STRENGTHENING THE UTILIZATION OF QUALITY HEALTH INFORMATION TO PREVENT MATERNAL MORBIDITY AND MORTALITY

BY

WILFRED OBWAYA OBWOCHA

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPY OF PUBLIC HEALTH OF JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

© 2024

Declaration

I do declare that this PhD thesis is my original work and has not been presented in any university for the award of a degree.

Signature……. Date…….

Wilfred Obwaya Obwocha

HI62/4224/2018

Supervisors:

This thesis has been submitted for examination with our approval as university supervisors.

Signature……. Date…….

Prof. George Ayodo PhD

School of Health Sciences

Jaramogi Oginga Odinga University of Science and Technology

Signature……. Date……...

Shehu Awandu PhD

School of Health Sciences

Jaramogi Oginga Odinga University of Science and Technology

Dedication

To my dearest son: Job Obwocha

Acknowledgement

I wish to acknowledge the almighty God for giving me patience. I would like to thank Prof. George Ayodo and Dr. Sheu Awandu, who were my research supervisors for their tireless effort, direction, inspiration and constructive critiques of this research work. May the good Lord grant them good health, love and peace as they continue supporting the students. I would like to thank the Board of Postgraduate Studies of JOOUST for the opportunity accorded to me to undertake the program on a Doctorate of Philosophy in Public health. My special thanks goes to all the lecturers in the School of Health Sciences for their words of encouragement and also to all those who are undertaking post-graduate studies.

Table of Content

Declaration ii

Dedication iii

Acknowledgement iv

Table of Content v

List of Figures viii

List of Tables ix

List of Abbreviations x

Definition of Terms xii

Abstract xiii

Chapter One: Introduction 1

1.1 Background Information 1

1.2 Statement of the Problem 3

1.3 Objectives 4

1.3.1 Broad objective 4

1.3.2 Specific objectives 4

1.4 Research questions 4

1.5 Justification 4

1.6 Significance of the study 5

Chapter Two: Literature Review 6

2.1 Introduction 6

2.2 Quality of health information to prevent maternal mortality 6

2.3 Availability of quality health information on maternal morbidity 9

2.4 Quality health information in health annual work plans 11

2.5 Framework to address concerns of quality health information 13
2.5.1 Data life cycle theory 15
2.6 Conceptual Framework 16
Chapter Three: Methodology 17
3.1 Study setting 17
3.2 Study design 17
3.3 Study population 17
3.4 Sample size determination 18
Reduction for population <10000 18
3.5 Inclusion and exclusion criteria 18
3.5.1 Inclusion criteria 18
3.5.2 Exclusion criteria 19
3.6 Sampling procedure 19
3.7 Data Collection Instruments 19
3.8 Data analysis 19
3.9 Validity and reliability 20
3.9.1 Validity 20
3.9.2 Reliability 20
3.10 Data collection procedure 20
3.11 Study Limitations 20
3.12 Scope of the study 21
3.13 Ethical considerations 21

Chapter Four: Results **22**

4.1 Demographic information 22

4.2 Health information on maternal mortality 23

4.3 Availability of quality health information on maternal morbidity 26

4.4 Quality health information in health annual work plans among healthcare workers 27

4.5 A Framework to address the concerns of quality of data and information 29

4.5.1 Assessment of various health indicators on the framework 31

Chapter Five: Discussion **35**

5.1 Quality of health information from the registers and RHIS 35

5.2 Availability of quality health information 36

5.3 Quality health information among healthcare workers 37

5.4 Framework assess effectiveness of quality of health information 38

Chapter six: Conclusions and Recommendations **41**

6.1 Conclusion 41

6.2 Recommendations for Action 41

6.3 Recommendation suggestion for further study 42

References **43**

Annex 1: Assessing quality of information on preventive maternal health indicators 51

Annex 2: Check list: On Therapeutic health indicators 53

Annex 3: Questionnaire for healthcare workers 55

Annex4: Likert scale assessing form for the framework 59

Annex 5: Introductory Letter from School of Postgraduate 62

Annex6: Approval from Baraton University Board 63

Annex8: Letter allowing data collection 65

List of Figures

Figure 2.1 Data life-cycle (Hassenstein and Vanella, 2022) 15

Figure 2.2 Conceptual framework 16

Figure 2.3 Conceptual Framework 16

Figure 4.1 A framework to assess the effectiveness of quality of information 30

List of Tables

Table 3.1 Sample size and sample frame populations for the study 18

Table 4.1 Demographic characteristics among healthcare workers involved in the study 22

Table 4.2 Maternal Mortality among the top four facilities in Migori County 23

Table 4.3 Correlation between RHIS and register data on preventive study indicators 24

Table 4.4 Median differences between RHIS data and register data (significance test) 25

Table 4.5 Correlation between RHIS and hospital register data on morbidity and mortality 26

Table 4.6 Comparison between RHIS and hospital registers data using correlation 27

Table 4.7 Achievement in health Indicators among healthcare workers in determining quality health information 28

Table 4.8 Availability of quality health information among healthcare workers 28

Table 4.9 Achievement in knowledge in available data management systems 29

Table 4.10 Assessment on Inputs/Resources per Health Facility in the Study -likert scale data (N and %) 31

Table 4.11 Assessment of Outputs on health Indicators per facility No. and % 32

Table 4.12 Likert scale assessment on system processes per facility 33

Table 4.13 Uses of quality information per facility 33

List of Abbreviations

AHIMA	American Health Information Management Association
ANC	Ante Natal Care
APH	Antepartum Hemorrhage
ART	Art-ant-Retroviral Therapy
CRH	County referral Hospital
CH	County Hospital
DHIS	District Health Information Software
E-Health	Electronic health
EHR	Electronic Health Records
EMR	Electronic Medical Records
EMR/L	Electronic Medical Records/ Linkage
GIS	Geographical Information System
HASA	Healthcare Access San Antonio
HIS	Health Information System
HIMSS	Health Information Management Systems Society
HIV	Human immunodeficiency virus
ICT	Information, Communication and Technology
IFAS	Iron-Folic Acid Supplement
IPT	Intermittent preventive therapy
IT	Information Technology
LLITNs	Long Lasting Insecticide Treated Nets
M and E	Monitoring and Evaluation
MCRH	Migori County referral Hospital
MDG	Millennium Development Goal
MH	Mission Hospital
MMR	Maternal Mortality Ratio
MOH	Ministry of Health
MPDSR	Maternal, Perinatal Disease Surveillance Response
NACOSTI	National Commission of Science, Technology and Innovations

PHR	Personal Health Record
PMCT	Preventive mother to Child Transmission
PPH	Postpartum Hemorrhage
RHIS	Routine Health Information Software
SCH	Sub County Hospital
SCRH	Sub County Referral Hospital
SDG	Sustainable Development Goals
UNFPA	United Nations Population Fund
UNICEF	United Nations International Children Education Fund
WHO	World Health Organization

Definition of Terms

Data	Raw facts which do not make sense and cannot be used to make decisions
Healthcare workers	Providers of technical/professional health services work in a health facility
Quality data	Degree to which data increase the likelihood of the desired health outcomes
Strategic implementation	A set of processes carried out to identify the future needs of an organization
System	Interrelated parts which work together to achieve a common goal

Abstract

Strengthening utilization of quality health information is important for the provision of quality healthcare services. With high maternal morbidity and mortality in Migori County, it was important to undertake a study to improve the utilization of quality health information. This study therefore was to assess quality health information and design framework to address concerns of quality information and healthcare services. The data for the study were both quantitative and qualitative among morbidity and mortality healthcare indicators. Quantitative data were collected from Routine health information soft, hospital registers and healthcare workers, while Qualitative were collected from healthcare workers heading healthcare programs. The study used retrospective and cross-sectional study designs. This study was conducted in 4 health facilities in Migori County; Migori County and Rongo Sub County referral Hospitals, St Joseph Mission and Isebania County Hospitals. The study population included pregnant women attending antenatal healthcare services, healthcare workers among Nurses, Clinical officers, Medical Doctors and In-charges of programs. Cochran formula was used to calculate the population of the study. The sample size was 155, obtained from sample frame of 260. Proportionate and purposive sampling were used to identify and recruit study participants. Data tools for the study were structured check-lists, questionnaires, likert scale and non-structured interview guides. The quantitative data were analyzed using correlation, descriptive, hypothesis or significance tests and qualitative data used thematic analysis. Results for the study were presented in tables and figures. The study revealed that the majority of healthcare workers involved in the study were Nurses. Correlation coefficient tests on comparison of maternal registers and routine health information software (RHIS) data, on preventive health indicators revealed that minority achieved perfect association of 0.900-1.00. The majority of the indicators achieved moderate, weak and very weak positive associations. The achievement in less than 50% of these indicators tested for significance achieved ($p<0.05$). Meaning good achievement in quality information but insufficient. Most of the indicators achieved ($p>0.05$), implying poor quality data and information for decision making and interventions. On therapeutic health indicators less than 20% achieved perfect relationship and the majority weak and very weak associations. To determine quality heath information in annual and strategic plans, the highest achievement was in computer knowledge (72%) and training in health information (61%). Financial support was (16%) and electronic system use (32%). Migori County referral Hospital financial support for health information was 2.6%, while Rongo Sub County referral and Isebania Hospitals had 0%. Assessment of the framework achieved 96%-99% quality data. The framework was appropriate for improving information quality and its implementation was necessary due to its effectiveness and efficiency.

Chapter One: Introduction

1.1 Background Information

A maternal death happens when a woman dies while pregnant, within 42 days of the end of pregnancy, irrespective of the duration and the site of the pregnancy due to any reason related to or worsened by the pregnancy or its management (WHO, 2019). While, maternal morbidity is a health condition attributable to complication of pregnancy, and childbirth and has a negative influence on the woman's health (WHO, 2020). Quality health information is important for effective decision making, interventions, prevention of maternal morbidity and mortality, management of annual and strategic health plans and monitoring and evaluation (Van et *al*, 2017). Information is not only required by health policy makers to make operational decisions, but it is also used by healthcare providers to increase the quality and efficiency of healthcare services (Betlloch, et al., 2018a). Information generates health knowledge (Allen, *et al.,* 2016), developing and managing knowledge generates power to construct effective and efficient health interventions (Bryan, *et al*., 2019).

Quality health information is the degree to which information increase the possibility of the preferred health results and are dependent on professional knowledge (WHO, 2018). Quality is a powerful interaction among healthcare workers, management and patients/clients. The key parts of data quality include completeness, accessibility, availability, timeliness, safety and correctness (Joachim, *et al*., 2020). A strategy is an established plan and courses of action, which together will result in the attaining of a goal such as the prevention of maternal morbidity and mortality. The term ‘health strategy’ denotes high-level and complex public health areas that strengthen programmatic and policy-level creativities. Strategic implementation is a set of processes carried out to identify the future needs of the organization by developing guidelines and policies that set a path to achieve predicted goals (Ginter, *et al*., 2018). A strategic plan is implemented through annual operation plans and an action plan implements the later (quarterly). Health indicators measure results as part of performance achievement while annual maternal morbidity and mortality reveal the risks attributable to pregnancy and child birth (Pedro, *et al.,* 2019).

Globally, maternal mortality is very high but can be avoided, 295 000 women died during and following pregnancy and childbirth in 2017 (WHO, 2019). Many of these deaths (94%) occurred in low-resource countries although most of them could have been prevented. Globally, maternal mortality had reduced by 34 percent over the past 2 decades. (WHO, 2019).

Africa and Southern Asia contributed an estimation of 86% (254 000) of maternal deaths globally (WHO and World Bank, 2017). Sustainable Development Goal (SDG) targets to reduce world maternal mortality ratio to less than 70 per 100 000 live births by 2030. Although targets for millennium development goals (MDG) were not achieved, but every region of the world made significant improvements (WHO, 2018).

In Africa, the majority of low-income countries did not make sufficient progress towards achieving 75% maternal mortality reduction (MDG 5a), particularly in sub-Saharan Africa and battle-weary settings (MDG, 2014). Sub-Saharan Africa alone accounted for roughly two-thirds (70%) of global maternal deaths in the year 2017. This sub-region so far has achieved a substantial reduction in maternal mortality ratio (MMR) of nearly 33% since 2000 (WHO, 2023a). In Kenya, maternal morbidity mortality varies significantly among geographic regions. Nairobi County had 212 per 100,000 live births (MMR) and Migori County had 673 deaths per 100000 live births (UNFPA, 2017). The causes of mortality in Migori include antepartum hemorrhage, postpartum hemorrhage, eclampsia, ruptured uterus, sepsis and obstructed labor. These diseases are preventives if resources are appropriately allocated and utilized. There are many maternal deaths occurring in Migori County which need urgent preventive measures. According to the routine health information system in 2019 (RHIS, 2019), Migori County maternal mortality per year were: 36 deaths in 2018 (20%), 30 deaths in 2016 (17%), 29 deaths in 2017(16%) and 25 deaths in 2013(16%).

1.2 Statement of the Problem

The National, County Government and Partners contributed to infrastructure development, bed nets, purchase of drugs and supply, capacity building, financial and human resource support to improve quality healthcare services and information in Migori County. The Governments and Partners also supported development, monitoring and evaluation of annual and strategic plans (2018-2022) to improve maternal healthcare services (MOH, 2019). Despite these efforts, maternal morbidity and mortality remained high in Migori County. Maternal mortality ratio was 673 per 100000, compared to the National level 362 per 100000 (DHS, 2018). According to MOH report 2019 maternal mortality for the county referral hospital was 74, St Joseph Mission Hospital 50, Isebania 29 and Rongo Sub County Hospital 27. Maternal mortality was associated with high cases of maternal morbidity. Data in the registers and routine health information software did not match when they were compared. Utilization of quality health information for decision making, interventions, implementation of plans and prevention of maternal morbidity and mortality were challenging. Maternal deaths for the period of study, 2013-2019 were 180. Averagely 45 per facility, 26 per year and 3 per month. Quality health information, utilization and availability of quality healthcare services were not achieved in first strategic plan due lack of electronic systems to collect and analyze data for quality health information to prevent maternal morbidity and mortality. Therefore, there was need to evaluate these gaps on health information, healthcare delivery and utilization of information for decisions making and intervention in preventing maternal morbidity and mortality. The current strategic plan (2018-2023) will be reviewed at the end of 2023 (MOH, 2019).

1.3 Objectives

1.3.1 Broad objective

To investigate the strengthening of utilization of quality health information for prevention of maternal morbidity and mortality

1.3.2 Specific objectives

1) To assess the quality of health information for prevention of maternal mortality
2) To assess availability of quality health information on maternal morbidity
3) To determine quality health information in health annual work plans among healthcare workers
4) To design and assess the effectiveness of a framework to address concerns of quality health information

1.4 Research questions

1) What is the quality of health information for prevention of maternal mortality?
2) What is the availability quality of health information on maternal morbidity?
3) What is the quality health information on maternal morbidity and mortality among the healthcare workers?
4) What is the effectiveness of a framework on quality health information for preventing maternal morbidity and mortality, and implementation of the health plans?

1.5 Justification

Strengthening utilization of quality health information is an important component of quality healthcare services provided by health sector in Kenya. Utilization of quality health Information improves quality healthcare services and the longevity of women of reproductive age. As per 2010 constitution, health information is a powerful pillar in health sector. Provisions of healthcare services should be of the highest attainable standards for every citizen of this country. Maternal morbidity and mortality are manageable if strategies are put in place and implemented appropriately.

1.6 Significance of the study

This study was to identify and fill the gaps that existed in quality health information, health systems and maternal healthcare services. The study would help to improve utilization of information, healthcare services and implementation of annual and the strategic plans. The study results would be shared among policy makers, management and healthcare workers in the County and National Government to facilitate informed allocation of resources. The components of maternal health such as change in allocation of resources will affect reduction and prevention of maternal morbidity and mortality in the County.

Chapter Two: Literature Review

2.1 Introduction

There many maternal deaths occurring in Migori County which need urgent preventive measures. A maternal death happens when a woman dies while pregnant, within 42 days of the end of pregnancy, irrespective of the duration and the site of the pregnancy due to any reason related to or worsened by the pregnancy or its management (WHO, 2019). While, maternal morbidity is a health condition attributable to complication of pregnancy, and childbirth and has a negative influence woman's health (WHO, 2020).

Availability of quality health information to facilitate decisions and interventions to improve quality healthcare services was challenging (UNFPA, 2017a). Health information is associated with a person's medical history, as well as symptoms, diagnoses, procedures and outcomes. It is the intelligence to monitor the health and services and strengthen public health leadership, healthcare services, and management of all health indicators (AHIMA, 2023). Health information system is a set of associated parts and processes organized with the objective of generating health information (Azzopardi, *et al*., 2021). Its objective is to increase availability, timeliness, accessibility, reliability (quality) and user-friendly data/information at all levels of health (Sinhasane, 2022).

2.2 Quality of health information to prevent maternal mortality

There are three aspects of health information; Processes, systems and management. Information process: collects, analyses, presents, interprets and disseminates using information system. Management involves people because of their knowledge and decisions in implementation of activities, applying information (Koumamba, *et al*., 2021a). Information system consists of electronic software and information management structure, dealing with information systems' resources such as human resource; managers, statisticians, epidemiologists, and supplies such as telephones, computers, and report forms and finances (WHO, 2021a). Developing and synchronizing health systems are critical for generating and reporting quality health information. This was to help in strategic planning, implementing, monitoring and evaluation of healthcare

delivery at all levels of health services (Betlloch, *et al*., 2018b). In order ascertain a more responsive use of financial and human resource public health professionals are increasingly expected to engage in evidence and up-to-date decision-making (WHO, 2019). Information is not only required by health policy makers to make operational decisions, but it is also used by healthcare providers to increase the quality and efficiency of health services (Betlloch, et al., 2018). Information generate knowledge (Allen, *et al.*, 2016), developing and managing health knowledge generates power to construct effective and efficient health interventions (Bryan, *et al*., 2019). Improving the processes of data management increase availability of useful information for health planning, decision-making and share resources through different sources to deliver quality health services (WHO, 2018).

Health sector needs contributors in designing, developing and implementation of computerized health information systems in countries (Koumamba, *et al*., 2021b). This is potential to be identified and implemented in developing countries (WHO, 2019a). These components are integrated and used to produce high-quality and timely information for decision-making and provide set organizational directions, which are necessary to ensure the optimal use of health information system resources (WHO, 2018). Good quality information is based on web-based software necessary for quality data collection, operability, analysis, presentation and integration in health information management activities (Kiberu , *et al*., 2014). However, in many sub-Saharan African countries, information utilization in all healthcare systems is low (Mekonnen, 2021). Efforts to encourage information use and evidence-based decision-making is difficult (Eshetu , *et al*., 2018). Global summit on quantity and accountability for health has called for action. Countries should have health information flow and utilize information locally to strengthen healthcare services for success of programs (WHO, 2018).

Although health management information system (HMIS) offers opportunities to inform health decision-making at all levels of the health systems, its usefulness is realized when data is converted into meaningful information and knowledge (Shiferaw, *et al.*, 2017). The concerns about the poor quality of routine information have challenged information use for decision-making in the health sector (Susan, *et al*., 2020).

Health information systems include data and concepts combined in health services given to patients to strengthen the management of such health services (WHO, 2015). Health information system has five key operations: data collection, compilation, analysis and synthesis, and communication used to develop the basis for decision-making (WHO, 2021b). Information system is a potential tool for health promotion which empowers people to increase control over, and strengthen, their health (Shahmoradi, *et al*., 2016). To reach a state of complete wellbeing; mentally and social, an individual or group must be able to recognize and realize their desires to satisfy needs and changes consistent with the environment (Susan, *et al*., 2020).

Information systems can aggregate demographic and geographic data about threats of diseases and associated data. Data about occurrences; mortality and prevalence of risk factors should be shared between the systems. Health information systems have been developed in order to integrate health information to meet consumer needs, contribute to epidemiological research, improve healthcare quality, reduce expenses and allow information management (Shahmoradi, *et al*., 2016). Shared information is used for management of healthcare services and programs. The demand for evidence towards the achievement of the SDGs, must be attached to the increasing needs for both multilateral and bilateral donors. This proves their contributions towards health development and creates increased demand for information (Edmond, *et al*., 2022). An information culture is achieved when there is high demand for data and clear indicators to plan, take action, or proposes new activities. This is when data talks loudest for decisions. The organization philosophy may foster/discourage information application. A good information culture is characterized by frequent information use. Information should be shared by providers, public, decision-makers and other stakeholders in the health sector and society (HIMS, 2020) To secure sustainability of health information system and create a culture supporting information use in decision making (Corrina, *et al.,* 2017).

The effectiveness and efficiency of an organization, depend on the performance of its workers. An organization is governed by guidelines, processes, procedures and systems which have ability to support or hinder an individual's ability to use information in decision making (Akparep, *et al*, 2019). An organization that has structures and processes for improving the interaction of data between users and producers, provides policy for data quality processes; defining roles and responsibilities interlinked to utilization of information. This will reinforce interventions put in

place to strengthen informed decision making (de Goor, *et al.*, 2017). A study showed that organizational factors, such as strengthening a culture of information and supportive quality supervision were weak. There was little evidence of systematic communication about performance, use of information for decision making and advocacy (Kruk, *et al*., 2018).

Feedback is an area where potential improvement, will be beneficial for lower level of responsibility associated to both monitoring, evaluation, planning and decision-making in places where electronic system is employed. When quality of health information is strengthened data providers will feel their data collection contribute to improvements and change, benefiting both themselves and patients, and then create ownership (JHIA, 2019). Inadequate systems to support monitoring and evaluation activities negatively affected the perceived importance, quality of data collection and use. Creating an information culture is challenging and therefore, a long-term behavioral intervention is required (Susan, *et al*., 2020). Data managers and users work collectively and are aware of data collection processes and methods, availability of data sources and quality. They have the opportunity to address obstacles to data use and strengthen the sharing of data resources to reduce maternal morbidity and mortality (Kawila, *et al.*, 2022).

2.3 Availability of quality health information on maternal morbidity

Quality information is important to monitor, evaluate, prioritize, and strengthen health care services (WHO, 2018). Quality in evaluating health indicators on maternal morbidity and mortality was a problem (Pedro, *et al*., 2019). World Health Organization (WHO) has developed approximations of maternal mortality due to lack of good quality data for monitoring trends and comparisons between countries (WHO, 2018). Demand for large amounts data, reports, frequent changes of health tools, inadequate monitoring of quality and absence of standards to measure data quality in organization structures, contribute to poor quality of information (Thein andThant, 2020).

Introduction of electronic health information systems quality indicators such as completeness and timeliness have significantly improved information in many countries (Obinwa, *et al*.,2020). Information on maternal mortality in the developing countries have been collected from hospital-based or small community-based studies and service statistics. In rare circumstances, population surveillance systems have reported on maternal deaths. In the developed world, maternal mortality statistics generally will result from vital registration systems (WHO, 2022).

Quality data on maternal health was lacking, which undermined planning and responses to maternal health issues in low-income countries (Rana and Dikaios, 2020). The governments should improve the collection and analysis of vital data to serve as an essential source of health information on maternal mortality. The Ministry of Health should enhance collection of maternal health data per health facility in all counties to help identify and monitor morbidity and mortality trends. Additionally, research on factors that contribute to high maternal mortality in different counties should also be conducted (Muchemi, *et al*., 2016). Evaluation of maternal mortality is needed to inform planning of reproductive health programs, guide advocacy efforts and research at the national level (Yost, *et al*., 2014). To be useful later the country approximations must be internationally comparable (WHO, 2019).

It was a challenge to assess the degree of progress towards the Millennium Development Goals due to inadequacy of reliable and accurate data on maternal mortality, especially in developing countries, where maternal mortality was too high (WHO, 2018). WHO, United Nations International Children Education Fund (UNICEF), United Nations Population Fund (UNFPA), and the World Bank have collaborated to develop and update five-yearly approximations of maternal mortality using statistics for countries where no reliable data on maternal mortality exist (WHO, 2023b). Consultations with countries were carried out to give countries the opportunity to review their countries' approximations, data sources and methods. In addition, this helped in finding primary data sources which were not or used to build common understanding of the strengths and weaknesses of available data and ensure broad ownership of the outcomes (WHO, 2016).

In relation to maternal deaths the collection of information on deaths with a view to find out why the deaths occur, and what can be done to prevent them, is the keystone of quality assurance approaches (WHO, 2016). This can take the form of verbal autopsies in the community, maternal death reviews, confidential enquiries, reviewing cases of severe maternal morbidity and criterion- based clinical audit of life-threatening complications (Willcox, *et al*., 2020). Primary prevention of maternal mortality is exemplified in the deliberation of family planning as an approach. Throughout the 1980s, family planning was presented as one of the key strategies for maternal mortality reduction in developing countries (Chola, *et al*., 2015). Attainment of decisions about employing a strategy, regardless of whether or not there is good evidence, it is important to

remember that the value of a strategy is dependent on the circumstances in which it is to be employed. This has led to the concept evidence- based decision making for health policies in which context plays a role in the introduction, interpretation and application of evidence (Obinna, *et al*., 2015).

2.4 Quality health information in health annual work plans

Health care quality is the degree to which health care services for individuals and populations increase the chances of anticipated health outcomes (Kruk, *et al.,* 2018). Information users have different information needs, at different levels and have different roles in the decision-making processes (Yousef , *et al*., 2020). The aspiration to improve health systems and healthcare delivery is common in many low- and middle-income countries (Langlois, *et al*., 2020). Implementations were often lacking among health personnel when data quality are poor. Demand for information drops, thus crippling the cycle of information to inform decision making (Adil, *et al*., 2020). However, Healthcare is hampered by chronic lack of resources especially human resource and inadequate material resources essential for healthcare (Obinna , *et al*., 2019). At the same time, expectations are high for both the quality of care and training, particularly in tertiary hospitals (Maru, *et al*., 2023).

Skills deficiency in data management contributes to poor quality data collection due to late reports, as well as incomplete and inaccurate submission of monthly routine reports to counties. (Boone, *et al*., 2019). If the patient load and staff shortage are anything to go by, then an effort to ensure quality improvement in health care delivery, increasing staff capacity and reducing staff turnover needs to be addressed and hence no longer merely known and neglected (WHO, 2016).

Leadership is one of the cornerstones of sustainable quality improvement, while continuous weak leadership structures may compromise the quality services (Kruk, *et al.,* 2018). Managers sometimes feel that they have little control over health workers (Cowie, *et al*., 2020). There is lack of integration of systems leading to inadequate data flow between them (Figueroa, *et al*., 2019). The purpose of integrating health information systems is to provide services to patient and clients, influence continues workflow and information, enabling efficient healthcare decision making (Shahmoradi and Habibi-Koolaee, 2016)**.**

The most barriers that delay or hinders adoption and successful implementation of electronic health records and electronic medical records systems are human negative beliefs, behaviors and attitudes of healthcare professionals. There is lack of ability to learn over time, computer knowledge, understanding and believing in electronic medical records systems (Emwodew, *et al*., 2021). There is a big gap between planning for the introduction of health information systems and electronic medical records to hospitals. There is inadequate success in implementing such systems and operating them optimally to achieve the primary purpose and benefit needed and expected (Yost, *et al*., 2014).

Health information technology systems are becoming available almost equally to all world countries. There is no country or region in the world which does not have computers and information networks. There is provision of technical support for those systems during and after their implementation, as well there is cost of changing the traditional paper medical records to the electronic systems Kingsley, A. (2017a). However, there is inadequate health care funding to cover the costs of implementing health information systems and operationalize training of end users. (WHO, 2022). Interventions to improve health information system do not address behavioral factors such as attitudes toward the use of health information, motivation and incentives for making information-based decisions. This results in poor quality data due to underreporting and influences poor information use in decision making (Annika, *et al*., 2020).

Perceptions and attitudes of senior management towards data will determine the use of health information (Tahmina, *et al*.,2020). If senior managers fail to promote evidence-based decision-making and the use of information for transparency and accountability, then a culture of information use is improbable to be fostered. It is therefore important to examine the perceptions, attitudes and values of senior managers. Also scrutinize other organization members in association to information-related operations (Khuwaja, *et al*., 2020). In most developing countries, particularly in sub–Saharan Africa, health reporting has been dominated by manual systems in data collection and storage that generates incomplete and inaccurate reports (Koumamba, *et al*., 2021c). The use of manual systems contributes to poor data quality in terms of reliability, availability, timeliness and completeness of reporting, and reductions of quality healthcare service (Susan, *et al*., 2020).

There is a need to deploy electronic based health management information systems to reduce errors in health reports, strengthen precision and usability of health information. The development of electronic based health information systems opened a new chapter for strengthening health reporting in the developed world and this is gradually taking root in most developing countries (Kiberu, *et al*., 2014). Electronic based systems have influenced the ability to collect quality data and information to inform planning and decision-making (Soumya and Han-fen, 2022).

2.5 Framework to address concerns of quality health information

High maternal morbidity and mortality existed in Migori County. Maternal mortality was 180 in 2013-2019 (RHIS, 2019) in the four study facilities. This was very high and needed urgent attention to salvage the situation. Due to these circumstances, a framework was designed to address the concerns of poor quality of information and healthcare services to prevent maternal morbidity, mortality and implement health plans. Healthcare framework (HCF) was developed on the basis of 5 health dimensions; **i**nputs, outputs, systems and processes, outcomes and uses and all were based on cloud healthcare platform to capture data, manage patient workflow, consultations in person or virtual (RHIS, 2019).

Inputs

Governance and leadership, Policies, systems and processes, people and skills, partnerships support

Processes and Software Systems

EHR, EMR, data collection and analysis, information, knowledge and dissemination of information.

The purpose of these software was to improve and manage data quality.

Outputs

Accuracy, timeliness, accessibility, availability, reliability, consistency, standardized, comparable, valid, relevant, evaluable, credible, distinguishable and information

Outcome

Availability of quality information in health Plans, Reduced morbidity and mortality, reduced mortality Ratio (MMR and Quality of data/information.

Uses of quality health information/knowledge:

Making decisions, interventions, innovations, inventions, strategies, plans and effective monitoring and evaluation which influence: reduced morbidity and mortality.

Figure 4.1 illustrates how these dimensions are interlinked and interrelated to achieve a common purpose; quality of data/information, safety, effectiveness, patient/client centeredness, efficiency, equity and timelines (Gomes, 2018). Health information framework to guide combined effort to collect, organize, analyze, interpret, display and utilize information and knowledge to inform decisions and health policy was necessary (Hjollund, *et al.,* 2019). Routine health systems strengthening are global priorities for interventions on maternal morbidity and mortality reduction (Alanazi, *et al*., 2023).

The Donabedian model is an example of a conceptual model that provides a framework for examining health services and evaluating quality of health care. It assesses health care quality using three domains: structure, process, and results (Ayanian and Markel, 2016). Quality healthcare is influenced by people's practices, perceptions and anticipations (Alanazi, *et al*., 2023. There are several systems which collect and scrutinize routine data worldwide; Patient's health records which emerged in early 1970s with the objective of increasing patient commitment and empowerment. Centric platform supported the new vision of health services that enables patient-provider information sharing and collaboration, had a goal of improving health results and minimizing costs (Kharrazi, *et al*., 2019).

Personal health records and electronic health records systems have been developed to enable patients to manage their own health care. Electronic health records transmits data such as laboratory results, summary of care and patient-generated data. The amount of overlap in terms of data and functionalities between the electronic medical records and personal health records depend on the type of implementation: tethered, interconnected, or stand-alone (Decker, 2019).

Electronic health record is a longitudinal patient's health information created by one or more encounters in a healthcare service setting. It has the ability to generate a complete record of a clinical patient encounter and supports other associated activities directly or indirectly through an interface; evidence-based decision support, quality management, and outcomes reporting. Electronic health records systems are said to be interoperable if they are able to exchange data based on standardized data transmission formats (Kharrazi, *et al.,* 2019).

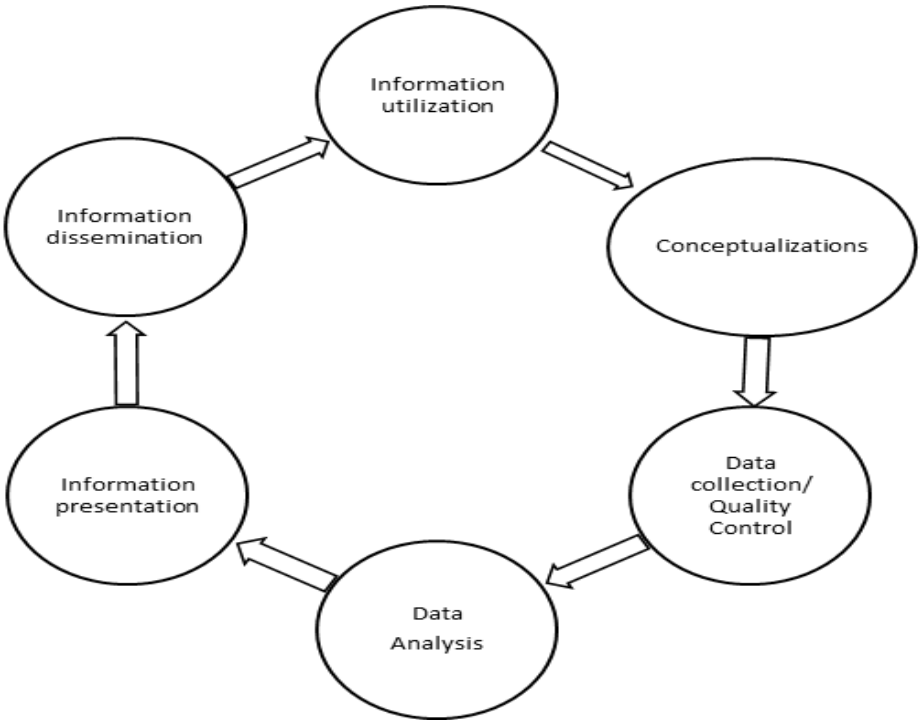
As defined by the program, the initial stage of meaningful use motivates providers to integrate technology into medical practice, making vast amounts of patient data available electronically. Later stages of the program focuses on empowering patients by providing them with online access

to their health data **(**Reisman 2017). Implementation of electronic data quality system improves data completeness and accuracy. This implies that use of a web-based system can strengthen reporting data quality (Susan, *et al.,* 2020). All these are inbuilt in the framework to improve data quality, decisions and interventions.

2.5.1 Data life cycle theory

This study was supported by data life-cycle theory (Figure 2.1) in which collection is the potential starting point, having already an idea of the goal and the objectives. Analysis provides information for informed decisions. Data collection and quality control ensure that data and information quality are fit for quality decision making. These involve; systems, information and practices of professionalism. Dissemination of information implies utilization of information which strengthen quality. In order to manage data, one must involve people (knowledge) and systems (Technology) and application (utilization) to improve quality data, information and healthcare services (Hassenstein and Vanella, 2022).

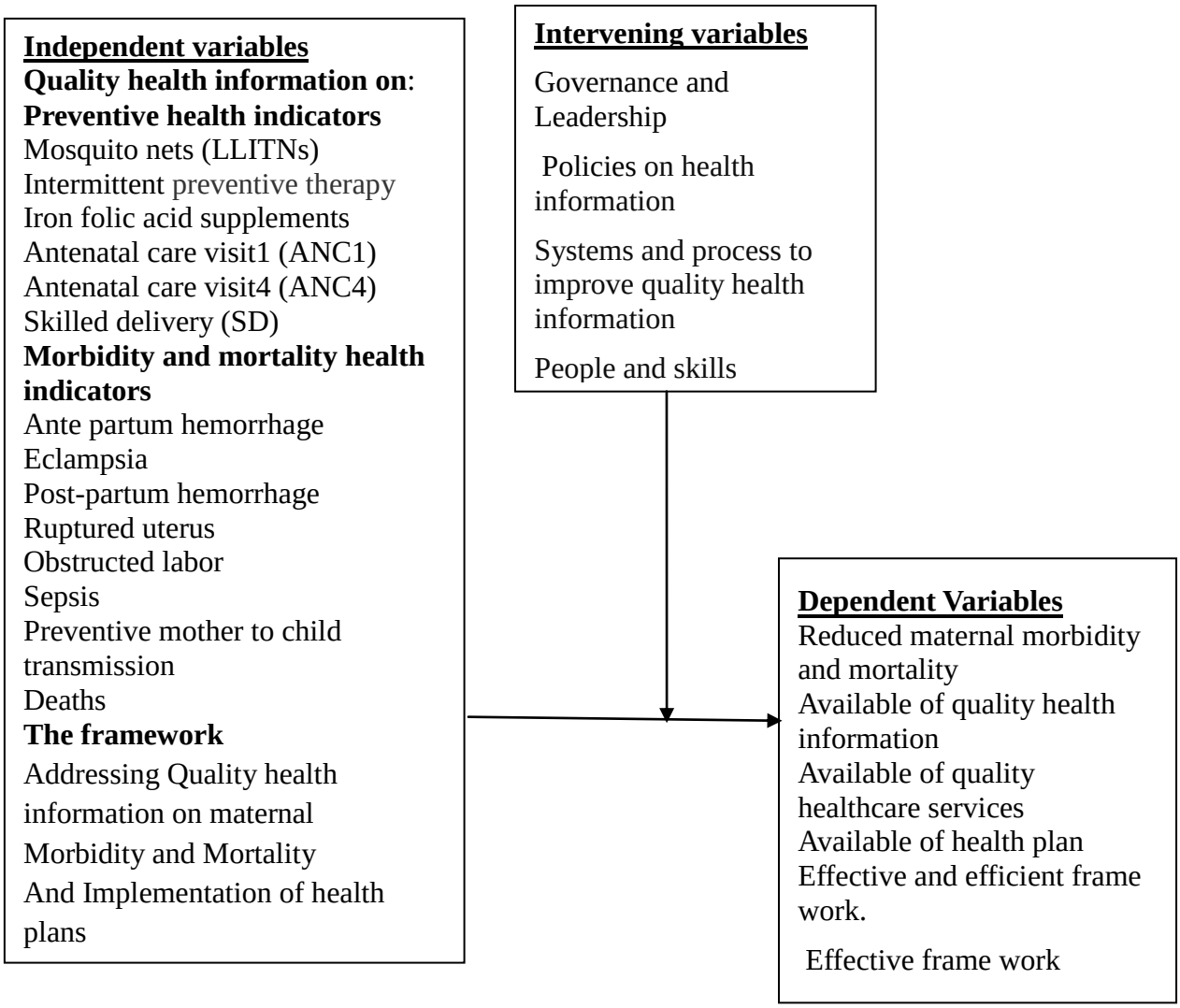
Figure 2.1 Data life-cycle (Hassenstein and Vanella, 2022)



2.6 Conceptual Framework

There are three variables used in this study; independent, dependent and modifiable. Independent variables refer to preventive health indicators, both morbidity and mortality. Dependent variables imply outcome, while intervening influence modifications on independent variables to generate outcomes.

Figure 2.2 Conceptual framework



Chapter Three: Methodology

3.1 Study setting

The study was conducted in 4 hospitals with the highest maternal mortality in Migori County; Migori County referral, St. Joseph Mission, Rongo Sub County referral and Isebania County Hospitals. The first two facilities for the study are found in Suna East Sub County and the other two are in Rongo and Kuria west Sub Counties (DHIS, 2019). Migori County had a total of 310 health facilities: Standalone 5, hospitals 29, Medical clinics 94, health centres 53 and dispensaries 129.

3.2 Study design

The study used retrospective design (Objectives 1 and 2), and cross-sectional design (objectives 3 and 4). The Key informant interview used qualitative study design. Both quantitative and qualitative approaches were deployed in the study.

3.3 Study population

The study population included pregnant women attending the four hospitals and documented in maternal health registers and Routine health information software (RHIS) (objectives 1and 2), and healthcare workers; Doctors, Clinical officers and Nurses (objectives 3 and 4). In addition, 25 program officers participated in the Key informant interview and generated qualitative data for the study. The health facilities for the study were: Migori County and Rongo Sub County referral, St Joseph Mission and Isebania County Hospitals. The study used 155 sample size population from the sample frame of 260. The Nurses, Doctors, and Clinical officers were involved in the study because they are closer to the patients and clients, and generate primary data (Table 3.1).

Table 3.1 Sample size and sample frame populations for the study

Staff cadre	Sample					
	MCRH	Rongo SCRH	Isebania CH	St Joseph MH	Sample size	Sample frame
Doctors	16	1	0	2	19	34
Nurses	63	17	9	16	105	175
Clinical officers	13	9	4	5	31	51
Total	92	27	13	23	155	260

3.4 Sample size determination

The sample size for this study was determined by Cochran formula:

$n = Z^2pq/d^2$

Where:

n=desired sample size for population greater than 10,000

Z= the standard normal deviation set at 1.96.

p = the estimated proportion of success (assumed at 50%)

q = the estimated proportion of failures (50%)

d = degree of accuracy desired usually set at 0.05

Substituting, n = 384.16

Reduction for population <10000

nf = n/[1+ (n/N)] where N = sample frame = 260 and n=sample size

nf = 384 ÷ [1+ (384/260)] Therefore, nf =**155**

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

- Pregnant women entered in maternal health register and RHIS
- Healthcare Workers who were working in the hospitals as Doctors, Nurses and Clinical officers.
- Head of programs in the 4 health facilities

3.5.2 Exclusion criteria

- Those who declined to consent
- Under 18 years of age
- Those who were not registered
- Transferred out
- New in the job and facility

3.6 Sampling procedure

Proportionate and Purposive Sampling were used to identify and recruit study participants respectively. A total of 155 out of 260 targeted respondents participated in the study as calculated below:

Migori County referral Hospital= 155/260*155 = 92

St Joseph Mission Hospital=39/260*155 = 23

Rongo Sub County Hospital=46/260*155 = 27

Isebania Sub County Hospital=21/260*155 = 13

3.7 Data Collection Instruments

The study used structured check-lists to collect data (objectives 1 and 2), structured questionnaires and likert scale (objectives 3 and 4). Finally, Key informant interview data were collected using unstructured interview guide. The data were collected from hospital registers, routine health information software and healthcare workers.

3.8 Data analysis

Data analysis for the study used correlation coefficient and significance tests (objectives 1 and 2), involving two population groups; hospital registers data and routine health information software data. Descriptive analysis was used on data collected from the health workers (objectives 3 and 4) and qualitative data used thematic analysis (KII).

3.9 Validity and reliability

3.9.1 Validity

Pretesting of the tool was done in four facilities; Oyani County Hospital, Macalder Sub County referral Hospital, Uriri Sub County referral Hospital and Sori Lakeside Hospital. The questionnaires were reviewed by the experts in the areas of data quality. Then the specialized comments were used to correct the tool for use

3.9.2 Reliability

Testing of consistency of the responses among the respondents was done. The study tools were tested 3 times on the same participants and the results were recorded. Then Cronbach alpha coefficient was applied. The results were $\alpha = 0.79$ which were reliable, and adjustments were made on the tools accordingly, and finally used to collect data for the study.

3.10 Data collection procedure

Data were collected using structured questionnaires, check-lists, Likert scale and qualitative interview guides. The data collected included: Retrospective for prevention of maternal morbidity and mortality on healthcare indicators. Data were also collected from among healthcare workers; Nurses, Doctors, clinical officers and the in-charge of programs. The tools were designed to assess the quality of health information on maternal morbidity and mortality, and experience of the healthcare workers. The questionnaires were administered on eligible healthcare workers. After the interviews, all the questionnaires were reviewed daily for completeness and accuracy.

3.11 Study Limitations

Cross-sectional study design is prone to biases and confounding. To counter the biases and confounding, application of triangulation was deployed. The sample size of 155 (60%) out of 260 sample frame, was insufficient and was not the best for the best results. Covid 19 affected movement for data collection of the key informants. However, data collection was conducted by telephone and tape recorders

3.12 Scope of the study

The study focused on four facilities in Migori County on assessing quality health information on morbidity and mortality, determining quality health information in health annual and strategic plans and a frame work addressing data and information quality. The study involved pregnant women Doctors, Nurses, Clinical officers (155), and Program officers (25) and data systems.

3.13 Ethical considerations

A letter of introduction was provided by Jaramogi Oginga Odinga University of Science and Technology. Ethical clearance to conduct the study was obtained from the University of Eastern African Baraton Research Committee and research Permit was granted by National Commission for Science, Technology and Innovation (NACOSTI). Permission to conduct the study was obtained from Migori County Research Ethical Board. The purpose, risks and benefits of the study were explained to the participants by the researcher before obtaining a written consent from them. Participation in the study were voluntary and participants were informed that they could withdraw from the study at any stage of the interview if they so desired without any penalty. Confidentiality was assured by maintaining the anonymity of the participants and storing the data in password protected files. The findings of the study would be disseminated by publishing them in the refereed journals. Also, they could be presented in workshops, seminars and conferences.

To maintain confidentiality and ensure the identities of all participants questionnaire were kept under lock and key and the investigators were made aware of it. Identification codes were assigned to each questionnaire before entry of data into the SPSS software for analysis.

Chapter Four: Results

4.1 Demographic information

Table 4.1: The healthcare workers involved in the study included; Nurses, Clinical officers and Doctors. The majority of whom were Nurses (65%), while the Clinical officers and Doctors were (35%). Most the healthcare workers had attained college education (62%). They were all trained in midwifery. They were experienced and effective providers of healthcare services. These conditions were conducive for provision of quality healthcare services.

St Joseph Mission Hospital did not have staff with experience of 20 years and over due to high staff turnover. This was the reason for poor performance in the healthcare indicators.

Table 4.1 Demographic characteristics among healthcare workers involved in the study

Facilities/Attributes		Migori CRH	St Joseph M	Rongo SCRH	Isebania CH	Total n (%)
Level of education	College	53(57.6)	13(56.5)	22(81.5	8(61.5)	96(62)
	University	39(42.4)	10(43.5)	5(18.5).	5(38.5)	59(38)
Profession	Nurse	55(59.8)	15(65,2)	19(70.4)	11(84.6)	100(65)
	Clinical Officer	20(21.8)	5(21.7)	7(25.9)	2(15.4)	34(21)
	Doctor	17(18.4)	3(13.0)	1(3.7)	0(0)	21(14)
Experience	1-10 Yrs.	60(65.2)	18(78.3)	21(77.8)	5(38.5)	104(67)
	11-20 Yrs.	16(17.4)	5(21.7)	3(11.1)	3(23.1)	27(17)
	21-30 Yrs.	10(10.9)	0(0)	3(11.1)	1(7.7)	14(9)
	31+ Yrs.	6(6.5)	0(0)	0(0)	4(30.8)	10(7)
Trained in Midwifery	Yes	79(85.9)	23(100)	27(100)	11(84.6)	140(91)
	Total(n)	92	23	27	13	96(62)

4.2 Health information on maternal mortality

Table 4.2: The study revealed the existence of maternal health problems and needed urgent attention. The four facilities selected for this study were leading in maternal mortality in Migori County.

The highest cumulative number of maternal deaths occurred at Migori County referral Hospital (74), followed by St Joseph Mission Hospital (50). Rongo Sub County and Isebania Hospitals had 29 and 27 deaths respectively. Average deaths per year were 26 and 45per facility. This was beyond the expected maternal deaths in the county and controls were inevitable.

Table 4.2 Maternal Mortality among the top four facilities in Migori County

Facility/year	2013 %	2014 %	2015 %	2016 %	2017 %	2018 %	2019 %	Total %	Average
St Joseph M	16 (64)	1 (4)	3 (17)	5 (17)	20 (69)	3 (8)	2 (11)	**50 (28)**	8
Isebania CH	1 (.4)	5 (21)	3 (17)	5 (17)	1 (3)	13 (36)	1 (5)	**29 (16)**	5
Migori CRH	5 (20)	13 (54)	11 (65)	10 (33)	8 (28)	12 (33)	15 (79)	**74 (41)**	11
Rongo SCH	3 (12)	5 (21)	0 (0)	10 (33)	0 (0)	8 (22)	1 (5)	**27 (15)**	4
Total (n)	25	24	17	30	29	36	19	180	26

Table 4.3: The highest achievement in correlation coefficient of the register and RHIS data at Migori County referral Hospital was perfect association in IPT1 and LLITNs of 0.964 and 0.901 respectively. The rest of the indicators achieved between 0.247 and 0.714, which were moderate to weak associations respectively. St Joseph Mission Hospital had strong correlation coefficient in

ANC1 and LLITNs of 0.893 and 0.878 respectively. The facility had an average of moderate correlation of 0.625. Rongo Sub County referral Hospital had perfect association of 1.000 in deliveries and most of the indicators achieved moderate relationships ranging between 0.643-0.786 and very weak association of 0.08 in LLITNS. Isebania County Hospital achieved very weak and weak correlation coefficient.

The average correlation coefficient was 0.66 which was a moderate association. This was not sufficient for health information to be considered of quality. This means that quality of data and information were not adequate to support quality decisions, interventions and innovations.

Table 4.3 Correlation between RHIS and register data on preventive study indicators

Facilities		Healthcare indicators							
Facilities/ Indicators		Deliveries	ANC1	ANC4	IFAS	IPT1	LLITNs	Mean	SD
Correlation coefficients	Migori CH	0.464	0.714	0.286	0.464	0.964	0.901	0.63	0.247
	St. Joseph Hospital	0.286	0.893	0.26	0.679	0.536	0.878	0.59	0.254
	Rongo SCH	1	0.643	0.75	0.786	0.679	0.08	0.66	0.282
	Isebania CH	0.36	0.536	0.771	0.369	0.536	0.499	0.51	0.137
	Std deviation	0.280	0.130	0.244	0.165	0.175	0.335		

Table 4.4: The study revealed that deliveries achieved significance of $p<0.05$ in ANC1 and LLITNs. Migori County referral and St Joseph Mission Hospitals achieved $p<0.05$ in deliveries and ANC4. Rongo Sub County referral Hospital achieved $p<0.05$ in IPT1 and ANC4. Lastly Isebania County Hospital achieve $p>0.05$ in all its indicators**.** These data could not be used for decision making and effective management of healthcare services because most of the indicators did not achieve quality data. This hampered utilization for decisions and interventions in health services.

Table 4.4 Median differences between RHIS data and register data (significance test)

Facilities		Migori CRH	St Joseph MH	Rongo SCRH	Isebania CH	Average
P-values	Deliveries	0.042	0.091	1	0.128	0.32
	ANC1	0.04	0.492	0.317	0.285	0.28
	ANC4	0.6	0.027	0.017	0.0463	0.17
	IFAS	0.612	0.398	0.317	0.144	0.37
	IPT1	0.893	0.225	0.018	1	0.53
	LLITNs	0.018	0.465	0.062	0.715	0.32

The systems used in health information management were manual, electronic and hybrid. Improving quality health information by use of electronic software was in important. In Migori County only a few facilities used electronic systems and in a few sections in the hospital. When the health records and information officer was asked about the systems for data collection he responded and said. '*The software for data management of health information exists in supports centers for HIV data management and the rest of the hospital used paper. However, there was a hybrid system (RHIS), which collected secondary data and it was not interoperable with any other system. Therefore, the data, collected had human, transcription and omission errors, hence there was no quality information for decisions and interventions* (KII-1)*.'*

*Training of healthcare workers on information management was a very important aspect of quality health information. The responses of the clinicians on data training were 'we have not undergone health information training although, we do handle data and information because h*ealth information system does not have its own professionals. This is due to the fact that the Government and mission have not considered information as important and valuable so as to recruit enough records and information officers. Therefore, any worker collects data and provides *wrong reports because this is not their professional work. The few records staff in the facility are always overwhelmed with this work'* (KII-2)

4.3 Availability of quality health information on maternal morbidity

Table 4.5: The study shows that Migori County referral Hospital had moderate correlation coefficient of 0.592 in PPH. The five other indicators had no association. The rest of the indicators had weak and one very weak association. St Joseph had perfect association of 0.915 in ruptured uterus. Sepsis, PMCT and maternal deaths had moderate association of 0.630, 0.607 and 0.60 respectively. Rongo had moderate, weak and very weak association. Lastly, Isebania had two perfect, two moderate, one weak association. Availability of quality of data was not acceptable, considering the usefulness of such data and information.

Table 4.5 Correlation between RHIS and hospital register data on morbidity and mortality

Facility/ Indicator		APH	PPH	Eclampsia	Ruptured Uterus	Obstructed Labor	Sepsis	PMCT	Death
Correlation Coefficient	Migori CRH	0.004	0.592	0.000	0.000	0.000	0.003	0.270	0.153
	St Joseph MH	0.315	0.003	0.097	0.915	0.000	0.630	0.607	0.62
	Rongo SCRH	0.089	0.032	0.027	0.000	0.055	0.033	0.256	0.432
	Isebania CH	0.785	0.000	0.542		1.000	0.946	0.326	

Table 4.6: The study shows that Migori County referral Hospital achieved perfect association of 1.000 in ruptured uterus, strong associations in eclampsia, 0.854 and weak relationships in four other indicators. St Joseph achieved moderate association of 0.752 in maternal deaths and the rest of the indicators achieved weak and very weak relationships. Rongo Sub County and county referral Hospital achieved perfect correlation coefficient in three indicators; PPH, Ruptured uterus and obstructed labor of 1.000 and the rest moderate, weak and very weak associations. Isebania had perfect correlation in APH of 1.000, moderate correlation in four indicators and weak associations. Quality of data and information could not be considered in these achievements and the use of such information was unacceptable due to insufficiency of quality of health information.

Table 4.6 Comparison between RHIS and hospital registers data using correlation

	Facility/ Indicator	APH	PPH	Eclampsia	Ruptured uterus	Obstructed labor	Sepsis	PMCT	Death
Correlation coefficient	Migori CRH	0.399	0.144	0.854	1.000	0.102	0.157	0.398	0.017
	St Joseph	0.465	0.027	0.223	0.193	0.174	0.109	0.028	0.752
	Rongo SCRH	0.59	1.000	0.285	1.000	1.000	0.109	0.237	0.132
	Isebania SH	1.00	0.102	0.593	0.317	0.357	0.455	0.499	0.017

Electronic health records and electronic medical records were involved in the uses of computer software for quality health information. Electronic health records and electronic medical records are generally not used in Migori County facilities due to inadequacies of knowledge, hardware and software. On this point a public health officer said, *"Paper records are not organized because knowledge for filling systems and methods are lacking among the Nurses who are the majority in managing health records and information in health facilities. Recruitment of health records and information officers can salvage this situation. Inadequate electronic systems and finances are key to generation of quality health information for decisions and interventions".*

4.4 Quality health information in health annual work plans among healthcare workers

Table 4. 7: The study reveals that the highest achievement was in computer knowledge (72%), followed by training in health information (61%) and the least was in interoperability (0%). Financial support was (16%) and electronic system use (32%). Migori County referral Hospital, financial support for health information was 2.6%, while both Rongo Sub County referral and Isebania Hospitals had (0%). The activities supporting annual work plans were not supported financially, so achievement of the strategic plan was practical. Most indicators in these 3 facilities achieved less than 32% except Migori County referral Hospital which had between 2.6%-59%. Health information training provides knowledge for functional operations of health systems and services. Support of finances was key for purchase of logistics, computers and monitoring and evaluation of healthcare services. The table shows the supports for quality health information was unavailable. Therefore, decisions and interventions were not practicable.

Table 4.7 Achievement in health Indicators among healthcare workers in determining quality health information

Facilities/ Study Indicators	Ownership	Health Workers	Trained healthcare worker in H/information	Electronic system use	Computer knowledge among HWs	Interoperability	Financial Support
Migori CH	GOK	92(59)	49(32)	8(5.2)	63(41)	0(0)	4(2.6)
St Joseph H	FBO	23(15)	21(14)	22(14)	20(13)	0(0)	21(14)
Rongo	GOK	27(17)	17(11)	1(0.6)	20(13)	0(0)	0(0)
Isebania H	GOK	13(8)	7(5)	3(2)	8(5)	0(0)	0(0)
Total	4	155(100)	94(61)	34(32)	111(72)	0(0)	25(16.1)

Table 4.8: The study revealed that the highest achievement among health indicators by healthcare workers was the use of electronic system (86%) at St Joseph Mission Hospital, then availability of computer knowledge (41%) and training of health in information system (32%) at Migori County referral Hospital. Rongo achieved 11% in training of health information system. Isebania achieved 5% and 2% on training in health information systems and use of electronic systems receptively. On the other hand, the gaps existing in electronic health records ranged between 85%-99%. However, gaps in all indicators ranged between 59%-99%. These gaps have negative impacts in quality of data and information for supporting health plans (Table 4.8)

Table 4.8 Availability of quality health information among healthcare workers

Training, use and availability		Health Facilities			
Indicators	Application	Migori CRH	St Joseph MH	Rongo SCRH	Isebania CH
Training in health information system	Trained	49(32)	20(13)	17(11)	7(5)
	Not Trained	106(68)	135(87)	138(89)	148(95)
Use of Electronics Systems	Used	8(5)	133(86)	1(1)	3(2)
	Not Used	147(95)	22(14)	154(99)	152(98)
Availability of Computer knowledge	Available	63(41)	20(13)	20(13)	8(5)
	Not Available	92(59)	135(87)	135(87)	147(95)

Table 4.9: shows that the most used system in Migori County was manual, ranging from 60- 92% at an average of 68.5% among the four health facilities. Routine health information use ranged between 54%-92% at an average of 80% and analytics ranged between 3-28% at an average of 11%. Generally, the most used system for data management was manual 34- 92% (paper), followed by routine health information software 8-46%, and the least was data analytics 3-28%. Manual system use health information in health information management will produce poor quality information which will not be used in healthcare services.

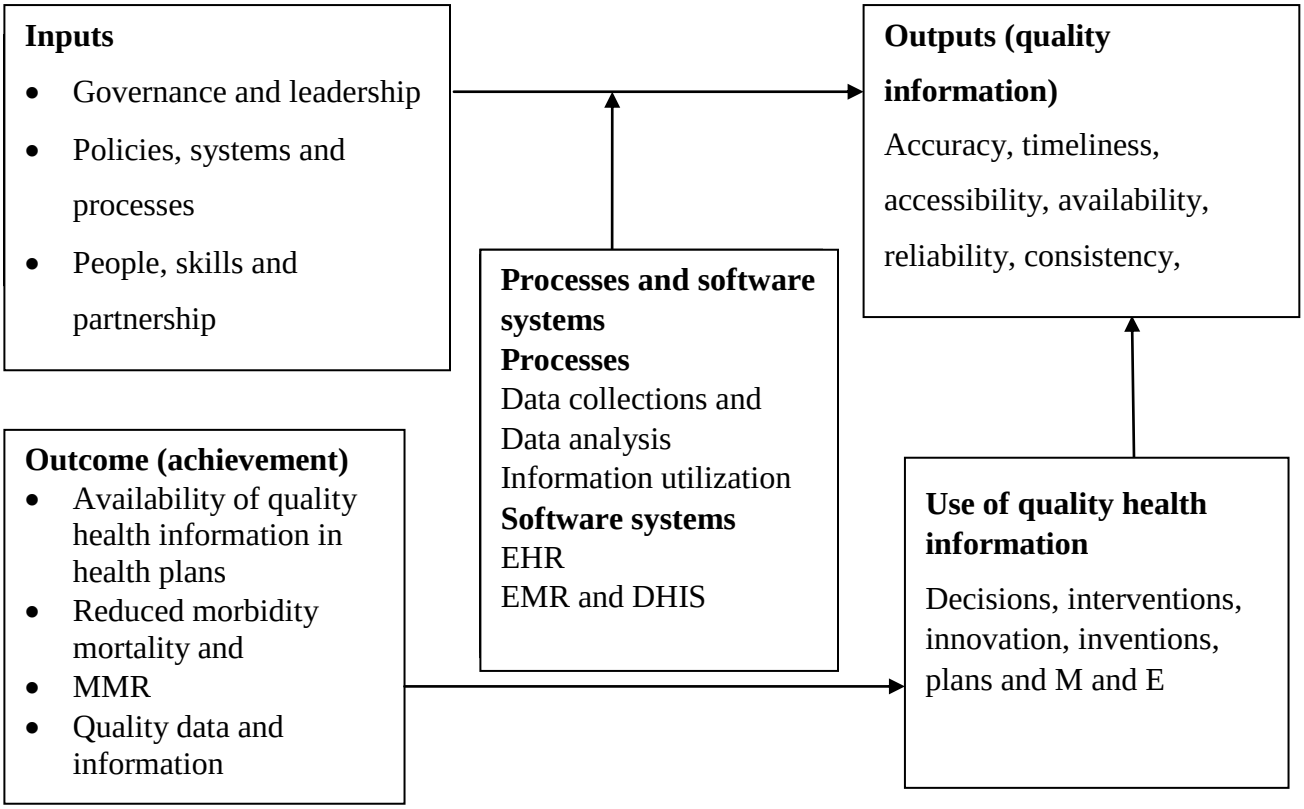
Table 4.9 Achievement in knowledge in available data management systems

Health Facilities for the study				
Systems used (%)	Migori CRH	St Joseph MH	Rongo SCRH	Isebania CH
Manual E-health	93[60]	53[34]	142[92]	127[88]
	62[40]	102[66]	13[8]	28[12]
Routine health information software	83[54]	136[88]	142[92]	131[84]
Others	72[46]	19[12]	13[8]	24[16]
Analytics Knowledge/	43[28]	5[3]	6[4]	13[8]
Others	112[72]	150[97]	149[96]	142[92]

4.5 A Framework to address the concerns of quality of data and information

The framework illustrated in Figure 4.1 has 5 components in its structure; inputs, outputs, processes and software, outcome and utilization which assess the effectiveness of quality of health information in maternal morbidity, mortality and health plans. The framework uses processes and software on inputs to generate out puts and outcomes. The outcomes are used as information and knowledge to reduce maternal morbidity and mortality. Collection of data uses the Likert scale and results are as shown on Tables: 4.10- 4.13

Figure 4.1 A framework to assess the effectiveness of quality of information (by Wifred Obwocha)



4.5.1 Assessment of various health indicators on the framework

Table 4.10: The study reveals that Migori County referral Hospital had (97.3%) respondents, St Joseph Mission Hospital (100%), Rongo Sub County referral Hospital (97%) and Isebania County Hospital (100%) on strongly agree/agree and strongly disagree/ disagree ranged between 0-5 percent. The indicators involved in this study were: Governance, leadership, policies, system processes, people and skills, partnerships support and data. The average achievement in these inputs/ resources was 99% respondents. This was within the acceptable range of 95-100% and therefore good quality data and information to be used for quality decision making and interventions.

Table 4.10 Assessment on Inputs/Resources per Health Facility in the Study -likert scale data (N and %)

Inputs/Resources	Variables measured	MCRH	St Joseph	Rongo SCRH	Isebania
Governance/ leadership	Agree/ strongly agree	89(97)	23 (100)	26(96)	13(100)
	Disagree/ strongly disagree	3(3)	0 (0%)	1(4)	0 (0)
Policy	Agree/ strongly agree	92(100)	23 (100)	27 (100)	13 (100)
	Disagree/ strongly disagree	0(0)	0 (0)	0 (0)	0 (0)
People and skills	Agree/ strongly agree	87(95)	23(100)	26 (96)	13(100)
	Disagree/ strongly disagree	5(5)	0 (0)	1(4)	0(0)
Partnership and support	Agree/ strongly agree	89(97)	23(100)	26(96)	13 (100)
	Disagree/ strongly disagree	3(3)	0 (0)	1(4)	0 (0)
	Average	89(97)	23 (100)	25(93)	13(100)

Table 4.11: The study that confirmed that output indicators for Migori County referral Hospital achieved 97% respondents, St Joseph Mission Hospital (100%), Rongo Sub County referral Hospital (97.3%) and Isebania County Hospital (100%) on strongly agree/agree. On strongly disagree/ disagree ranged between 0-4 percent. Averagely the achievement per facility was 98.5% among the respondents. This was within the acceptable range of 95-100% and this information can be used for interventions and innovations.

Table 4.11 Assessment of Outputs on health Indicators per facility No. and %

Output Indicators	Variables measured	MCRH	St Joseph	Rongo SCRH	Isebania
Accuracy	Agree/ strongly agree	88(96)	23(100)	26 (96)	13(100)
	Disagree/ strong disagre	4(4)	0 (0)	1(4)	0 (0)
Completeness	Agree/ strongly agree	89(97)	23 (100)	26 (96)	13(100)
	Disagree/ strong disagre	3(3)	0 (0)	1 (4)	0(0)
Consistency	Agree/ strongly agree	89(97)	23 (100)	26 (96)	13(100)
	Disagree/ strong disagre	3(3)	0 (0)	1(4)	0(0)
Accessibility	Agree/ strongly agree	90(98)	23 (100)	26(96)	13(100)
	Disagree/ strong disagre	2(2)	0 (0)	1(4)	0 (0)
Availability	Agree/ strongly agree	90 (98)	23 (100)	27 (100)	13(100)
	Disagree/ strong disagre	2(2)	0 (0)	0 (0)	0(0)
Timeliness	Agree/ strongly agree	90(98)	23 (100)	27(100)	13 (100)
	Disagree/ strong disagre	2 (2)	0(0)	0 (0)	0(0)

Table 4.12: The study on system processes and software revealed that Migori County referral Hospital had 97%, St Joseph Mission hospital 100%, and Rongo Sub County referral Hospital 96% and Isebania 96% respondents on strongly agree/ agree. On strongly disagree/ disagree respondents ranged between 0-4% percent. Averagely the achievement of systems used to develop the framework per facility was 98%. This was within highly acceptable range of 96%-98%. This is quality information for quality decisions, interventions and inventions.

Table 4.12 Likert scale assessment on system processes per facility

Systems processes	Variables measured	MCRH	St Joseph	Rongo SCRH	Isebania
collection, analysis and use	Agree/ strongly agree	89(97)	23 (100)	26(96)	13(100)
	Disagree/ strongly disagree	3 (3)	0(0)	1(4)	0(0)
Dissemination of quality health information	Agree/ strongly agree	90(98)	23(100)	26(96)	13 (100)
	Disagree/ strongly disagree	2(2)	0(0)	1(4)	0(0)

Table 4.13: The study on uses of quality information revealed that Migori County referral Hospital had 98% respondents, St Joseph Mission Hospital 100%, Rongo Sub County referral hospital 100% and Isebania County Hospital 100% respondents on strongly agree/agree. On strongly disagree/ disagree ranged between 0-3% percent for all facilities. Averagely the achievement on use of information to develop the framework per facility was 98.6% respondents. This was within the acceptable range of 96-100%. This very good quality of information for applications of quality decisions and monitoring and evaluation.

Table 4.13 Uses of quality information per facility

Implementation indicators	Variables Measured	MCRH	St Joseph	Rongo SCRH	Isebania
Making decisions, Interventions, innovations and plans	Agree/ strongly agree	90(98)	23 (100)	27(100)	13 (100)
	Disagree/ strongly disagree	2(2)	0(0)	0(0)	0(0)
Monitoring and evaluation. Reduction of morbidity and mortality	Agree/ strongly agree	89(97)	23(100)	27(100)	13(100)
	Disagree/ strongly disagree	3(3)	0(0)	0(0)	0(0)

Policy to guide the management of data and information is important. Quality information cannot be generated without guideline. On policy the Nurse's responses were: *'Policy is key to guide the use of a framework, but it does not exist in Migori County facilities. Also practices of professionalism, cannot be practical due shortage of trained healthcare workers in health information systems. (KII-4)'* in addition 18 (72%) of healthcare do not practice professionalism and 16(68%) know there is no policy to guide the operations of the department.

Chapter Five: Discussion

5.1 Quality of health information from the registers and RHIS

In this study there were two key aspects of quality in health; quality information and quality services. Quality health services are dependent on quality health information. Quality health Information is not only required by health policy makers to make effective decisions but also used by healthcare workers to strengthen quality and efficiency of health services (Betlloch, et al., 2018). Quality health information provides knowledge and managing knowledge influences construction of effective interventions (Bryan , *et al*., 2019)

The study revealed that collection of primary routine health data for information uses manual health information systems among health facilities in Migori County. This resulted in poor quality of data and information. In the contrary, institutions where electronic systems are used, there is control over and generation of quality data and information for quality decision which influences quality healthcare services (JHIA, 2019).

The study found that aggregation and analysis of secondary data use routine health information software in the County (RHIS). This result concurred in a case study finding in Uganda on development of HMIS in poor countries, which recommended that a primary web-based software was necessary for quality data collection, operability, analysis, presentation and integration in health information management activities (Kiberu , *et al*., 3014). Introduction of electronic health information system has significantly strengthened information quality in many countries. Using Computer systems produce high-quality and timely information for effective decision-making and they are essential. This statement is in conformity with affirming that facilities where electronic system is used, quality of health information is guaranteed (Susan , *et al*., 2020).

The current study found that most health facilities did not have quality data for generation of quality information on morbidity and mortality to strengthen healthcare services. This was due to inadequacies of primary routine data collection software, training of healthcare workers, professional knowledge, use of health information and primary electronic tools (Koumamba, *et al*., 2021a).These facts agree with this study finding, affirming that even though the health management information systems offer opportunities to inform healthcare decision-making, its

usefulness is only realized when generated data is transformed into meaningful information and knowledge for action. It clearly highlights that the poor quality of routine data, undermines utilization of information for decision-making in the health sector (WHO, 2019).

5.2 Availability of quality health information

Availability of quality information is important because it increases efficiency and effectiveness among patients and clients in healthcare. Non availability of quality data and information will undermines development of quality healthcare services. The results from the current study clearly revealed that there was lack of availability of quality data and information in the facilities. This result conformed to WHO study findings, affirming that accurate assessment of health indicators on maternal morbidity and mortality is a problem (Yost, *et al*., 2014). Therefore, the World Health Organization has developed an approximation of maternal mortality due to lack of quality data and information for monitoring trends and comparisons among the member countries (WHO, 2019). The study also revealed that there were no primary electronic systems to collect, analyze, retrieve and store routine quality data or information. This was consistent with World Health Organization study findings explaining that excessive data demand, large number of reports, frequent changes in HMIS tools, and lack of effective systems to monitor quality and absence of standard guidelines to measure data quality contributed to unavailability of quality information (Yost, *et al.,* 2014).

According to the Ministry of Health, Kenya report 2019, data which were available in Migori county for use included routine primary data and vital statistics collected using manual system, routine household and demographic secondary survey data from census, using manual systems and used as denominator in calculating rates and finally estimated data by WHO because of lack of accurate information (Muchemi, *et al*., 2016). Currently there are no quality data for use in making effective decisions in Migori County due to the fact that the systems for data collection are manual and not electronic. WHO use estimated data for many countries due lack of accurate data and information. Such decisions and interventions are misleading.

5.3 Quality health information among healthcare workers

Data quality depend on several aspects; professionalism, competences among healthcare workers and experiences, and the relevant tools used. The current study divulges that healthcare workers on average were untrained in health information systems, leading to poor quality information which could not be used to manage strategic plans and monitoring and evaluation. Data at health facility level were managed by Record assistants, Nurses, Clinical officers and Doctors, majority of whom were untrained in health information. Due to deficiencies of knowledge and skills, there were incomplete and inaccurate submission of monthly routine reports. In addition, quality healthcare was hampered by chronic lack of resources, severe human resource and material deficiencies essential for healthcare services (WHO, 2018).

The study found that most health facilities for this study did not have quality data for generation of quality information and decision making due to inadequate primary routine data collection software, training of healthcare workers, shortage of professional knowledge, use of health information and electronic tools. (Cowie, 2020) This was in conformity with (WHO, 2018). The study findings, stated that though the health management information systems offer opportunities to inform health decision-making, its usefulness is realized only when it allows for transformation of generated data into meaningful information and knowledge for action (WHO, 2019). It clearly highlights that poor quality of routine health data have undermined utilization of information for decision-making in the health sector (Rana and Dikaios, 2020).

The study revealed that collection of primary routine health data for information, uses manual health information systems among facilities in Migori county resulting to poor quality data/information (Thein and Thant , 2020). Aggregation and analysis of secondary data use routine health information software (RHIS). These results concur with study findings and recommendation in another research study, stating that there should be a web-based software for data collection, analysis, and presentation of statistical data tailored to integrated health information management activities (Susan , *et al*., 2020). In addition, computer systems produce high-quality and timely information for effective decision-making and it is necessary (Obinna, *et al*., 2015). The challenges/ problems of quality are realized and can be prevented/reduced or eliminated by investing in computer systems software to improve electronic software use through

Interoperability; the software should communicate through linkages. In using these interventions there will be reduction in maternal morbidity and mortality and improvement of RHIS (Koumamba, *et al., 2021b).*

This study found that there were inadequate investments in electronic health records and information in Migori County. The highest investors (not adequate) of electronic health systems software were St Joseph Mission Hospital followed by Migori County referral Hospital while the rest of the facilities did not have electronic system. The current study revealed that healthcare workers on average were untrained in health information systems, leading to poor quality information which could not be used to manage strategic plans effectively. This result agreed with another study finding stating that data management at health facility level was by records assistants, majority of whom were nonprofessionals in health information system (Cowie et al., 2020)

Hindrances and delays among healthcare workers influence use of electronic health systems in facilities. This includes negative beliefs, behaviors and attitudes of healthcare professionals towards use of such systems (Yost, *et al*., 2014). There is high need for professional knowledge in the management of data and information because people are important due their skills. There is also need for good electronic system to generate quality data and information for quality decisions.

5.4 Framework assess effectiveness of quality of health information

Requirements for the framework design were inputs, outputs, processes and software**,** outcomes, health indicators. This conformed to Markel (2016) who stated that a framework for collection of data in assessing of health care quality used three domains: structure, process, and outcome. Quality healthcare is influenced by people's skills, perceptions and expectations Alanazi (2023). High maternal morbidity and mortality exist in Migori County. Maternal Mortality was 180 in 2013-2019 (RHIS, 2019). This was very high and needed urgent attention to salvage the situation. Due to these circumstances, a framework was developed to address the concerns of poor quality of information and healthcare services to prevent maternal morbidity, mortality and to implement

health plans. According to Koumamba (2019b) health sector needs contributors in designing, developing and implementation of computerized health information systems in countries. This is a potential to be identified and implemented in developing countries (WHO, 2019a).

The healthcare framework was developed based on health indicators and cloud healthcare platform to capture data, manage patient workflow, consultations in person or virtual (RHIS, 2019). The initial stage of meaningful use of healthcare constituents encourage providers to integrate technology into medical practice. This makes vast amounts of patient data electronically available and later stages of the program focus on empowering patients by providing them with online access to their health information (Miriam, 2017). The framework can improve quality of health information. The deployment of inputs; governance and leadership, Policy, people and skills are important. This is in conformity with the study results of Gomes (2018) who states that requirements are interlinked and interrelated to achieve a common goal; quality of data/information, safety, effectiveness, patient/client centeredness, efficiency, equity and timelines in respect to the driving forces of processes and software systems; data collection, analysis and dissemination, using digital platforms; EHR and EMR.

Implementation of a primary electronic data quality management will result in outputs; accuracy, timeliness, accessibility, availability, reliability, consistency, exceptive standards, relevance to provide powerful intervention to strengthen healthcare service delivery. This will generate outcomes; availability of quality information in AOP and strategic plans, reduced morbidity and mortality, quality of data/information and these will be applied in decisions making, interventions, innovations, inventions, strategies, plans and effective M and E which influence reduced morbidity and mortality. This implies that application of primary web-based system can improve information quality and reporting (Kingsley *et al*, 2017).

The study revealed that the main data management system was manual in Migori county. This finding did not conform with Kharrazi(2019), who stated that there were several systems which collected and scrutinized routine data worldwide; Patient's health records which emerged in early 1970s with the objective of increasing patient commitment and empowerment. Centric platform supported the new vision of health services that enables patient-provider information sharing and collaboration, had a goal of improving health results and minimizing costs.

Personal Health Records and primary electronic health records systems have been developed to empower the patients to manage their own healthcare. Personal health records determine the type of implementation: tethered, interconnected or stand-alone. The framework can be used to achieve quality data and information, hence reduce maternal morbidity, mortality and improve healthcare services on the basis of effective interventions. According to Abdollah (2019), personal health records and electronic health records systems have been developed to enable patients to manage their own health care; electronic health records, transmitted data such as laboratory results, summary of care and patient-generated data. The amount of overlap in terms of data and functionalities between the electronic medical records and personal health records depend on the type of implementation.

Chapter six: Conclusions and Recommendations

6.1 Conclusion

1. The study concluded that there were inadequate quality information for utilization to prevent maternal mortality and strengthen utilization of information in providing quality healthcare services. The systems of quality were not adequately identified and addressed; the software to collect, store, retrieve, aggregate and analyze data since manual and secondary electronic systems were mostly used.
2. The study further concluded that there were deficient quality health information on maternal morbidity and mortality indicators to improve maternal healthcare services.
3. The study again concluded that there were no competent healthcare workers to manage health information and implement annual and strategic plans. As observed in this study, there were limited professional practices in health information systems. The concern was prompted by very high staff turnover in the mission and private hospitals, while in the government hospitals, there were few qualified staff to manage workload.
4. The study finally concluded that there was no framework on which data management was based; collection, analysis, interpretation, dissemination and utilization.

6.2 Recommendations for Action

1. The county, national governments and partners in health should invest in electronic health information systems to generate and utilize quality health information for interventions, innovations, inventions, plans, strategies and monitoring and evaluation.
2. The county, national governments and partners should introduce software interoperability to increase availability of quality health information to influence primary quality data/ information in maternal morbidity and mortality for effective decisions and interventions.
3. The county, national government and partners should hire/recruit more professionals in health information, to improve quality information, quality healthcare services, and health annual and strategic plans.

4. This study proposes a coherent framework to analyze and guide the development and integration of digital applications into HIS over the long term. The county Government should design and implement a framework to address the concerns of quality of data and information
   to prevent maternal morbidity and mortality, and improve health annual plans to implement strategic plans.

6.3 Recommendation suggestion for further study

Future research is desirable to determine the most effective health data systems for improving quality health information for decisions making and interventions

References

Abdollah (2019, september 12). Quality Management In Health Care Services.

Adil , H. S., Mohammad , Z. M., Mamdouh , A., Krishna , A. S., Agrawal, A., Kumar, R., and Ahmad Khan, R. (2020). Healthcare Data Breaches: Insights and Implications. *Healthcare Data Breaches: Insights and Implications*. doi:10.3390/healthcare8020133

AHIMA, A. H. (2023). *What is health information?* Retrieved from AHIMA International org: https://www.ahima.org/certification-careers/certifications-overview/career-tools/career-pages/health-information-101

Akarowhe, K. (2017). Information, Communication, and Technology: American Journal of Computer Science and Information Technology, doi:10.21767/2349-3917. 1000010

Akparep, J., Jengre, E., and Mogre, A. (2019). The Influence of Leadership Style on Organizational Performance at TumaKavi Development Journal Association, Tamale, Northern Region of Ghana. doi:10.4236/ojl.2019.81001

Alanazi, E., Hamdah , A., Alanazi, M., Alsadoun, A., Saeed , A., and Bahari, G. (2023, 1). Quality Perceptions, Expectations, and Individual Characteristics among Adult Patients Visiting Primary Healthcare. doi: 10.3390/healthcare11020208

Allen, C., Ivaylo, V., Anne, K., and Anne, R. (2016). Long-Term Condition Self-Management Support in Online Communities: A Meta-Synthesis of Qualitative Papers. *Journal of Medical Internet Research*. doi:10.2196/jmir.5260.

Anders , K. L., Nøhr, C., Sørensen, E. M., and Ori , O. (2014). A Review and Framework for Categorizing Current Research and Development in Health Related Geographical Information Systems (GIS). *Application of GIS in health science* . doi::10.15265/IY-2014-0008

Annika , J., Lars-Åke , P., Wickremasinghe, D., and Källestål, C. (2020). *Improving quality and use of routine health information system data in low and middle-income countries.* doi:10.1371/journal.pone.0239683

Ayanian, J. Z., and Markel, H. (2016). Framework for Health Care Quality. *Journal of Medicine 375(3):205-207*. doi:10.1056/NEJMp1605101

Azzopardi, N. M., Kluge, H. H., Asma, S., and Novillo, D. O. (2021). A call to strengthen data in response to COVID-19 and beyond. *Journal of the American Medical Informatics Association*, *3*(28). doi:10.1093/jamia/ocaa308

Betlloch, M. I., Sapena, R. R., García, A. C., and Ramírez, P. J. (2018). Implementation and Operation of an Integrated Quality Management System in Accordance With ISO 9001:2015 in a Dermatology Department. *Actas Dermosifiliogr*. doi:10.1016/j.ad.2018.08.003

Boone, D., Gwyneth , V., Zola , A., Wood, F., Gwyneth , V., Teplitskaya, L., and Settergren, S. (2019). *Technical briefs on the use of RHIS in evaluation.* Retrieved from https://www.data4impactproject.org/wp-content/uploads/2020/09/RHIS-guidance-for-evaluations_TR-20-242-D4I-3.pdf

Bryan , J., Emma , V., and Anna , O.-B. (2019). How to get started in quality improvement. *biomedical and life sciences journal, 364*. doi:10.1136/bmj.k5437

Chola, L., McGee, S., Tugendhaft, A., Buchmann, E., and Hofman, K. (2015). Scaling Up Family Planning to Reduce Maternal and Child Mortality: The Potential Costs and Benefits of Modern Contraceptive Use in South Africa. *10*(6). doi:10.1371/journal.pone.0130077

Corrina , M., Schwitters, A., Chantelle , B., Giles, D., Kilmarx, P. H., Ntolo , N., . . . Bossert, T. J. (2017). Sustainability of health information systems: a three-country qualitative study in southern Africa. *BMC Health Services Research* .

Cowie, J., Nicoll, A., Dimova, E. D., Campbell, P., and Duncan, E. A. (2020). The barriers and facilitators influencing the sustainability of hospital-based interventions. *BMC Health Services Researc*. doi:https://doi.org/10.1186/s12913-020-05434-9

de Goor , v. I., Hämäläinen , R., Syed , A., Juel , L. C., and Sandu , P. (2017). Determinants of evidence use in public health policy making: Results from a study across six EU countries. doi:0.1016/j.healthpol.2017.01.003

Edmond , L., Clarke, J., Ashrafian, H., Ara , D., and Neves, A. L. (2022). The Impact of Electronic Health Record Interoperability on Safety and Quality of Care in High-Income Countries: Systematic Review. *Journal of Medical Internet Research*. doi:10.2196/38144

Emwodew , D. Y., Seboka , B., Tesfa , G., Desalegn , A., and Amede, E. S. (2021). Barriers to the Adoption of Electronic Medical Record System in Ethiopia. doi:https://doi.org/10.2147/JMDH.S327539

Envuladu, E., Agbo, H. A., Lassa, S., Kigbu, J. H., and Zoakah, A. I. (2013). Factors determining the choice of a place of delivery among pregnant women in Russia village of Jos North, Nigeria: achieving the MDGs 4 and 5. *Internal Journal of Medicine and Bimedical Research, 2*(1). doi:10.14194/ijmbr.215

Evangelos , F. C., Papathanasiou, I. V., Mitsi, M., Konstantinos , T., Kleisiaris, C. F., and Kourkouta, K. (2014). Health Based Geographic Information Systems (GIS) and their Applications. doi:10.5455/aim.2014.22.402-405

Figueroa, C. A., Harrison, R., Ashfaq , C., and Meye, L. (2019). Priorities and challenges for health leadership and workforce management globally. *BMC Health Services Research*. Retrieved from https://bmchealthservres.biomedcentral.com/

Ginter, P. M., W, J. D., and Linda, E. S. (2018). *The Strategic Management of Health Care Organizations* (8th ed.). Cambridge, Massachusetts: Blackwell Publishers Ltd. Retrieved https://www.wiley.com/en-ie/The Strategic Management of Health Care Organizations,8th Edition-p-9781119349709

Gomes, J. (2018). *Organisational Maturity and Information Systems and Technology Projects in Healthcare: The Mediation of Project Management.* Retrieved from ACADEMIA: https://www.academia.edu/35988609/Organisational_Maturity_and_Information_Systems_and_Technology_Projects_in_Healthcare_The_Mediation_of_Project_Management

Hassenstein , M. J., and Vanella , P. (2022). Data Quality. *Data Quality—Concepts and Problems*. doi:https://doi.org/10.3390/encyclopedia2010032

health, R. M. (2019). *Health report.* Government of Kenya, HIS. Retrieved from hiskenya.org

HIMSS. (2020). HealthManagement.org is intended only for healthcare professionals and uses cookies to provide best user experience and personalised service. *2020 HIMSS Global Conference and Exhibition, 2020 in Orlando.* Retrieved from https://healthmanagement.org/c/it/event/himss-global-conference-exhibition-2020

Hjollund, N. I., Valderas, J. M., Kyte, D., and Melanie, J. C. (2019). Health Data Processes: A Framework for Analyzing and Discussing Efficient Use and Reuse of Health Data With a Focus on Patient-Reported Outcome Measures. *Journal of Medical Internet Research*. doi:10.2196/12412

JHIA, H. a. (2019). From Evidence to Practice: The implementation of digital health interventions. (U. K. Nicky Mostert, Ed.) *6*(2). Retrieved from file:///C:/Users/hp/Downloads/12-46-PB.pdf

Joachim, C., Tungu, P. K., Mwingira, V. S., Mbata, D., Malekia, E. S., Mboera, M., . . . Mremi, I. (2020). *Data quality of the routine health management information system at the primary healthcare facility and district levels in Tanzania.* Retrieved from https://www.researchgate.net/publication/347442978_Data_quality_of_the_routine_health_management_information_system_at_the_primary_healthcare_facility_and_district_levels_in_Tanzania

Kawila, C., Daniel , M., Olwanda, E., Wangui , M., Mwang, E., Rotich, W., and Njuguna, D. (2022). ituation Analysis on the Quality of Maternal and Child Health in Nairobi and Garissa County in Kenya. *Public Health Research*. doi:10.5923/j.phr.20221205.02

KENIA. (2018). *Strategic Plan 2018-2022.* Retrieved from Kenya National Innovation Agency: https://www.innovationagency.go.ke/uploads/php4d3zjG.pdf

Khalifa , E., Elaine , B., and ’Donovan, D. o. (2015). trategies to increase demand for maternal health services in resource-limited settings: challenges to be addressed. *BMC Public Health*. Retrieved from https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-015-2222-3

Kharrazi, H., Ehrenstein, V., Lehmann,, H., and Taylor, C. O. (2019). Obtaining Data From Electronic Health Records. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK551878/

Khuwaja, U., Ahmed, K., Ghulam, A., Adeel, A., and Wanasika, I. (2020). *Leadership and employee attitudes: The mediating role of perception of organizational politics.* Retrieved from https://www.tandfonline.com/doi/full/10.1080/23311975.2020.1720066

Kiberu , V., Matovu, J. K., Makumbi, F., Kyozira, C., Mukooyo, E., and Wanyenze, R. K. (3014). Strengthening district-based health reporting through the district health management information software system: the Ugandan experienceBMC Medical Informatics and Decision Making. *BMC Medical Informatics and Decision Making*. doi:https://doi.org/10.1186/1472-6947-14-40

Kiberu, V. M., Matovu, J. K., Makumbi, F., Kyozira, C., Mukooyo, E., and Wanyenze, R. K. (2014, 5 13). Strengthening district-based health reporting through the district health management information software system. Retrieved from https://bmcmedinformdecismak.biomedcentral.com/

Koumamba, A. P., Bisvigou, U. J., Ngoungou, E. B., and Gayo , D. (2021a). Health information systems in developing countries: case of African countries. Retrieved from https://bmcmedinformdecismak.biomedcentral.com/

Koumamba, P., Bisvigou, U. J., Ngoungou, E. B., and Gayo, D. (2021b). Health information systems in developing countries: case of African countries. *BMC Medical Informatics and Decision Making*. doi:https://doi.org/10.1186/s12911-021-01597-5

Kruk, M. E., Gage, A. D., Arsenault, C., Keely , J., Leslie, H. H., and Sanam , R.-D. (2018). High-quality health systems in the Sustainable Development Goals era: time for a revolution. *Lancet Global Health Commission, 6*(11). doi:https://doi.org/10.1016/S2214-109X(18)30386-3

Lale, S., Chou, D., Gemmill, A., Tunçalp, Ö., Moller, A.-B., Daniels, J., . . . Alkema, L. (2014). Global causes of maternal death: a WHO systematic analysis. *Lancet Glob Health*. doi:10.1016/S2214-109X(14)70227

Langlois, E. V., McKenzie, A., Schneider, H., and Mecaskey, J. W. (2020). Measures to strengthen primary health-care systems in low- and middle-income countries. *Bull World Health Organ. 2*. doi:oi: 10.2471/BLT.20.252742

M, R. (2017). EHRs: The Challenge of Making Electronic Data Usable and Interoperable. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5565131/

Maru, S., Masresha , D. T., Sharew, e., Melaku, Nebyu , D. M., Ashenafi, F., . . . Makida , F. (2023). Healthcare professionals' knowledge, attitude and its associated factors toward electronic personal health record system in a resource. *ORIGINAL RESEARCH*. doi:Volume 11 - 2023 | https://doi.org/10.3389/fpubh.2023.1114456

Masaba, B. B., and Mmusi, P. R. (2023). A Strategy for Reducing Maternal Mortality in Rural Kenya. *Int Journal Womens Health*. doi: 10.2147/IJWH.S396257

Mehrolhassani, M. H., and Emami, M. (2013). Change theory for accounting system reform in health sector: A case study of Kerman University of medical sciences in Iran. *International Journal on Health Policy Management, 1*, 279–85.

Mgawadere, F., Unkels, R., Kazembe, K., and Nynke, v. d. (2017). Factors associated with maternal mortality in Malawi: application of the three delays model. *BMC Pregnancy and Childbirth volume*. Retrieved from https://bmcpregnancychildbirth.biomedcentral.com/submission-guidelines/aims-and-scope

Miriam, R. (2017). The Challenge of Making Electronic Data Usable and Interoperable. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5565131/

Mphatswe, W., Mate, K. S., Bennett, B., Ngidi, H., Reddy, J., Barker, P. M., and Rollins, N. (2012). Improving public health information: a data quality intervention in KwaZulu-Natal, South Africa. *Bull World Health Organ, 3*(90). doi:10.2471/BLT.11.092759

Muchemi, O. M., Gichogo, A., Mungai, J. G., and Roka, Z. G. (2016). Trends in health facility based maternal mortality in Central Region, Kenya. *Pan African Medical Journal (ISSN: 1937-8688, 23*(259). doi:10.11604/pamj.2016.23.259.8262]

NBS. (2009). *Migori County Population census*.

Obinna , O. O., Momoh,, J., Uzochukwu, B. S., Mbofana, F., Adebiyi, A., Barbera, T., . . . Taylor-Robinson, S. D. (2019). Identifying Key Challenges Facing Healthcare Systems

In Africa And Potential Solutions. *International Journal of General Medicine*. doi: 10.2147/IJGM.S223882

Obinna, O., Nkoli , U., Giuliano , R., Enyi , E., Chinyere , M., Tolib , M., and Uzochukwu, B. (2015). ole and use of evidence in policymaking: an analysis of case studies from the health sector in Nigeria. *Health Research Policy and Systems*. Retrieved from https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-015-0049-0

Obinwa , O., Scott, P. J., and Hopgood, A. A. (2020). Automating Electronic Health Record Data Quality Assessment. *Journal of Medical Systems*.

Pedro , J., Saturno-Hernández, Ismael Martínez-Nicolá, I., Estephania , M.-Z., Fernández, M., Fernández-Elorriaga, M., and Poblano-Verástegui, O. (2019). *Indicators for monitoring maternal and neonatal quality care:*. Retrieved from https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-019-2173-2

Rana , D., and Dikaios, S. (2020). Barriers to Accessing Maternal Care in Low Income Countries in Africa: A Systematic Review. *Int J Environ Res Public Health.* doi:10.3390/ijerph17124292

RHIS, M. K. (2019). *Achievement Report.* Retrieved from hiskenya.org

Shahmoradi , L., Arji , G., Farzaneh , A. N., and Darrudi , A. (2016). Electronic Health Record Implementation: A SWOT Analysis. *Indian Journal of Community Medicine*. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5139973/

Shahmoradi , L., and Habibi-Koolaee, M. (2016). Integration of Health Information Systems to Promote Health. *Iranian Journal of Public Health*.

Shiferaw , A., Zegeye , D., Assefa , S., and Yenit , M. (2017). Routine health information utilization and associated factors among health care professionals working at public health institution in North Gondar. *National Information Health* .

Sinhasane, S. (2022). *What is Health Information System and and Its Significance in the Healthcare Sector?* Retrieved June 22, 2023, from Mobisoft: https://mobisoftinfotech.com/resources/blog/importance-of-health-information-system/

Soumya , U., and Han-fen, H. (2022). A Qualitative Analysis of the Impact of Electronic Health Records (EHR) on Healthcare Quality and Safety: Clinicians' Lived Experiences. doi:10.1177/11786329211070722

Susan , F. R., Lyimo, E. P., Mremi, I. R., Tungu, P. K., Mwingira, V. S., Mbata, D., . . . Mboera, L. G. (2020). ata quality of the routine health management information system at the primary healthcare facility and district levels in Tanzania. *BMC Medical Informatics and*

Decision Making volume. Retrieved from https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/s12911-020-01366-w

Tahmina , B., Muberra , S. M., Adamou, B., Ferdous, J., Muhammad , P. M., Saiful , M. I., . . . Anwa, I. (2020). *Perceptions and experiences with district health information system software to collect and utilize health data in Bangladesh: a qualitative exploratory study.* doi:https://doi.org/10.1186/s12913-020-05322-2

Thein, H., and Thant , Z. (2020). Factors in determining data quality produced from health management information systems in low- and middle-income countries. *Health Management Information System (HMIS) , 9*(4).

UNFPA. (2014). *Summary Report of UNFPA assessment on Maternal Mortality Ratio In Kenya.* Retrieved from https://kenya.unfpa.org/sites/default/files/pub-pdf/UNFPA%20RMNCAH%20Advocacy%20Campaign%20Assessment%20Summary%5BTo%20Print%5D.pdf

WHO. (2016). *standards for improving quality of maternal and newborn care in health facilities.* Retrieved from https://cdn.who.int/media/docs/default-source/mca-documents/qoc/quality-of-care/standards-for-improving-quality-of-maternal-and-newborn-care-in-health-facilities.pdf

WHO. (2016). *WHO methods and data sources.* Data and Analytics. Retrieved from https://www.who.int/docs/default-source/gho-documents/global-health-estimates/ghe2019_life-table-methods.pdf

WHO. (2018). *Maternal, newborn, child and adolescent health: what is quality of care and why is it important?* Retrieved from World Health Organization: http://www.who.int/maternal_child_adolescent/topics/quality-of-care/definition/en/

WHO. (2019). *World health statistics 2019: monitoring health for the SDGs, sustainable development goals.* Retrieved from https://www.who.int/publications/i/item/9789241565707

WHO. (2020). What is the evidence on policies, interventions and tools for establishing and/or strengthening national health research systems and their effectiveness? *The National Center for Biotechnology Information advances science and health by providing access to biomedical and genomic information.* Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK558505/

WHO. (2022). *Maternal mortality.* Retrieved from https://unstats.un.org/sdgs/indicators/database/

WHO. (2022). *programme-based budgeting in health.* Retrieved from https://www.who.int/teams/health-systems-governance-and-financing/covid-19

WHO, (2023). *Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division.* Retrieved from https://www.who.int/publications/i/item/9789240068759

WHO, and World Bank. (2017). *Tracking Universal Health Coverage:2017 Global Monitoring Report.* Retrieved from https://apps.who.int/iris/bitstream/handle/10665/259817/9789241513555-eng.pdf

WHO, UNICEF, World Bank Group, UNFPA, and United Nations Population Division. (2019). *Maternal mortality: Levels and trends 2000 to 2017.* Geneva: WHO. Retrieved 2019, from (https://www.

WHO, University of Oslo, UNICEF, Global Fund., GAVI , and PEPFAR. (2021, 10). WHO Toolkit for Routine Health Information Systems Data. *DHIS2 Integrated Packages*.

Wilhelm, J. (2023). Coefficient of variation. Retrieved from https://www.google.com/search?q=The+coefficient+of+variation+(CV)+is+the+ratio+of+the+standard+deviation+to+the+meanandoq=The+coefficient+of+variation+(CV)+is+the+ratio+of+the+standard+deviation+to+the+meanandaqs=chrome..69i57.1693j0j7andsourceid=chromeandie=UTF-

Willcox, M., J, P., S, S., Nicholso, BD, B, S., . . . Dumont A. (2020). Death audits and reviews for reducing maternal, perinatal and child mortality. *Death audits and reviews for reducing maternal, perinatal and child mortality*. doi:10.1002/14651858.CD012982.pub2

Wills, J. (2023). Data Consumers and Producers. *The Data Administration Newsletter A Framework for Understanding Data Consumers and Producers*.

Yost, J., Dobbins, M., Traynor, R., Kara , D. C., Workentine, S., and Lori, G. (2014, July 18th). Tools to support evidence-informed public health decision making. *BMC Public Health*. doi:10.1186/1471-2458-14-728

Yousef , A., Baker , E.-E., Salameh , A., Mjlae, Waheeb , A.-U., Ahmed, H. H., . . . Iryani , S. A. (2020). Effectiveness of management information system in decision-making. Retrieved from https://www.researchgate.net/publication/356598560_The_Effectiveness_Of_Management_Information_System_In_Decision-Making

Z, A. J. (2016). Donabedian's Lasting Framework for Health Care Quality. *New England Journal of Medicine*. doi:10.1056/NEJMp1605101

Annex 1: Assessing quality of information on preventive maternal health indicators

Form Serial number……

Name of the facility……

To assess quality of information on preventive maternal health indicators

Years	2013		2014		2015		2016		2017		2018		2019	
Indicators	RHIS	REG	RHIS	REG	RHIS	REG	RHIS	REG	RHIS	REG	RHIS	REG	RHIS	REG
Skilled delivery														
ANC1														
ANC4														
IFAS														
IPT1														
LLITN														

Name of the facility……

Key informant interview guide

KEY INFORMANT INTERVIEW PROTOCOLS –I'm [Wilfred Obwocha], A PhD student of [Jaramogi Oginga Odinga University of Science and Technology]. I am collecting research data on [strengthening utilization of quality health information in implementing health strategic plans to reduce maternal morbidity and mortality in for four hospitals in Migori County].

An important first step in this effort is to better understand [the quality of data and its application to improve maternal health system and Service]. To do that, I am conducting interviews among health records and information officers, disease surveillance coordinators, and community health focal persons. The outcome of the interview will be used in [planning, policy development, prevention disease and maternal deaths /etc). Everything from the interviews will be strictly confidential. (If you agree)] Your knowledge is valuable and will bring great change in maternal health services.

Questions

1. For how long have you been providing health care services……
2. What do you think should be done to improve the quality of data/information in your hospital?
3. What are the challenges on the following-?

i), Accuracy (close to accepted) …….

ii). Timeliness (Right time for action) ……

iii). Completeness (no gap) …….

iv). Accessibility (retrievable, having user rights) ……

v). Availability (existence)…….

vi). Consistency (without large variances) ……

vii). Relevance (related to the subject/use) ……

viii). Reliability (dependable)…….

4. I know it may not be possible to solve all these issues, what are the key things of priority?
5. How can these key things of priority be implemented?
6. How can information use for decision making be enhanced?

Annex 2: Check list: On Therapeutic health indicators

Form serial number……

Name of the facility……

Check list: On morbidity and mortality indicators

Years	2013		2014		2015		2016		2017		2018	2019	
Indicators	DHIS		DHIS	REG	DHIS	Regist	DHIS	REG	DHIS		REG	DHIS	Regist
ante partum hemorrhage													
post-partum hemorrhage													
Eclampsia													
ruptured uterus													
obstructed labor													
Sepsis													
PMCT													
Maternal death													

Questions

1. For how long have you been providing health care services……

2. What do you think should be done to improve the quality of data/information in your hospital?

3. What are the challenges on the following-?

i), Accuracy (close to accepted) …….

ii). Timeliness (Right time for action) ……

iii). Completeness (no gap) …….

iv). Accessibility (retrievable, having user rights) ……

v). Availability (existence)…….

vi). Consistency (without large variances) ……

vii). Relevance (related to the subject/use) ……

viii). Reliability (dependable)…….

4. I know it may not be possible to solve all these issues, what are the key things of priority?

5. How can these key things of priority be implemented?

6. How can information use for decision making be enhanced?

I'm [Wilfred Obwocha], A PhD student of [Jaramogi Oginga Odinga University of Science and Technology]. I am collecting research data on [strengthening the utilization of quality health information to prevent maternal morbidity and mortality].

An important first step in this effort is to better understand [the quality of data and its application to improve maternal health system and Service]. To do that, I am conducting interviews among health records and information officers, disease surveillance coordinators, and community health focal persons. The outcome of the interview will be used in [planning, policy development, prevention of diseases and maternal deaths /etc.). Everything from the interviews will be strictly confidential. (If you agree)], your knowledge is valuable and will bring great change in quality health information and maternal health services.

Annex 3: Questionnaire for healthcare workers

FORM SERIAL NO……

Name of the facility……..

Determine quality health information in health annual work plans in implementing strategic plans to reduce maternal morbidity and mortality

Demographic Data:

1. Please state your highest level of education: Primary ☐ Secondary ☐ College

University ☐

2. What is your profession?

A Nurse ☐ A Clinical officer A Doctor ☐ A Manager ☐

3. What is your sex? Male ☐ Female ☐

4. For how long have you been working? 0-10yrs. ☐ 11-20 yrs. ☐ 21-30 yrs. ☐

30 and above ☐

5. What is the category of your facility? County referral Hospital ☐ Sub Hospital ☐

Sub County referral Hospital ☐

6. Who owners this facility? GK ☐ private PR actioner ☐ FBO ☐

7. Which services do you offer in this facility? Curative ☐ Promotive ☐

Preventive ☐ Maternaland Child health ☐ Administrativ ☐ All above ☐

8. Which age category contributes to most maternal mortality? Adolescents ☐ youths ☐ Adults ☐

9. Are you trained in health information? Yes ☐ No ☐

10. Are you a skilled delivery provider? Yes ☐ No ☐

11. Are you a trained midwife? Yes ☐ No ☐

Governance and leadership

1. Do you have MPDSR committee in this facility? Yes ☐ No ☐

2. Do you have you have minutes for the last meeting? Yes ☐ No ☐

3. Do you have M andE committee in this facility? Yes ☐ No ☐

4. Does the hospital leadership support data quality? Yes ☐ No ☐

5. Do you monitor trends of maternal morbidity and mortality? Yes ☐ No ☐

6. Do you use any statistical framework for estimating mortality data? Yes ☐ No ☐

7. Is there a budget for data and data quality in this facility? Yes ☐ No ☐

8. What proportion of annual operational plan is implemented in each year?

50% ☐ >50% ☐ <50% ☐

Policies

1. Do you have an information policy in this facility? Yes ☐ No ☐

2. As a facility do you have an information health plan? Yes ☐ No ☐

3. Do you conduct monitoring and evaluation of data quality Yes ☐ No ☐

4. Do you have Mand E framework in this facility? Yes ☐ No ☐

Systems and processes

1. Which information systems do you have in this facility?

Manual ☐ Electronic ☐ Hybrid ☐ other specify…….

DHIS ☐ Paper ☐ EMR ☐ HR ☐ Other (Specify)….

2. Why are you using this system? It is provided ☐ is approved for use ☐

It is user friendly ☐ can improve quality of data/ information ☐

3. Does the system in use provide quality data/ information? Yes ☐ No ☐

4. Do these systems share information? Yes ☐ No ☐ do not know ☐

5. Do you use GIS to present information? Yes ☐ No ☐

6. How many information systems do you use in this facility?

None ☐ One ☐ More than one ☐

People and skills

1. How often are you trained on health information as a healthcare worker?

Quarterly ☐ Annually ☐ Biannually ☐ Not at all ☐ other specify…..

2. Do you have data analytical knowledge? Yes ☐ No ☐

3. Do you have knowledge in computer systems? Yes ☐ No ☐

4. Are healthcare workers knowledgeable about quality of data?

Yes ☐ No ☐ do not know ☐

5. Do you have professionals in health information department? Yes ☐ No ☐

2.4.7**:** Data use and reporting

1. Which software do you use to present information? EMR ☐ EHR ☐ DHIS ☐

None ☐

2. Does the management practice use of information when they are planning for this facility? Yes ☐ No ☐

3. Which system do you apply in managing information?

EMR ☐ E-HR ☐ Paper ☐ Biometric ☐

4. Which knowledge do you have for information use? Analytics ☐ Interpretation ☐ Modeling ☐ Visualization ☐ None ☐

5. Do you use information to reduce maternal morbidity? Yes ☐ No ☐

6. Is there a culture of information use among healthcare workers?

Yes ☐ No ☐

Do you have a database for maternal mortality data?

Yes ☐ No ☐

7. Do clinicians use electronic system for their clinical work positively?

Yes ☐ No ☐ do not know ☐

2.4.8 Partnerships/ support

1. Do you normally have technical support in generating quality data for annual plans?

Yes ☐ No ☐

2. Do you hold stakeholders' review of data and information in this facility?

Yes ☐ No ☐

3. Do you disseminate information? Yes ☐ No ☐

4. Are you always updated on M and E and maternal mortality changes? Yes ☐ No ☐

Annex4: Likert scale assessing form for the framework

SECTION A

1). Do you agree that this framework improve the accuracy of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral

2). Do you agree that this framework improve the completeness of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

3). Do you agree this framework can improve the consistency of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

4). Do you agree that this framework can improve the accessibility of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

5). Do you agree that this framework can improve the availability of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] neutral [ ]

6). Do you agree that this framework can improve the timeliness of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

7. Do you agree that this framework can improve the utility of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

8). Do you agree that this framework can improve the reliability of information on maternal morbidity and mortality? Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

SECTION B

1). Do you agree that this framework can improve the accuracy of information on preventive health indicators in the annual work plans?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

2). Do you agree that this framework can improve the completeness of information on preventive health indicators in the annual work plans?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

3). Do you agree that this framework can improve the consistency of information on preventive health indicators in the annual work plans?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

4). Do you agree that this framework can improve the accessibility of information on preventive health indicators in the annual work plan?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

5). Do you agree that this framework can improve the availability of information on preventive health

Indicators in the annual work plan?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

6). Do you agree that this framework can improve the timeliness of information on preventive health indicators in the annual work plan?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

7). Do you agree that this framework can improve the utility of information on preventive health indicators in the annual work plan?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

SECTION C

1). Do you agree that governance and leadership can improve the quality of health information

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

2) Do you agree that policies can improve the quality of health information?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

3). Do you agree that systems and process can improve the quality of health information?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

4). Do you agree that people and skills can improve the quality of health information?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

5). Do you agree that data use and reporting can improve the quality of health information?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

6). Do you agree that partnerships/ support can improve the quality of health information?

Agree [ ] strong agree [ ] strongly disagree [ ] disagree [ ] neutral [ ]

Annex 5: Introductory Letter from School of Postgraduate

I

JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY

BOARD OF POSTGRADUATE STUDIES
Office of the Director

Tel. 057-2501804
Email: bps@jooust.ac.ke

P.O. BOX 210 - 40601
BONDO

Our Ref: H162/4224/2018 **Date:** 19th December 2019

TO WHOM IT MAY CONCERN

RE: OBWOCHA WILFRED – H162/4224/2018

The above person is a bona fide postgraduate student of Jaramogi Oginga Odinga University of Science and Technology in the School of Health Sciences pursuing a PhD in Public Health. He has been authorized by the University to undertake research on the topic:

"STRENGTHENING UTILIZATION OF QUALITY HEALTH INFORMATION IN IMPLEMENTING HEALTH STRATEGIC PLANS FOR PREVENTION OF MATERNAL MORBIDITY AND MORTALITY"

Any assistance accorded to him shall be appreciated.

Thank you.

Prof. Dennis Ochuodho
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

Annex6: Approval from Baraton University Board

OFFICE OF THE DIRECTOR OF GRADUATE STUDIES AND RESEARCH
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O Box 2500-30100, Eldoret, Kenya, East Africa

B0506122019 March 27, 2020

TO: Wilfred Obwaya Obwocha
Department of Public Health, School of Health Sciences
Jaramogi Oginga Odinga University of Science and Technology

Dear Wilfred,

RE: Strengthening Utilization Of Quality Health Information In Implementing Health Strategic Plans To Reduce Maternal Morbidity And Mortality.

This is to inform you that the Research Ethics Committee (REC) of the University of Eastern Africa Baraton has reviewed and approved your above research proposal. Your application approval number is UEAB/REC/27/03/2020. The approval period is 27th March, 2020 - 27th March, 2021.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (ammendments, deviations and violations) are submitted for review and approval by the Research Ethics Committee (REC) of the University of Eastern Africa Baraton.
iii. Death and life threatening problems and serious events or unexpected adverse events whether related or unrelated to the study must be reported to the Research Ethics Committee (REC) of University of Eastern Africa Baraton within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to the Research Ethics Committee (REC) of the University of Eastern Africa Baraton within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submissions of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to the Research Ethics Committee (REC) to the University of Eastern Africa Baraton.

Prior to commencing your study, you will be expected to obtain a research licence from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Sincerely Yours,

Prof. Jackie Kpeinzeh Obey, Phd
Chairperson, Research Ethics Committee

University of Eastern Africa, Baraton
27 MAR 2020
P.O Box 2500-30100
ELDORET
Research Ethics Committee

Annex 7: Permit from NACOSTI for data collection

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **296001**

Date of Issue: **04/May/2020**

RESEARCH LICENSE

This is to Certify that Mr.. Wilfred Obwaya Obwocha of Jaramogi Oginga Odinga University of Science and Technology, has been licensed to conduct research in Migori on the topic: STRENGTHENING UTILIZATION OF QUALITY HEALTH NFORMATION IN IMPLEMENTING HEALTH STRATEGIC PLANS TO REDUCE MATERNAL MORBIDITY AND MORTALITY for the period ending : 04/May/2021.

License No: **NACOSTI/P/20/4840**

296001

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Annex 8: Letter allowing data collection

REPUBLIC OF KENYA

COUNTY GOVERNMENT OF MIGORI
DEPARTMENT OF HEALTH AND SANITATION

Telegrams: "MOH", Migori

Telephone:0716 649 609
Email:**beffyvill@gmail.com**
When replying please quote;

COUNTY RESEARCH COORDINATOR,
DIVISION OF RESEARCH & LEARNING,
MIGORI COUNTY.
P O BOX 1045-40400
SUNA - MIGORI

REF: MCG/MOH/CRLC/VOL 1/14/2023 **6th May, 2023.**

To,

Wilfred Obwaya Obuocha,

Reg No: H162/4224/2018.

RE: APPROVAL TO CONDUCT A STUDY.

Thank you for your letter requesting authorization to conduct a research study titled '**Strengthening utilization of quality health imformation in implementing strategic plans for prevention of maternal morbidity and mortality.** After careful consideration of your research proposal, we are pleased to inform you that your request is officially granted.

We appreciate you for having met the Migori County Research and Learning Pre-requisite, shared the Ethical Review approval, NACOSTI permit and paid the required County research fees. We are confident that the study will be conducted in accordance with all the policies and procedures guiding it.

The study will take place for a period ending **31st May, 2023**. You will be required to continuously be sharing preliminary feedback/reports to the County as through the Division of Research & Learning (DRL) as implementation takes place. Equally, in collaboration with the DRL you will be required to officially disseminate or share the study findings to relevant officers and stakeholders after the completion of the study.

Kindly liaise with the Sub County Research & Learning Coordinators through the SCMOH's as you undertake the research study.

Wishing you the very best.

NB: Data collection is authorized for Rongo Sub County Hospital, St. Joseph's Mission Hospital and Isebania Sub County Hospital.

Thank you,

BEFFY VILL,
RESEARCH & LEARNING COORDINATOR,
MIGORI COUNTY.

CC: CEC Health, Chief Officers for Health and Directors for Health.