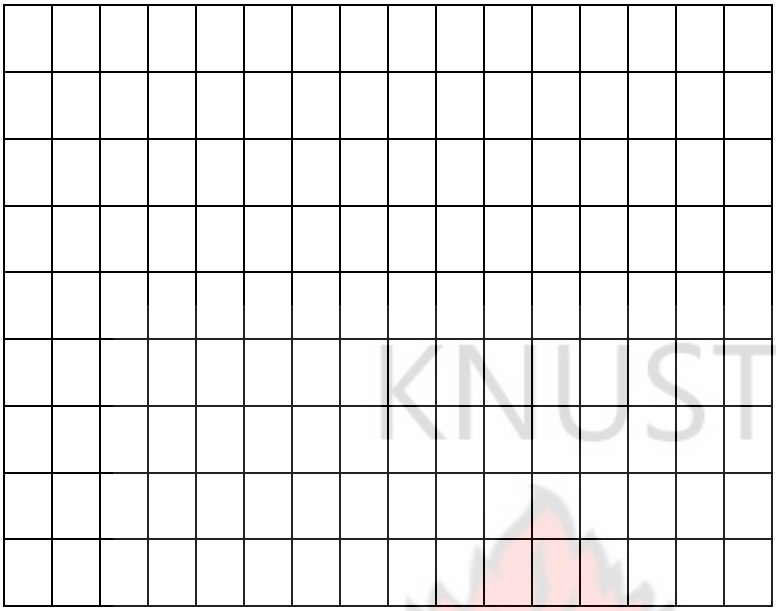
SE1. I can check data accuracy	0	10	20	30	40	50	60	70	80	90	100
SE2. I can calculate percentages/rates correctly	0	10	20	30	40	50	60	70	80	90	100
SE3. I can plot data by months or years	0	10	20	30	40	50	60	70	80	90	100
SE4. I can compute trend from bar charts	0	10	20	30	40	50	60	70	80	90	100
SE5. I can explain findings & their implications	0	10	20	30	40	50	60	70	80	90	100
SE6. I can use data for identifying gaps and setting targets	0	10	20	30	40	50	60	70	80	90	100
SE7. I can use data for making various types of decisions and providing feedback	0	10	20	30	40	50	60	70	80	90	100

We would like you to solve these problems about calculating percentages, rates and plotting and interpreting information.

C1. The estimated number of pregnant mothers is 340. Antenatal clinics have registered 170 pregnant mothers. Calculate the percentage of pregnant mothers in the district attending antenatal clinics.

C2.The full immunization coverage for 12-23 month-old children were found 60%, 50%, 30%, 40%, 40% for years 1997, 1998, 1999, 2000 and 2001 respectively.

C2a. Develop a bar chart for coverage percentages by years



C2b. Explain the findings of bar chart

C2c. Did you find a trend in the data? If yes or no, explain reason for your answer

2d. Provide at least one use of above chart findings at:

UD1. Facility level

UD2. District level

UD3. Policy Level

UD4. Community level

C3. A survey in a district found 500 children under five years old that were malnourished. The total population of children less than five years old was 5000. What is the malnutrition rate?

C4. If the malnutrition rate in children less than 2 years old was 20% and the number of total children less than 2 years old was 10,000, then calculate number of children who are malnourished.

Appendix B: Training Modules Presentation

PhD Research

The role of quality improvement process (QIP) in enhancing the effectiveness of Routine Health Information System in health service planning in the Ejisu-Juaben Municipal

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January 2013

TRAINING MODULES IN DATA QUALITY IMPROVEMENT

Ejisu-Juaben Municipal Health Directorate

MODULE I: REVIEW OF RHIS PRINCIPLES, ASSUMPTIONS & BENEFITS

Session 1: List, Categorize, and Compare Knowledge

By the end of section, participants will be able to:

- List the information available on the monthly report form and compare it with their own knowledge; and
- Describe benefits of the information at different levels- personal, management, community, policy, advocacy, others.

MODULE I: REVIEW OF RHIS PRINCIPLES, ASSUMPTIONS & BENEFITS

Step 1: Write on one sticky card one item of information available on the monthly reporting form. Participants are encouraged to write more than one item of information on an appropriate number of cards. (5min)

Step 2: Post the cards on the flip chart.

Step 3: After the cards are posted, put the category cards on the wall. Group the information written on the sticky cards into the categories below. (10min)

MODULE I: REVIEW OF RHIS PRINCIPLES, ASSUMPTIONS & BENEFITS

e.g. Out-patient attendance , Laboratory tests, diseases

MCH and family planning activities , Essential drugs and contraceptives , Other outreach activities

Step 4: Compare categories with the lowest and highest number of responses and note whether some categories have no responses.

Step 5: Discuss reasons for low and high responses and their implications.

MODULE II: IMPROVING RHIS DATA QUALITY

Session 2: Skills for Checking Data Quality

By the end of section, participants will be able to:

- Define data quality quantitatively;
- Identify causes of gaps in data quality, including their responsibility;
- Develop solution(s) for closing gaps in data quality, including what participants should do
- Measure data quality using time series analysis
- Develop plan to check gaps in data quality and develop monitoring plan chart and display

MODULE II: IMPROVING RHIS DATA QUALITY

Activity I: Defining Data Quality

Step 1: What do you understand by data quality.

Some characteristics of data quality:

- Completeness
- Timeliness
- Relevance
- Accuracy
- Poor or good *records about a thing, situation, or service*

MODULE II: IMPROVING RHIS DATA QUALITY

Activity II: Importance of Data Quality

Step 1: Why timeliness is part of data quality?

Step 2: What is the definition of timeliness is in Ghana Health Services HIS policy?

Step 3: Why completeness is part of data quality?

Step 4: What is the definition of completeness?

Step 5: Why relevance is part of data

MODULE II: IMPROVING RHIS DATA QUALITY

Activity II: Importance of Data Quality

Step 6: What is the definition of relevance in data quality?

Step 7: Why accuracy is part of data quality?

Step 8: List reasons for emphasizing data accuracy

Step 9: How could timely and complete data still be of undesirable quality?

MODULE II: IMPROVING RHIS DATA QUALITY

Activity II: Describing Standards of Data Quality

- Now that consensus has been reached on criteria for defining data quality, we need to define our expectations, standard or targets of timeliness, completeness, and accuracy. These standards, target should be defined in such a way that they are measurable.

Step 10: Why it's inappropriate to use such terms as "poor" or "good" to define quality?

Lets take a few minutes to discuss why it is not enough to define data quality as good or poor.

MODULE II: IMPROVING RHIS DATA QUALITY

Activity II: Describing Standards of Data Quality

Step 11: Why do we need to define the problem in quantitative terms.

Step 12: Define problem of data quality in quantitative terms

Step 13: Conclude with the following definition examples: Standards at district level

- 95% of the facilities should submit the monthly reporting forms on time on monthly basis in Ejisu-Juaben Municipal
- 95% of the facilities should submit monthly reporting forms where 85% of the data elements are filled in Ejisu-Juaben Municipal
- 90% of the facilities should have 80% data accuracy in Ejisu-Juaben Municipal

MODULE II: IMPROVING RHIS DATA QUALITY

Activity II: Describing Standards of Data Quality

Standards at facility level

- 95% of the monthly reporting forms were submitted on time in quarter 1 in facility A
- 90% of the data elements in monthly reporting forms were filled in facility A in each month
- 80% of the reported data is accurate in monthly report in Facility A in each month
- *Data accuracy reached 40 percent in facility ABC in July 2011, indicating a gap of 60 percent for achieving 100 percent accuracy in facility ABC.*

MODULE II: IMPROVING RHIS DATA QUALITY

Activity III: Causes of Gaps in Data Quality

Objectives

By the end of activity, participants will be able to:

- Identify causes of gaps in data quality;
- Learn to develop cause-and-effect diagram; and
- Differentiate between individual and contextual causes

MODULE II: IMPROVING RHIS DATA QUALITY

Step 1: Describe Situational Analysis and audit report results. *Situation analysis showed that:*

- 65 percent of facilities have update of both a register and a monthly report;
- Data accuracy reached only 30 percent;
- 54 percent of participants were not able to calculate the percentage/rate while their confidence level exceeded 80 percent, indicating a gap between perception and actual performance;
- 36 percent of participants were able to plot data while their confidence level around 69 percent, indicating a gap between perception and actual performance;
- 75 percent of facilities received at least one supervisory visit the last year; and
- 55 percent of facilities reported receiving district feedback.

MODULE II: IMPROVING RHIS DATA QUALITY

Step 2: Implementing a Causal-effect Analysis

Step 3: We develop a diagram which provides us with a comprehensive picture of what is causing what, and ultimately effecting the problem.

List of causes:

- Is it due to lack of knowledge and skills of staff?
- Is it because of materials like resources, equipment, forms, registers, etc., are not available?
- Is it because the responsibilities are not distributed properly?
- Is it because the process of carrying out a task is not clear?

MODULE II: IMPROVING RHIS DATA QUALITY

Identify causal relationship:

- It provides us information what are the direct or immediate causes and what are the indirect causes affecting the problem. What is the inter-relationship between direct and indirect causes?

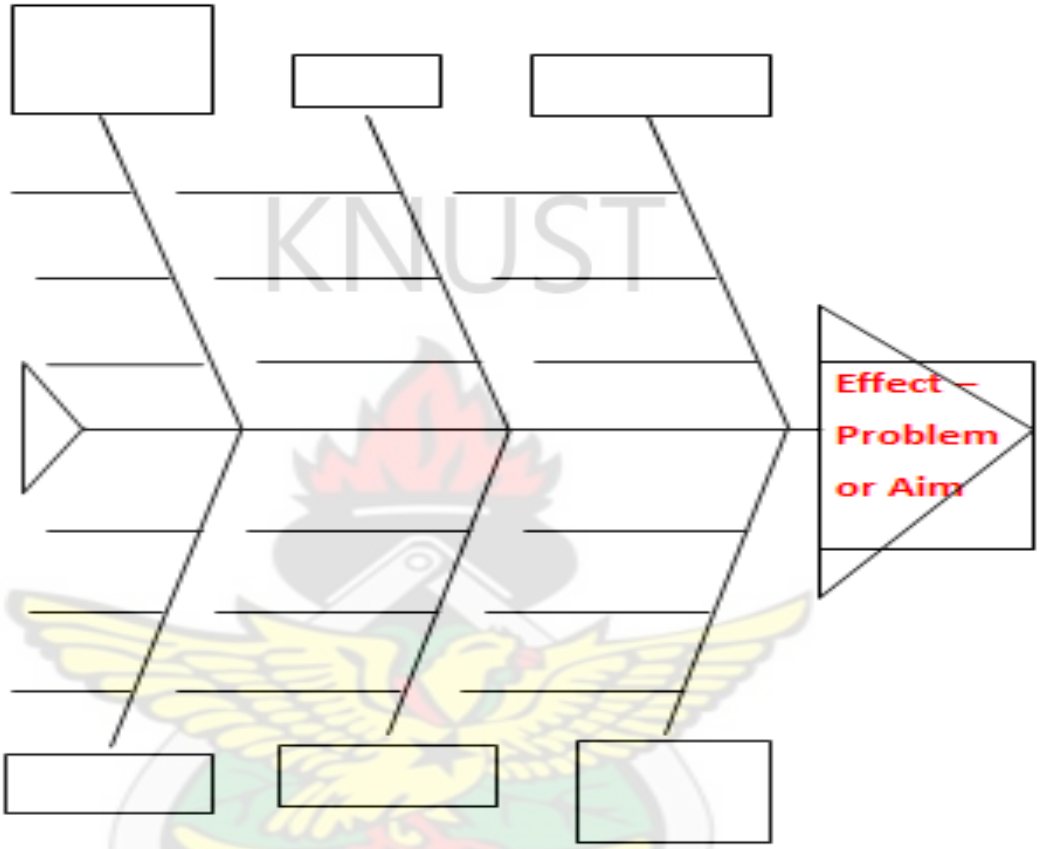
Location of the causes:

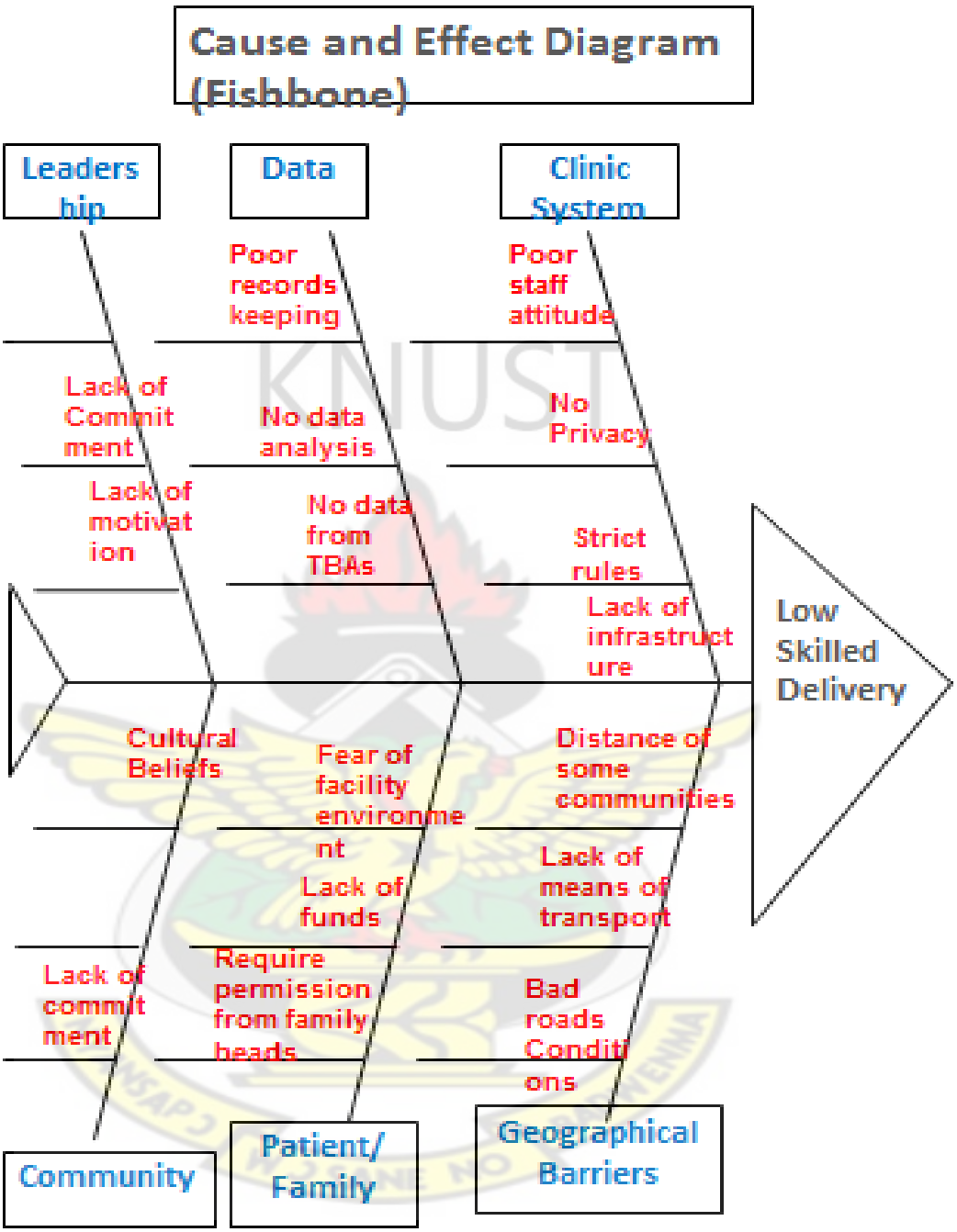
- The diagram is useful in locating where the cause lies. Is it at facility, district or national levels?

Opportunities for intervention(s):

- Since we know the causes, their inter-relationship, and their locations, opportunities exit to develop where to intervene and what types of interventions would be feasible.

Root Cause Analysis - Fishbone




Cause and Effect Diagram (Fishbone)
Leaders hip
Data
Clinic System
Poor records keeping
Poor staff attitude
Lack of Commit ment
No data analysis
No Privacy
Lack of motivat ion
No data from TBAs
Strict rules
Lack of infrastruct ure
Low Skilled Delivery
Cultural Beliefs
Fear of facility environme nt
Distance of some communities
Lack of funds
Lack of means of transport
Lack of commit ment
Require permission from family heads
Bad roads Conditi ons
Community
Patient/ Family
Geographical Barriers

5 Whys

WHY?.....because.....

WHY?.....because .....

WHY?.....because.....

WHY?.....because.....

WHY?.....because.....

MODULE II: IMPROVING RHIS DATA QUALITY

Step 3: Exercise:

- Work in **groups of four** to brainstorm on causes of gaps in data quality (incompleteness, inaccuracy and un-timeliness) and develop a cause-and-effect diagram.

Instructions for developing cause-and-effect diagram:

- Write the problem at the facility level at the head of the "fish".
- Brainstorm to identify the immediate ***(main***) causes contributing to the problem and list them under the problem.
- Consider causes and effects and what causes them and write them down.
- Repeat the process three times in order to chart major causes of the problem and their effects and root cause(s).

MODULE II: IMPROVING RHIS DATA QUALITY

Step 4: Why each effect exists. Ask "why" five times to identify the root cause for several causes. After five circles of asking "why," we assume that we have enough causes to understand the problem fully and do not need to go further.

Step 5: Look at your hand-outs and diagrams. The cause-and-effect diagram helps identify immediate and distant causes of poor data quality. Other factors or causes influence the immediate cause(s). **So** the cause becomes an effect.

Step 6: Share you "cause-and-effect

MODULE II: IMPROVING RHIS DATA QUALITY

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Step 6: Share you "cause-and-effect

MODULE II: IMPROVING RHIS DATA QUALITY

Activity IV: Criteria for Priority Setting for Causes

By the end of activity, participants will be able to:

- Develop selection criteria for choosing causes to be addressed; and;
- Apply criteria to select one or two cause(s) for developing a solution for improving data quality

MODULE II: IMPROVING RHIS DATA QUALITY

Step 1: List criteria for setting priorities for choosing causes of the problem.

Possible criteria could be:

- Impact of cause : level of impact might determine degree to which problem is resolved.
- Immediacy of cause
- Individual versus contextual factors
- Confidence to address the cause
- Simple versus complex cause
- Easy versus difficult to address
- Urgency of cause
- Interest in addressing cause
- Other

MODULE II: IMPROVING RHIS DATA QUALITY

Step 2: Lets check whether you mentioned causes related to your own responsibilities.

- Note that causes related to individuals' responsibilities are important as they immediately affect the problem. Moreover, individuals may have the power to eliminate the causes.

Step 3: Based on selection criteria, select two problems that relate to insufficient skills in checking data quality and motivation to carry out HMIS tasks.

MODULE II: IMPROVING RHIS DATA QUALITY

Session 3: Skills for Checking Data Quality

By the end of section, participants will be able to:

- Describe means of checking data quality;
- Check data quality;
- Use LQAS table for checking level of data accuracy

MODULE II: IMPROVING RHIS DATA QUALITY

Activity I: Means of Checking Data Quality

By the end of activity, participants will be able to:

- Identify means of checking data quality;
- Differentiate between census and sample

MODULE II: IMPROVING RHIS DATA QUALITY

Step 1: Discuss means of checking data quality.

- *Note that some ways of checking data quality include:*
  - Observation of the service provider for correct diagnosis and documentation;
  - Comparison of monthly report with registers;
  - Comparison of generated data with other source of data;
  - Data entry problems– numbers which are unusually high or low raise concern and need to be checked
  - Internal consistency–comparison of number of patients and medicine use; and
  - Historical comparison.

Step 2: we will concentrate on developing skills for checking transfer of data from registers to monthly reporting form.

MODULE II: IMPROVING RHIS DATA QUALITY

Step 3: You are responsible for making sure that the transfer of data from register to monthly reporting form is accurate.

Step 4: What do you think is not provided for checking data accuracy?

Step 5: How would you know that mistakes were made?

Step 6: How would you know how many mistakes were made?

MODULE II: IMPROVING RHIS DATA QUALITY

- The simple answer is. . . .
  - Check all data points to know how many mistakes are made (or other answer as appropriate).
  - *This is what is called census audit of all forms.* It will also take care of question of level of confidence, as all data points are included.
  - Note that the monthly reporting form has more than **200** data points. It will be time-consuming and inefficient to check all of them.
  - What therefore is the next step?
    - One possibility is to check a percentage of data points to draw conclusion about the whole.

MODULE II: IMPROVING RHIS DATA QUALITY

Activity II: Using Lot Quality Assurance Sampling (LQAS) to Measure Data Quality

By the end of activity, participants will be able to:

- Use an LQAS table for checking the level of data quality;

MODULE II: IMPROVING RHIS DATA QUALITY

Step 1: Describe characteristics of LQAS.

- Based on random sampling;
- Requires a small sample that is easy to collect at low cost;
- Provides information on whether a target is met;
- Provides an estimate with statistical precision or an error rate;
- Helps in setting target; and
- Helps in monitoring and assessing progress toward target or making comparison over time.
- Decision Rule - A number that provides the limit for making mistakes, allowing an assessment of whether a target is achieved.

MODULE II: IMPROVING RHIS DATA QUALITY

Step 2:. Look at the LQAS table and discuss how it may be interpreted (**see Hand-out #3**).

Step 3: Look at the table and describe what is in the extreme left column.

- It describes sample sizes for LQAS from 12 to 30

Step 4: Look at the table and describe what is in the top row of the table.

- It describes the target ranges from 10 to 95 percent (data quality targets)?

MODULE II: IMPROVING RHIS DATA QUALITY

Step 5:. what the numbers between the top row and extreme left column stand for.

- These numbers are decision rules.

For each sample size and target level, there is a decision rule. A decision rule tells you how many correct answers you need to reach a certain target based on a certain sample size. The numbers in the table are decision rules and provide information about where you stand regarding a specific target.

MODULE II: IMPROVING RHIS DATA QUALITY

- For example, if you decide that your data accuracy should be 70 percent and you use a sample size of 12, the decision rule is seven; that is, seven or more matches between registers and monthly report are needed to say that 70 percent of the data accuracy target is achieved or that only six mistakes occurred from 12 randomly selected data points.
- However, if the sample size increases to 15 while the target of 70 percent remains unchanged, then decision rule would be nine, indicating. . . .
- Similarly, if the sample size is reduced to 12 while target increases to 80 percent, then the decision rule would be 8, indicating. . . .
- If the sample size increases to 15 while the target of 80 percent remains unchanged, then decision rule would be 10, indicating. . . .

MODULE II: IMPROVING RHIS DATA QUALITY

Activity III: Checking Data Quality

By the end of activity, participants will be able to:

- Check data quality

MODULE II: IMPROVING RHIS DATA QUALITY

Step 1: Conduct data quality check at facility level.

- We are checking how many mistakes are made during the transfer of data from registers to monthly reporting forms. Thus, you need various registers, a monthly reporting form, and a data quality checklist.

Step 2: Explain the data quality checklist (Hand-out #3).

- The first column is for entering 12 randomly selected data items that may include total number of patients under age five, DPT III immunizations for birth to 11 months, number of women receiving condoms, and so forth.
- The second column is for copying numbers from the monthly report for the selected data items.
- The third column is for entering calculated numbers from the registers on selected items.
- The fourth column is for checking whether the monthly report number matches the calculated

MODULE II: IMPROVING RHIS DATA QUALITY

Checking Data Quality (Hand-out #6)

Tasks

- Select randomly any 12 data points—with numbers -- from the monthly report form. Enter them into the first column of the data quality check.
- Copy the number from the monthly report form into the second column of the data quality checklist under the heading of monthly report.
- Calculate the total number of selected data items and enter that number into the third column of the data quality checklist, under the heading register.
- If the numbers are same in columns 2 and 3, enter "yes" in column 4, otherwise "no."

MODULE II: IMPROVING RHIS DATA QUALITY

Checking Data Quality (Hand-out #6)

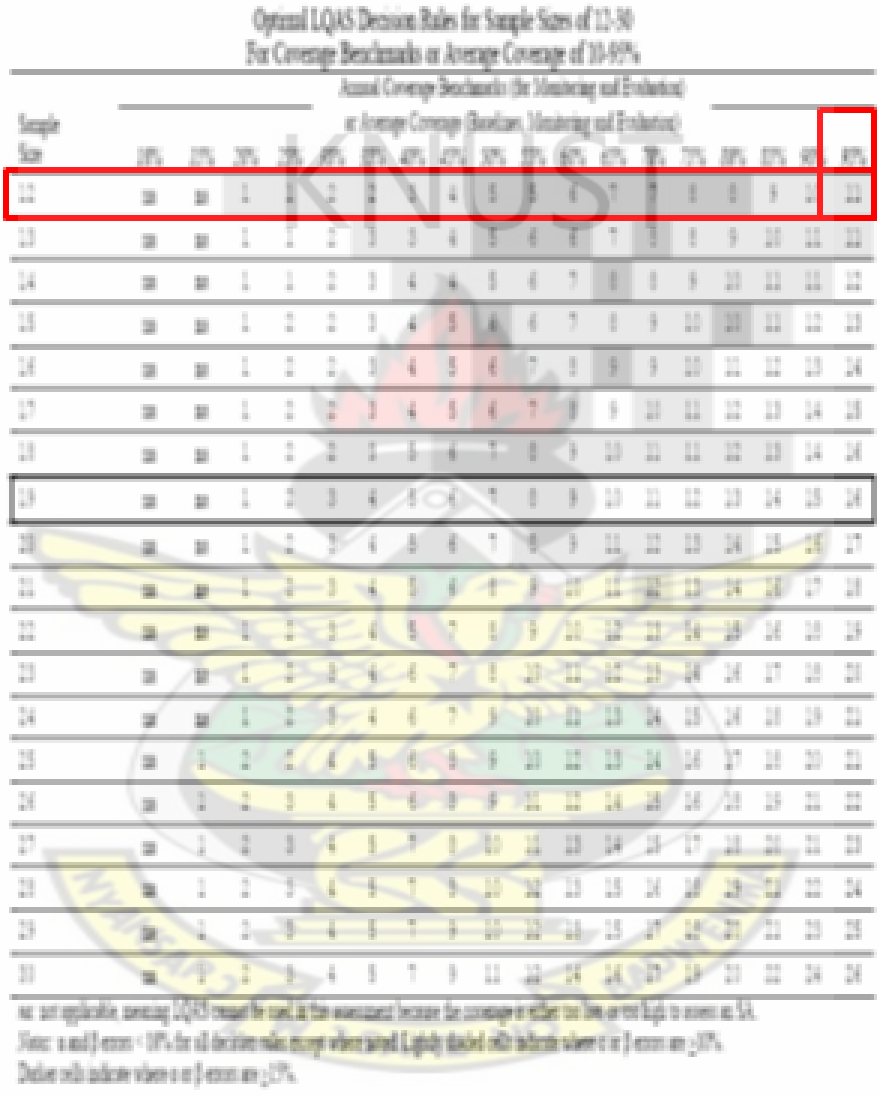
Tasks

- Calculate total matched and mismatched numbers and write under row of total. Total matched numbers are the accurate number.
- Check on the LQAS table on a sample size of 12 and total correct answers. What level of accuracy was reached?
- **Share with others the number of mistakes made and the level of accuracy based on the LQAS table.**

MODULE II: IMPROVING RHIS DATA QUALITY

S/N	Indicator (Data element)	# Correct (out of 12) From the 12 month data points in the year per indicator	Data Accuracy Rate = 93.7% (Sum of correct number matched data /Number of indicators X 12) i.e. 90 / (8x12)	Equal to or Above Decision Rule? Yes or No
1	IPT3	10		No
2	DPT3	16		Yes
3	4th ANC Visit	8		No
4	1st Trim	15	Decision Rule = 11	Yes
5	Measles	10	(Using Decision Rule table and Coverage Estimate or Program Target Rate)	No
6	Yellow Fever	17		Yes
7	FP Acceptors	5		No
8	Malaria cases	9		Yes

MODULE II: IMPROVING RHIS DATA QUALITY



MODULE II: IMPROVING RHIS DATA QUALITY

Solution Development for Improving Data Quality

By the end of activity, participants will be able to:

- Develop selection criteria for choosing solution(s), and;
- Apply criteria to select one or two solution(s) for implementing data quality improvement.

MODULE II: IMPROVING RHIS DATA QUALITY

Activity I: Solution Development

Step 1: Work in four groups. Take 15 minutes to develop solutions for checking data quality and improving motivation, write them on flip chart, and present them to the group..

Step 2: (10 minutes total, 2 minutes per group) Group Presentation.

MODULE II: IMPROVING RHIS DATA QUALITY

Activity II: Selection Criteria for Prioritizing Solutions

Step 1: list selection criteria for choosing which solution to implement.

.

MODULE II: IMPROVING RHIS DATA QUALITY

Model for Improvement to Introduce Change

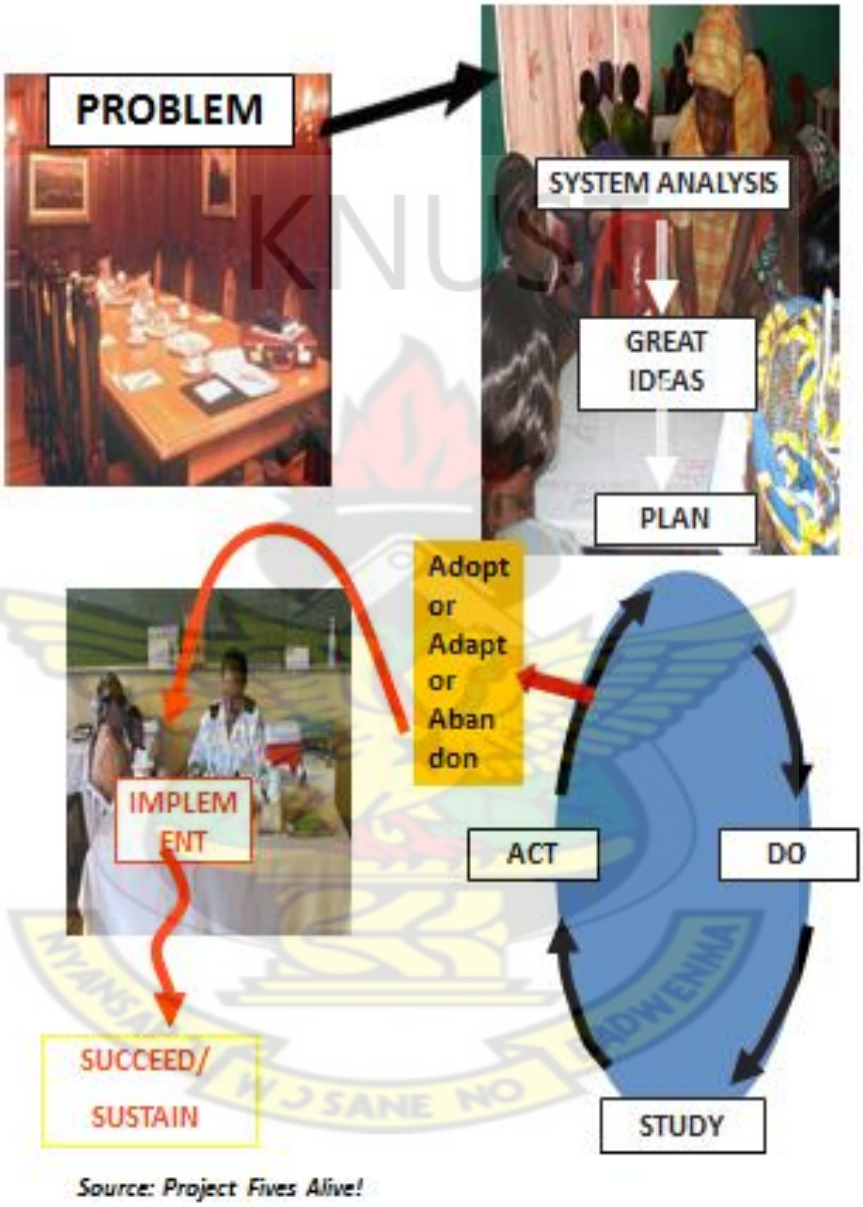
By the end of activity, participants will be able to:

- Set Aim;
- Know different types of measurement;
- Apply of the PDSA Model for Data Quality Improvement

Traditional Model for Introducing Change

Source: Project Fives Alive!

Model for Improvement to Introduce Change



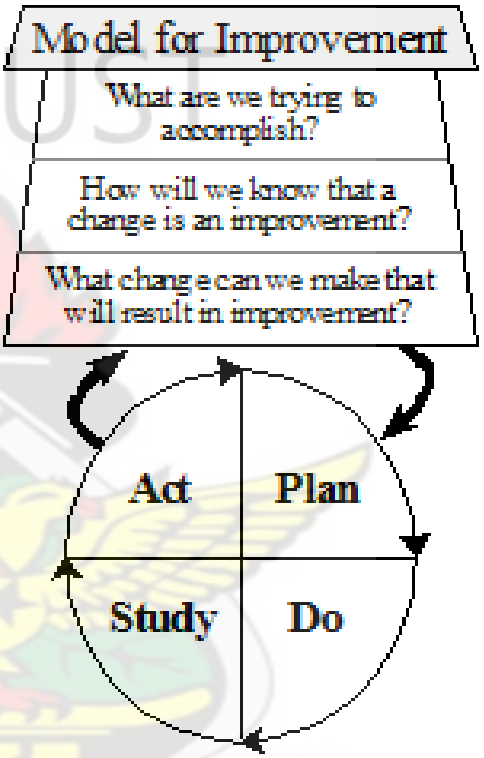
Source: Project Fives Alive!

Model for Improvement

The model comprises three basic questions and a fourth element that describes a cycle for testing innovations

The four simple steps are:

- Set aims
- Define measurements / indicators
- Find promising ideas for change, and
- Test those ideas in real work settings



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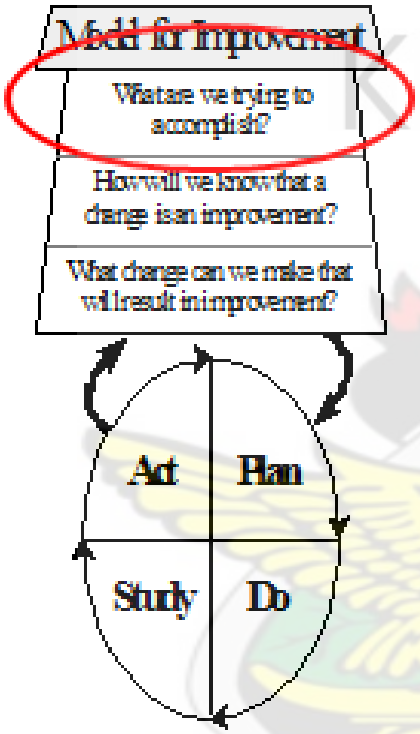
1. Clear aims/objectives/goals



Aim should not just be a vague desire to "do better" or "work harder", but a commitment to achieve measured improvement

- In a specific *system*
- With a definite *timeline*
- And numeric *goals*
- Needs to be *ambitious* for the current system
- Needs to be *achievable* with system re-design

Source: Project Fives Alive!

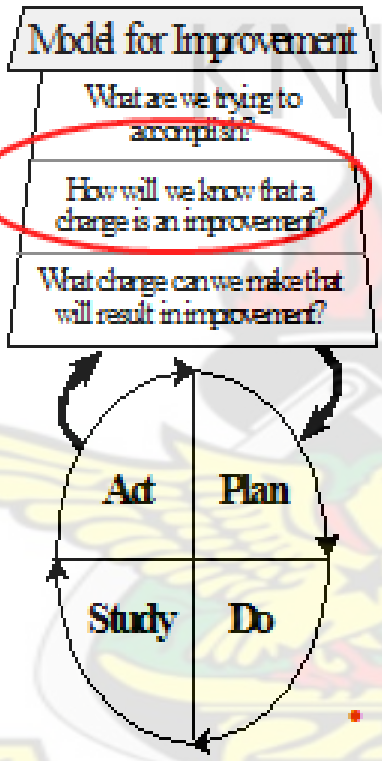
Aim Statement

District A DQI Aim:

reduce the # missing data elements in 4 priority returns from the current level of 20/100 to 5/100 by June, 2013

Source: Project Fives Alive!

2. Results-focused



- **Outcome measures** (related to overall aim)
  - E.g. Under-5 mortality rate
  - E.g. % Data Accuracy

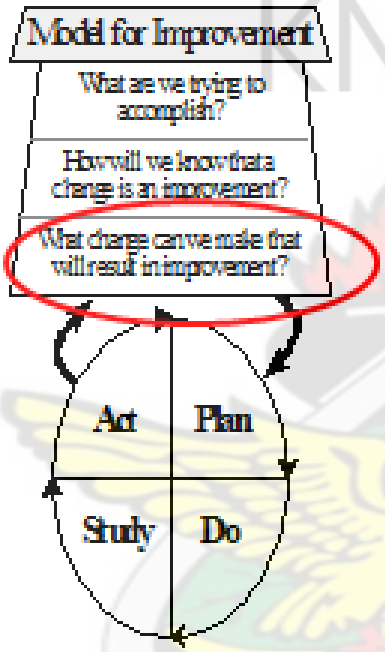
Process measures (intermediary indicators)

- E.g. Proportion of children Under-5 with severe malaria/anaemia receiving blood transfusion within 2hrs of presentation
- E.g. Proportion of premature babies receiving KMC for at least 1 week
- E.g. Proportion of facilities given monthly feedback on data accuracy

- **Balancing measures** (unintended effects of change – positive or negative)
  - E.g. Maternal mortality rate
  - E.g. # of missing data elements in priority returns

Source: Project Fives Alive!

3. Innovation & Creativity



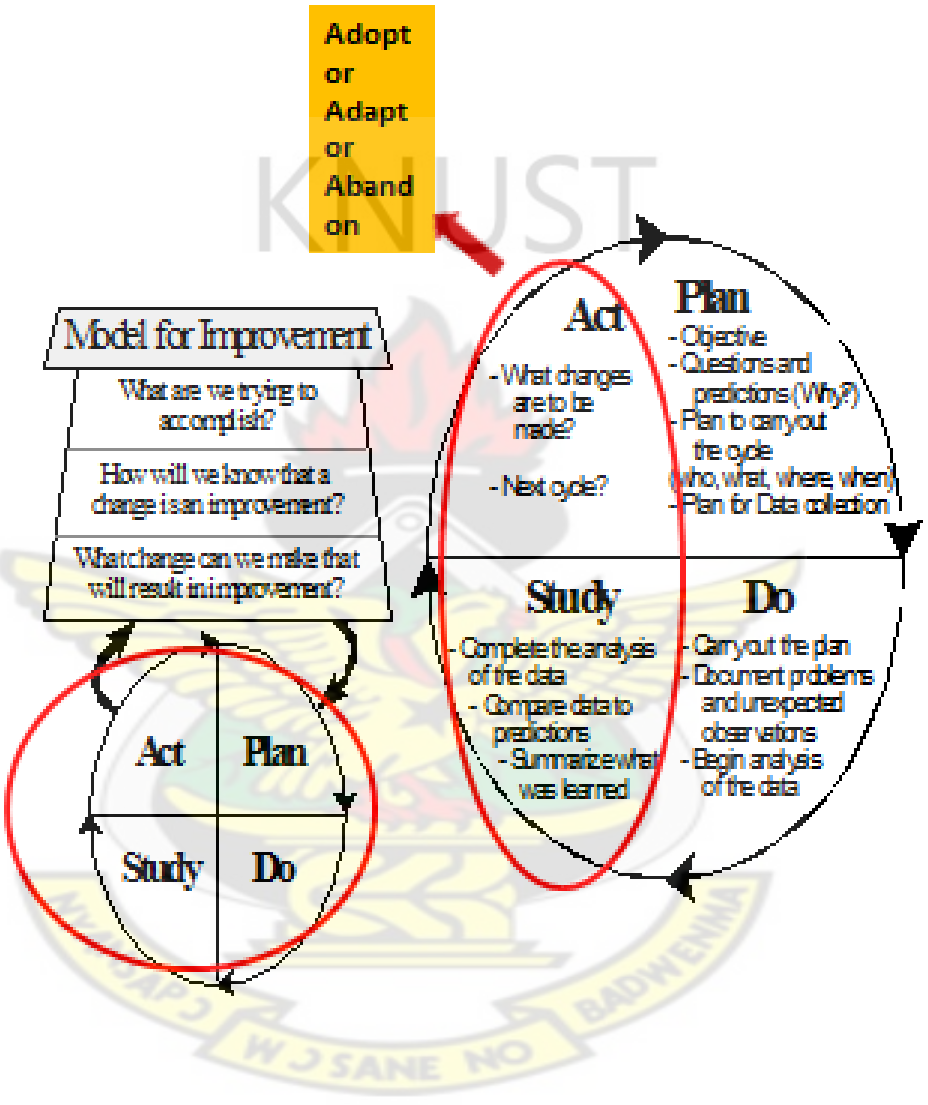
Diagnose process failures using quality planning tools such as process mapping, root cause analysis, 5 Whys, Pareto analysis, scatter plots

&

Develop changes to improve processes using creativity methods (e.g. brainstorming, provocation, six thinking hats) & learning from peers or other sectors

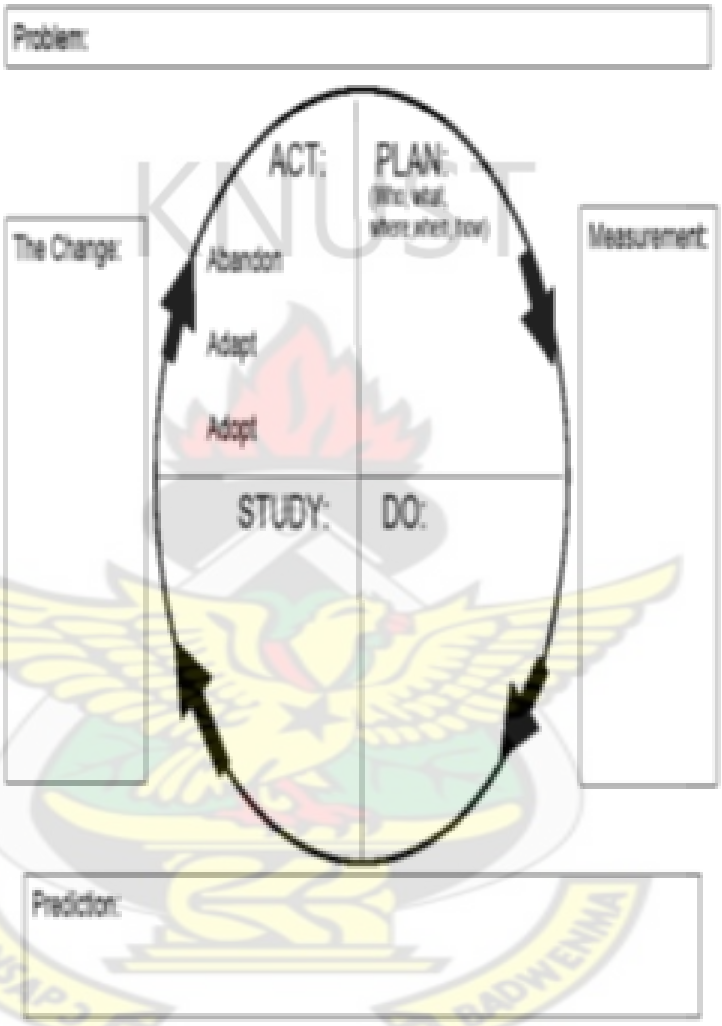
Source: Project Fives Alive!

4. Rapid-cycle Testing & Learning



Source: Project Fives Alive!

PDSA (Plan)



Source: Project Fives Alive!

MODULE II: IMPROVING RHIS DATA QUALITY

Denteh Clinic

Problem Identified: High Maternal Mortality Rate(MMR)

Objective:
Increase skilled deliveries from the current 60% to 90% in 12months

Prediction:
Follow up on pregnant women(34+) to remind them of health facility delivery will result in 30% increase in skilled deliveries

What:
Register for tracking/follow up on all pregnant women(34+)

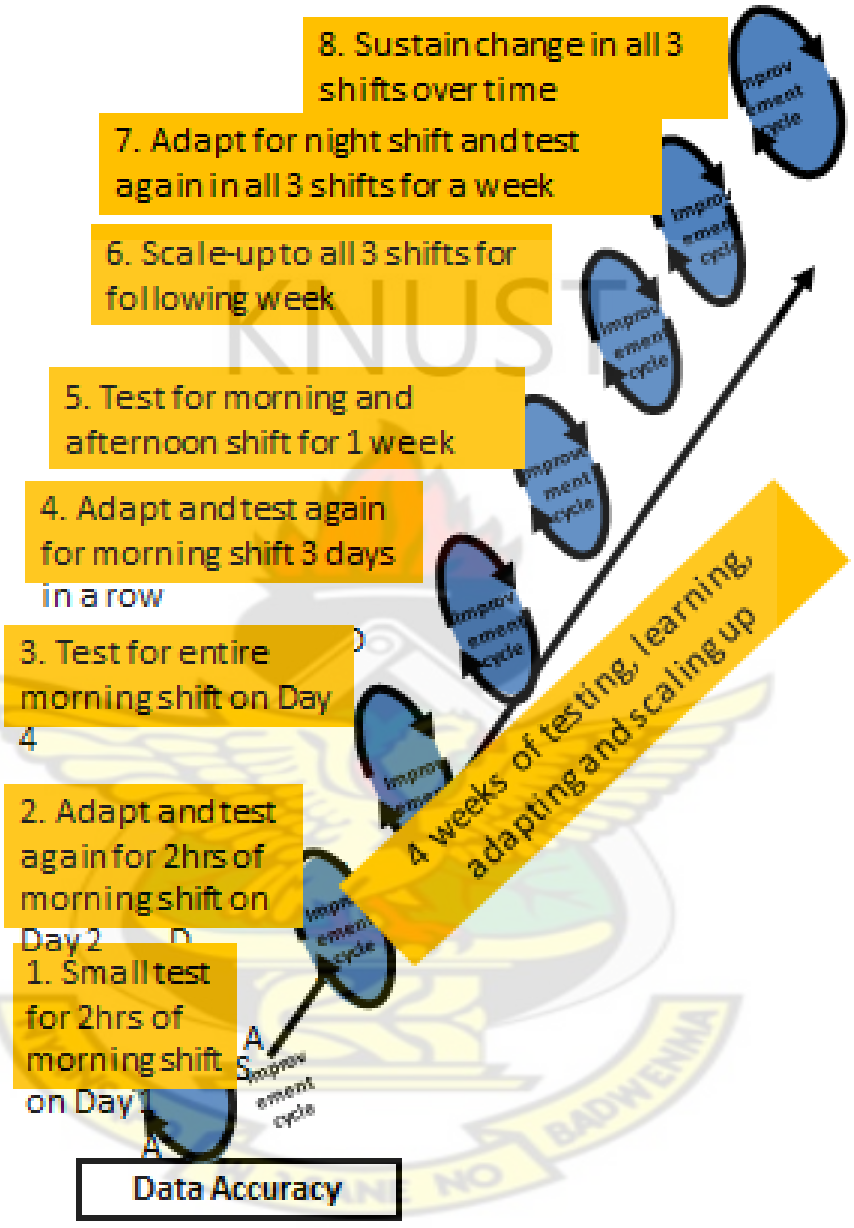
How:
CHOs/CHNs maintain regular contact with pregnant woman and family, older women, mother in-laws educated on importance of health facility delivery.

Who:
clinic staff, older women and mother in-laws

Where:
Bazua sub district

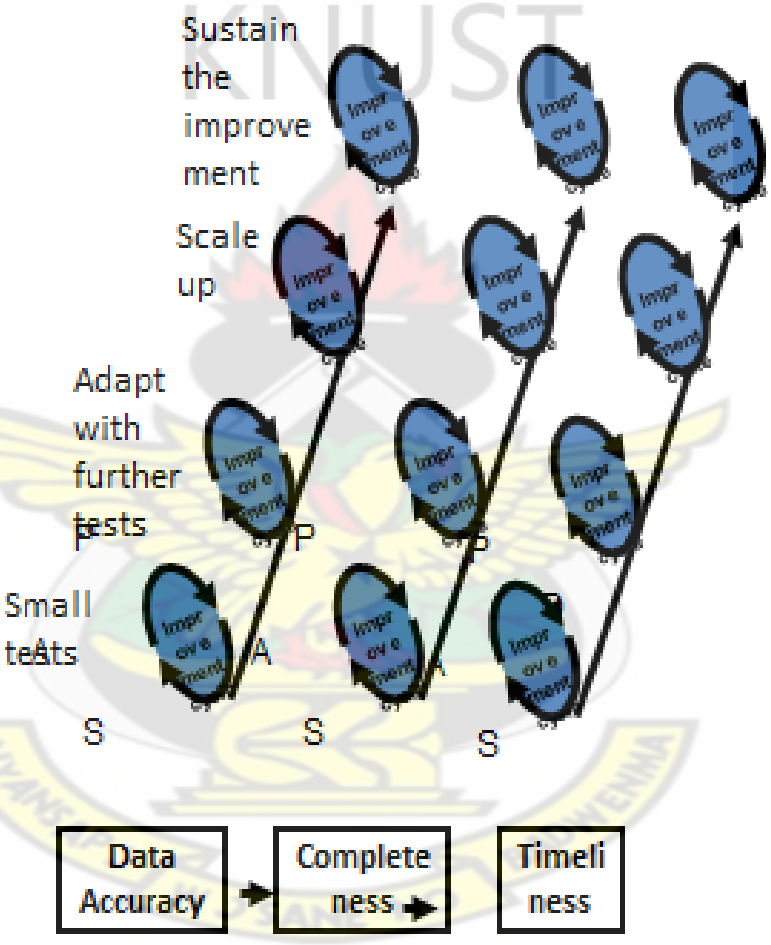
When:
15th April 2013

5. Testing is NOT Implementation



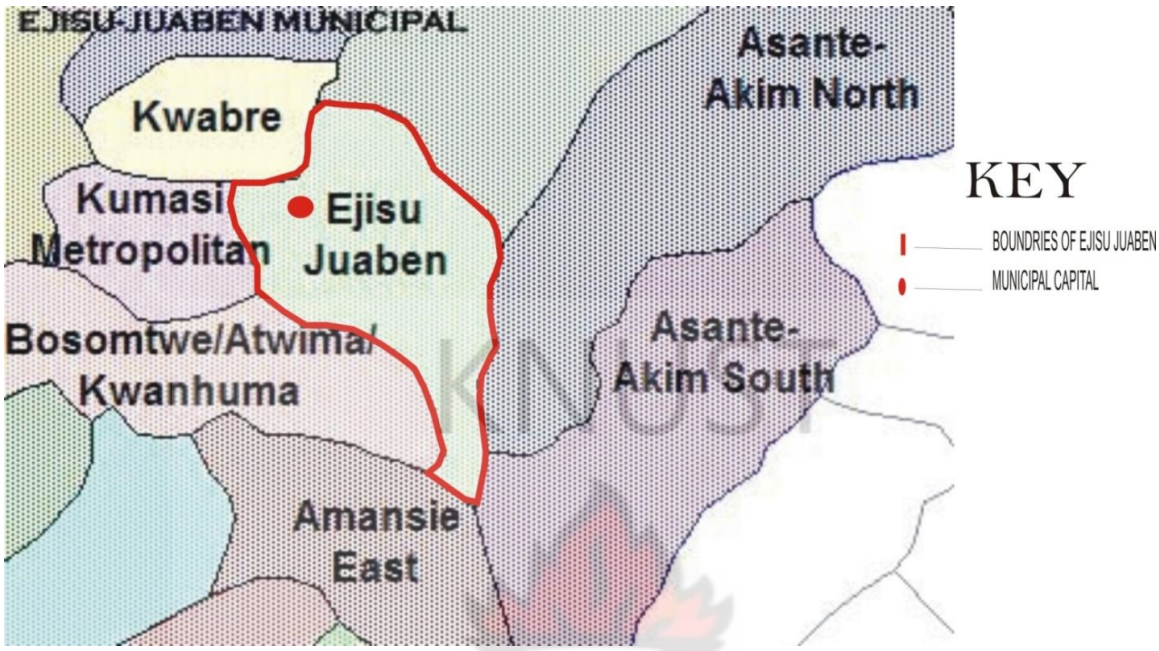
Source: Project Fives Alive!

Multiple PDSA Cycles



Source: Project Fives Alive!

Appendix C: Map of Ejisu-Juaben



Appendix D: Photos of Data Quality Improvement Training Session

The researcher is taking participants through the modules of improving RHIS.

The Municipal Health Information Officer is taking participants through data analysis, interpretation and use.

A participant is making contribution to the topic discussed.

Participants are busily trying their hands on data presentation on graphs sheet.

Participants are engaged in group discussions exercise.

Participants are presenting their group work with their peer group

Participants are presenting their group work with their peer group

Appendix E: Poster Presentation

Competencies Gap Analysis of Health Staff Performance in Health Information System Tasks: The case of Ejisu-Juaben Municipal in Ashanti Region of Ghana

Richard O. Boadu[1], Alberta Lomotey[2], Peter Agyei-Baffour[1]
[1]University of Science and Technology, Kumasi, Ghana; [2]Ghana Health Service, Ejisu-Juaben Municipal, Ghana

Background

Sound policy, resource allocation and day-to-day management decisions in the health sector require quality information from routine health information systems (RHIS) to track the delivery of quality health care services and related support systems. However, previous data quality assessments in developing countries, including Ghana, indicate that the RHIS is often in disarray due to many factors. However, there is limited empirical evidence on competency gaps analysis in RHIS in the Ejisu Juaben Municipal Health Directorate thus crippling management's ability to address the problem.

Purpose of the Study

This study analyses gaps in health staff competencies in performing RHIS tasks. The findings will inform the design of appropriate quality improvement (QI) training modules to improve staff competencies and empower them as Data Quality Improvement Agents.

Methods

Cross-sectional survey was employed in the study. The RHIS management assessment tool (adapted from those in the PRISM tool package) was administered to 141 health staff and management in 18 facilities in Ejisu-Juaben Municipality in July 2012. Varying methods such as interviews, observations and pencil paper tests were used to collect data.

The perceived self-efficacy was measured through a **series of continuous or Likert scale indicators**, which are then used to generate indices following the PRISM analysis guidelines. The Confidence Levels in Performing Health Information System Tasks incorporates four dimensions: collection, analysis, interpretation and use of data while the Competence in Performing Health Information System Tasks was measured by a pencil and paper test that measures the ability of respondents ***to perform calculations, and to interpret and use RHIS results***. To ensure reliability in this measurement, a marking scheme was used as a guide.

Results

Table 1: Results of Competencies Gap Analysis in Ejisu Juaben Municipal (July 2012)

Competencies Gap Analysis			
Self-Efficacy	% Average Confidence Level	% Average Performance Level	% Competencies Gap
I can check data accuracy	68.9	5.9	63.0
I can calculate percentages/rates correctly	73.3	46.1	27.2
I can plot data by months or year	68.9	36.4	32.5
I can analyze trends from bar chart	65.0	33.9	31.1
I can explain findings and their implications	65.0	26.8	38.2
I can use data for making various types of decision and providing feedback	65.0	20.4	44.6

The results in table 1 indicate staff and management have relatively high confidence in undertaking RHIS tasks as they rated themselves high marks with average scoring [65% – 73%]. On the contrary, their actual performance recorded low average scores [6% – 46%] which suggests competency gaps in performing RHIS tasks with particular deficiency of staff and management ability to check data quality of routine data generated by the health system.

Conclusions and Implications

The study concludes that there are huge competency gaps in data accuracy and other dimensions of performing heath information system task in the study area. The findings have policy, operational and management implications in health delivery particularly in QI interventions where routine health data are used for analysis and assessment of performance of process and outcome indicators. The study intend to designing and implementing RHIS quality improvement training modules through coaching and mentoring approach to improve competencies gap identified.