HEALTH INFORMATION SYSTEMS (HIS) IMPLEMENTATION AS A CONTRIBUTING FACTOR TO HEALTHCARE QUALITY IN A PRIVATE HOSPITAL.

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Keywords: Management, Improve, Safety, Care

ABSTRACT

Background and objectives:

The purpose of this study was to determine the impact of health information systems (HIS) implementation on healthcare quality. The objectives of this study were to determine the impact of HIS implementation on care, service, management and decision-making processes. In addition, the study was to determine the impact of HIS implementation on barriers to healthcare quality.

Methods: The study was conducted at Gertrude's children's hospital. This was a cross sectional study utilizing quantitative research approaches. Fischer et. al. formula was used to arrive at a sample size of 208 staff, 190 of which were front line staff and 18 management staff. Proportionate stratified sampling was the used to select the study participants. Self-administered structured questionnaires were used to collect data. Cronbach alpha was used to establish the reliability of the questionnaires. Data was analyzed using of SPSS version 22.

Results: There was no significant association between age and cadre on impact of HIS on service, care, management and decision making processes as well as barriers to healthcare quality ($p>0.005$). One sample T-test was used to disapprove the null hypothesis ($p<0.00$). This indicated that HIS had a positive impact on service, care, management and decision making processes as well as reduction on barriers to healthcare quality.

Conclusion: The study revealed that HIS implementation at Gertrude's Children's Hospital (GCH) had a positive impact on service, care, management and decision-making processes as well as reduction on barriers to healthcare quality.

Keywords: Management, Improve, Safety, Research, Care

INTRODUCTION

Background to the Study

With the increased view on healthcare as a service, quality is critical for the survival of healthcare institutions. Quality healthcare in this study refers to care that is timely, efficient, patient-centered, effective, equitable and safe as defined by The Institute of Medicine (Institute for Healthcare Improvement, 2017)

According to Macharia and Maroa (2014), health care is a critical objective of both district and national health systems, in the developing and developed countries. Despite this vital objective, there are deficiencies in the quality of care in hospitals be they private or public. These deficiencies include increased hospital acquired infections, patient injuries, stock outs of vital medicines and long waiting times. These deficiencies may sometimes lead to adverse outcomes. Patients in hospitals in developing countries face a major risk of medical errors (Edmondson, 2012). This is so because many developing countries are faced with challenges of not having adequate resources, such as necessary critical skills, limited financial resources and medical equipment necessary to support quality care. Poor quality of healthcare has a negative impact on the economy of a country as poverty is a consequence of poor health. Poor healthcare can also result to disability or death which negatively affects the productivity of countries. As noted in a study by Andel et.al (2012), "in 2008, medical errors cost the United States $19.5 billion". A study by researchers at Johns Hopkins Medicine indicated medical errors as the third leading cause of death in the US (Allen and Pierce, 2016).

Many countries and health institutions have embraced Health information systems (HIS) as one of the strategies to help improve quality in healthcare. HIS refer to any systems that capture, store, manage or transmit information related to the health of individuals or the activities of healthcare organizations such as disease surveillance systems, laboratory information systems,

hospital patient administration systems and human resource management information systems (HRMIS) among others. HIS make available the right information and knowledge, at the right time and place, to the right people and in the right form to support planning, management and decision making (Burg, 2010). Jahanbakhsh, Sharifi and Ayat (2014) affirm that HIS will fuel the next breakthroughs in health systems improvement throughout the world. In their article, Glaser, Drazen and Cohen (1986) highlight cost reduction, increased efficiency of operations, improved staff productivity and quality of care, timely service and increased accuracy in information management as some of the expectations that hospitals have when implementing HIS. They also note that even though HIS can result to these benefits, the benefits are diverse in various organizations. In their article, Goldsack and Robinson (2014) believe that health information technology, especially electronic medical record has the potential to improve the efficiency and effectiveness of healthcare providers.

Many hospitals especially in the developed countries have implemented HIS and there is an increase of this trend in hospitals in developing countries. Cheung et. al. (2014) note that increase of medical information in hospitals has resulted to growing demand in use of information technology to effectively support the management of collected data. The Kenya Health Policy 2012-2030, which provides guidelines to ensure development in the entire Kenyan health sector in line with Vision 2030 and the new constitution, contains seven orientations one of which is HIS (Kibui et. al., 2015).Despite this policy, the adoption of HIS in Kenya is more in the private sector as opposed to the public sector mainly because of the pressure in competition in the private sector.

Statement of the problem

Healthcare facilities in developing countries are increasingly under pressure from financiers, governments and patients to introduce quality control systems and strategies that support good

4

healthcare outcomes (Macharia and Maroa, 2014) which has influenced the adoption of HIS. For a long time private healthcare institutions in Kenya had been in the forefront in embracing use of HIS until recently when Kenya started recording numerous improvements and developments in use of HIS in public healthcare institutions both at the national and county levels. This growth has been majorly attributed to the devolution of health services which has enabled county governments to invest towards improving the quality of healthcare in the various counties. Organizations need financial as well as the right human resources in order to embrace HIS.

Similarly, despite the fact that GCH is a not-for-profit organization, it has continued to put a lot of investment towards the acquisition, development and maintenance of HIS in a bid to appropriately position itself in the business environment by offering quality care which is the primary goal of the organization.

Just like any other asset, it is important for organizations that have invested in HIS to be able to measure the return on investment of such assets. There is also limited literature on the impact of HIS, as an investment, on quality healthcare. This study therefore helps demonstrate the impact of HIS on quality healthcare in GCH. It also builds on findings from previous similar studies as well as generating new knowledge on the subject under study.

The main purpose of the study

To determine impact of health information system implementation on health care quality at Gertrude's children's hospital.

Specific objectives of the Study

1. To demonstrate the impact of HIS implementation on healthcare quality by assessing its impact on service, care, decision making as well as management processes.

2.   To investigate whether HIS implementation has helped eliminate barriers to healthcare quality.

Study Question

How do features of HIS implementation support facets of healthcare quality?

Significance of the study

GCH has invested largely in HIS. It is therefore important to demonstrate the return on investment of HIS. This study further links healthcare processes and measures to the HIS. The findings of the study will be shared with the management of the organization and other relevant institutions to inform decision making on the importance of HIS as well as help build up on information from previous similar studies. The beneficiaries of this information will be management and staff of these institutions. This study will add onto available knowledge on the impact of HIS on quality improvement by demonstrating that HIS is a worthy investment for healthcare institutions which aim at improving quality of care and ensuring sustainability in the turbulent business environment. This information will therefore encourage organizations to adopt, develop and implement HIS as well as encourage future researches on the use of HIS and its impact on quality of care.

Limitations of the study

The scope of the study is limited to only one institution which might limit the reliability of the findings. Since the institution under study is a private hospital, the findings of this study might therefore not be representative of the scenario in public health institutions.

Customer satisfaction as a key aspect of defining quality has however not be analyzed in this study as it will broaden the scope.

Scope of the study

This study was conducted at GCH, a private hospital in Kenya. The hospital has 13 branches, 10 of which are situated within Nairobi and its environs, and 3 of which are situated in various counties. This study was conducted in all the branches of the hospital. The study used cadres of staff within the hospital that actively use HIS, who included the hospital management team, Nurses, Doctors, Pharmacy, Laboratory, Front office and Radiology staff.

The study focused on three HIS i.e. the Patient health information management system (Kranium), the Human resource management system (Navision) and the Compliance system (Q-pulse). The findings are based on staff perception on the impact of HIS on healthcare quality at GCH.

Conceptual Framework

Figure1.1. Figure showing the conceptual framework on impact of HIS implementation on health care quality
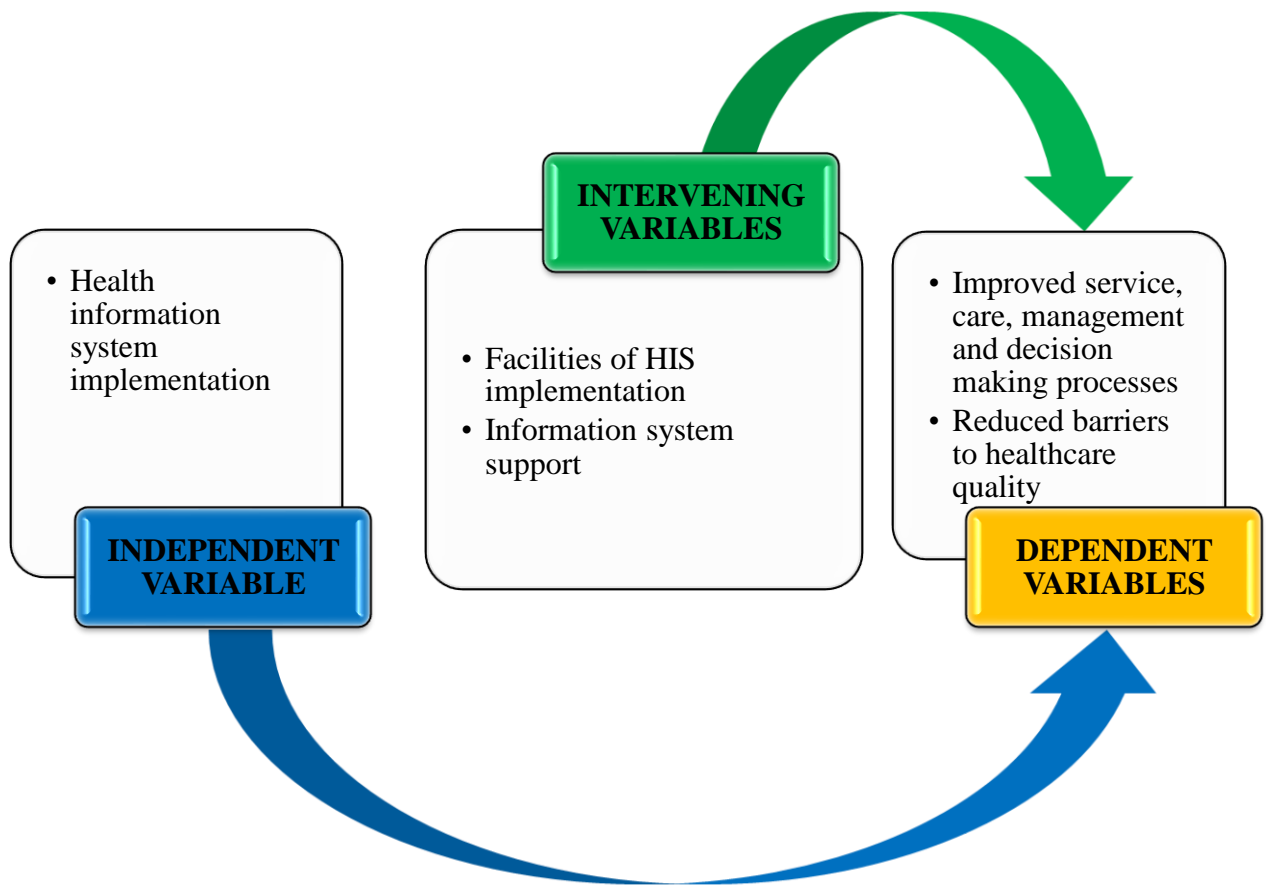
Operational Definition of Terms

Health information systems (HIS)–HIS refer to any systems that capture, store, manage or transmit information related to the health of individuals or the activities of healthcare organizations such as disease surveillance systems, laboratory information systems, hospital patient administration systems and human resource management information systems (HRMIS) among others.

Care processes –Processes through which customer needs and expectations are met

Barriers to quality healthcare - Limitations that make it difficult or impossible to offer or access quality healthcare.

Service processes- The systematic steps through which service is offered.

Decision-making processes–Methods of choosing between possible solutions to a problem by identifying a decision, gathering information and assessing alternative resolutions

Management systems- Systematic frameworks designed by an organization to manage their policies, processes and procedures as well as promote continual improvement, to ensure that they fulfill all the tasks required to achieve its objectives.

Facilities for HIS implementation –Hardware used to support HIS such as computers, servers etc

Information system support –Any organized system for collection, organization, storage and communication of information

METHODOLOGY

Introduction

This chapter describes the research methodology. It comprises the study design chosen; the study population; sampling; data collection techniques and tools; validity and reliability; data analysis; study limitations and the ethical considerations regarding the study.

This was a descriptive study design utilizing quantitative methods to describe the impact of health information systems implementation on health care quality.

Study Variables

The study variables included independent, dependent and intervening variables. The **Independent variable** was the health information systems implementation. The **Dependent variables** included improved care, service, decision-making and management system processes as well as reduced barriers to quality healthcare. **Intervening variables** are factors which may greatly affect the functions of both independent and dependent variables but will

not be part of the study. They included the facilities for HIS implementation and information systems support.

Participants and/or data sources

The study was conducted at the GCH. It is the largest hospital in East and Central Africa dedicated exclusively to the care of children up to the age of 21 years. The hospital is a non-profit organization, chartered with responsibilities of benefiting humankind such as providing health services, fostering good health, carrying out research and teaching healthcare professionals. Gertrude's Children's Hospital aims to be the preferred healthcare provider for East and Central Africa for children. The organization values regarding patients' needs as its top priority and providing safe and child friendly environment for its patients.

GCH has a total of 13 outlets, all of which are in Kenya, and offers both in and outpatient services. Nine of these outlets are located within Nairobi County and its environs with the rest being in Mombasa, Kiambu and Kajiado Counties.

The target population consisted of various cadres of staffs within the organization that actively use HIS. These cadres included management team, nurses, doctors, pharmacy, laboratory, front office and radiology staff.

Stratified sampling technique was used to determine the sample population. This was done using the current Human resource database consisting of 453 staffs who belong to various cadres i.e. nurses, doctors, pharmacy staff, laboratory staff, radiologists and physiotherapists. Fischer et.al test was then used to calculate the sample size. Stratified sampling was then used to calculate sample sizes of each cadre in proportion to their sizes. Random sampling was then applied to get the participants from each cadre to amount to the desired sample size.

The sample frame used for this study was 453 staff which composed of the following population sizes as per the current GCH human resource employee data.

Table 3.1: Table showing the population size per cadre

	CADRES OF STAFF						
	NURSES	MANAGEMENT TEAM	DOCTORS	LAB STAFF	PHARMACY STAFF	FRONT OFFICE STAFF	PHYSIOTHERAPY STAFF
No. of staff per cadre out of a total of 453 staff	215	39	83	42	63	8	3

To ensure that the results of the study can be generalized beyond GCH, Fischer et.al test was used to calculate the adequate sample size for population below 10,000 people. This was done as follows;

The sample size was obtained from 453 staffs who are working in GCH.

$$n = \frac{z^2 \ pq}{d^2}$$

Where n = desired sample size (if the population was greater than 10,000).

Z = Standard normal deviation at the required confidence interval is 1.96

P = the proportion in the target population estimated to have characteristics being measured. (0.5)

$$q = (1 - p)$$

Hence;

$$q = (1 - 0.5)$$

d = the level of statistical significance set as 0.05

Hence;

$$n = \frac{(1.96)^2 \ (0.5)(0.5)}{(0.05)^2}$$

$$n = \frac{0.9604}{0.0025}$$

$$n = 384.16$$

$$nf = \frac{n}{1 + \left(\frac{n}{N}\right)}$$

nf = desired sample size

N = was the estimate of population size = 453

$$nf = \frac{384.16}{1 + \left(\frac{n}{N}\right)}$$

$$nf = \frac{384.16}{1 + \left(\frac{384.16}{453}\right)}$$

$$nf = \frac{384.16}{1 + 0.85}$$

$$nf = \frac{384.16}{1.85}$$

$$nf = 207.65 = \mathbf{208}$$

A Sample Size of **208 staffs** was obtained after calculating from accessible population of 453 staffs.

Stratified sampling was used to determine the sample size for each cadre based on their populations as follows;

Table 3.2: Table showing the sample size per cadre

	CADRES OF STAFF						
	NURSES	MANAGEMENT TEAM	DOCTORS	LAB STAFF	PHARMACY STAFF	FRONT OFFICE STAFF	RADIOLOGY STAFF
No. of staff per cadre out of a total of 453 staff	215	39	83	42	63	8	3

% of staff of each cadre of the total (453)	47%	9%	18%	9%	14%	2%	1%
No. of participants required per cadre to achieve 208 sample size	98.720	17.907	38.110	19.285	28.927	3.673	1.377
No. (rounded off to the nearest whole number) of participants required per cadre to achieve 208 sample size	99	18	38	19	29	4	1

Figure 3.1: A figure representation of the % of staff by cadre that make up the sample frame
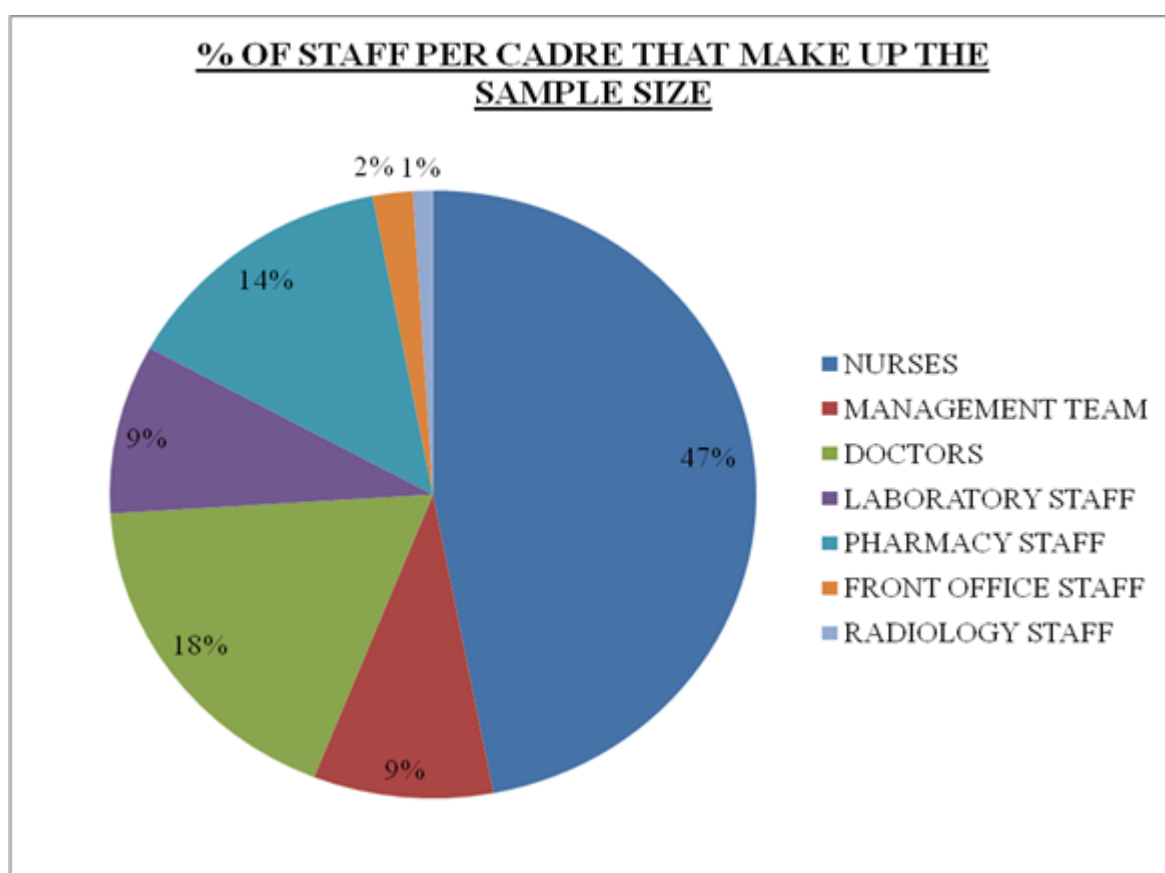
Table 3.3: Table showing percentage of participants per group used in the study

	Management team	Front line staff
Number of participants per group	18	190

% of participant per group of the total number of participants	9%	91%
% of participants per group of the total number of staff per group	46%	46%

The study used 18 (46%) participants from the management team out the total 39 management staff. Similarly the study used 190 (46%) participants from the front line staff out of the 414 frontline staff at GCH. Out of the total participants used in the study, 9% represented the management team whereas 91% represented the front line staff. This has been illustrated in the figure 3.2 below.

Figure 3.2: A figure showing the percentage of participants per group used for the study
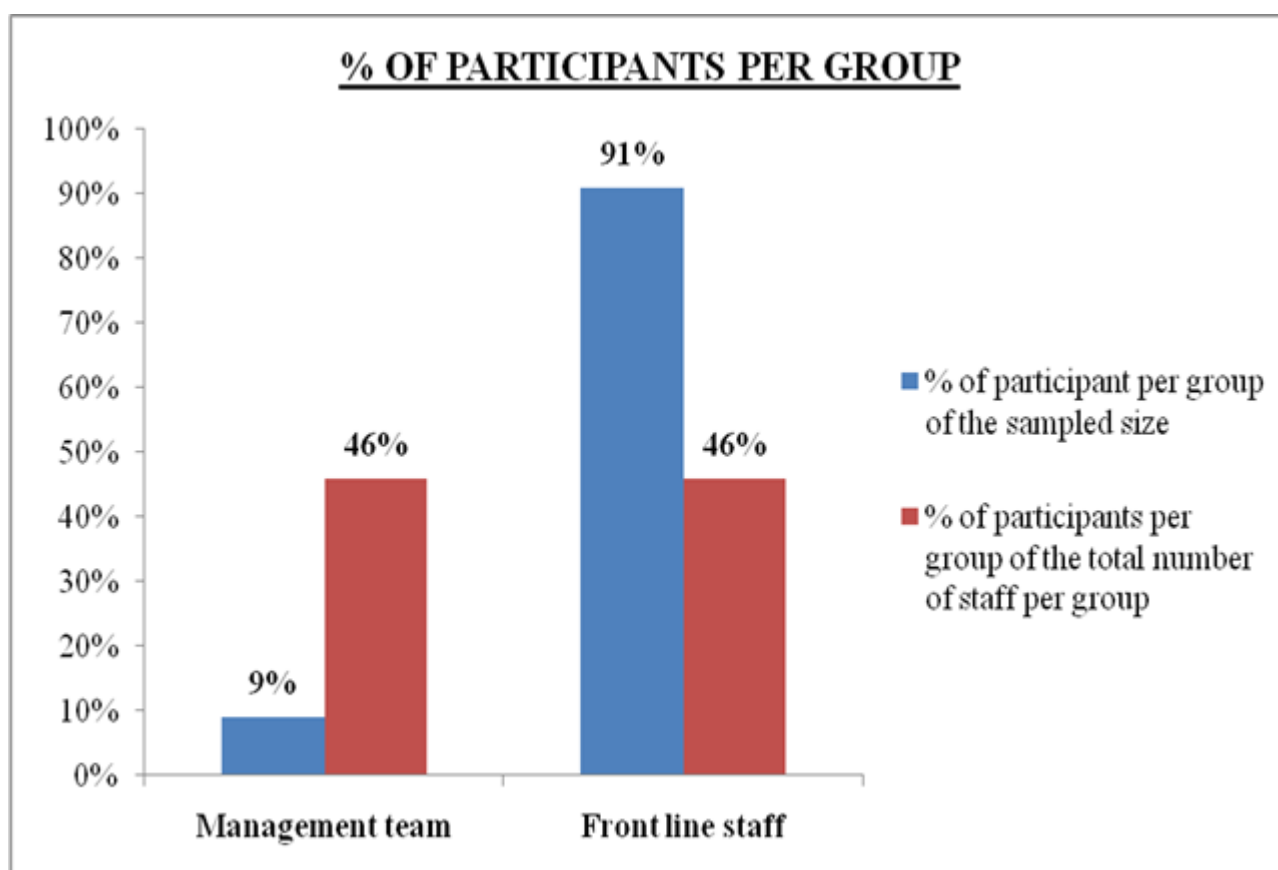
Role of the Researcher

The researcher had the role of ensuring ethical practice during the period on the study by seeking authorization to carry out the study from the institution under study, ensuring anonymity and confidentiality of participant information and disclosing findings only to authorized persons. The researcher also clearly disclosed to the participants about the study and sort consent from them to participate in the study. The participants were allowed independence and the researcher ensured that the participant information was used as it is without any alterations.

The researcher avoided biasness by using scientifically proven methods to identify the participants to use for the study, using structured questions for all participants. It was the researcher's role to avoid any conflict of interest associated with the study. The researcher ensured clarity of the study by answering all questions that were raised by the participants, ensured reliability and validity of study tools by conducting a pilot study. The researcher also put necessary measures to ensure security of the collected data.

Data gathering or Data generation techniques

Structured questionnaires (Appendix 1 and 2) were used to collect data from the study participants. A pilot study was conducted at GCH to assess the validity of the research instruments. After the successful pilot study, the researcher proceeded to administer the questionnaires to the sampled staff for data collection.

The researcher prepared participant information sheets (Appendix 3) that contained a summary of the study which were read by each participant prior to signing the consent form and filling the questionnaire.

The researcher prepared consent forms (Appendix 4) that the participants signed prior to filling the questionnaire as a confirmation of their willingness to participate in the study. Two types of questionnaires each containing 27 structured questions were used for data collection. One of the questionnaires was for the management team and focused on Decision making processes, management processes and barriers to healthcare quality (Appendix 1). This questionnaire comprised of 6 questions on decision-making processes, 12 questions on management processes and 9 questions on barriers to healthcare quality. The other questionnaire was for the front line staff and focused on services processes, care processes and barriers to healthcare quality (Appendix 2). This questionnaire comprised of 9 questions on service processes, 7 questions on care processes and 11 questions on barriers to healthcare quality. All questionnaires contained closed-ended questions with Likert type scales and were administered either directly or online via emails to the participants. The Likert scale comprised of 5 response categories whereby 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly agree.

1. Pilot Study

The pilot study was conducted at GCH to ensure that a similar population to that of the study was used. Neither the staff used nor the questionnaires collected in the pilot study were included in the final sample. The role of the participants of the pilot study was to analyze the study data gathering tools (participant information sheets, consent forms and questionnaires) in a way to confirm their validity and reliability. They analyzed the questions for clarity and relevance to the study subject. Their input was then considered by the researcher and necessary adjustments done. 22 participants, who represented each cadre of to be used for the study were selected to ensure adequate representation. This represented 10% of the projected sample size per cadre. Feedback collected from the pilot study included adding an appreciation clause at the end of each questionnaire, correcting the age ranges from 20-30, 30-40, 40-50 and 50 and above to

read 20-30, 31-40, 41-50 and 51 and above. Similarly, the staff noted that the employment period ranges should be corrected from 1-3, 3-5, 5-10 and 10 years and above to read 1-3, 4-5, 6-10 and above 10 years. The staff also suggested that the Likert Scale be included above each category of questions in the questionnaire. These adjustments were therefore made to both questionnaires. The pilot staff felt the participant information sheet and the consent form were relevant as they contained the relevant information to help them understand the study as well as to willingly consent to participate in the study.

Table 3.4: Table showing the number of staff per cadre used for the study pilot

CADRE	NUMBER OF STAFF
Nurses	10
Management team	2
Doctors	4
Laboratory staff	2
Pharmacy staff	2
Front office staff	1
Radiology staff	1

Figure 3.3: Figure showing the % of staff per cadre used for the study pilot

% OF STAFF PER CADRE USED FOR PILOT STUDY

Legend:
- Nurses
- Management team
- Doctors
- Laboratory staff
- Pharmacy staff
- Front office
- Radiology staff

Values shown: 45%, 18%, 9%, 9%, 9%, 5%, 5%
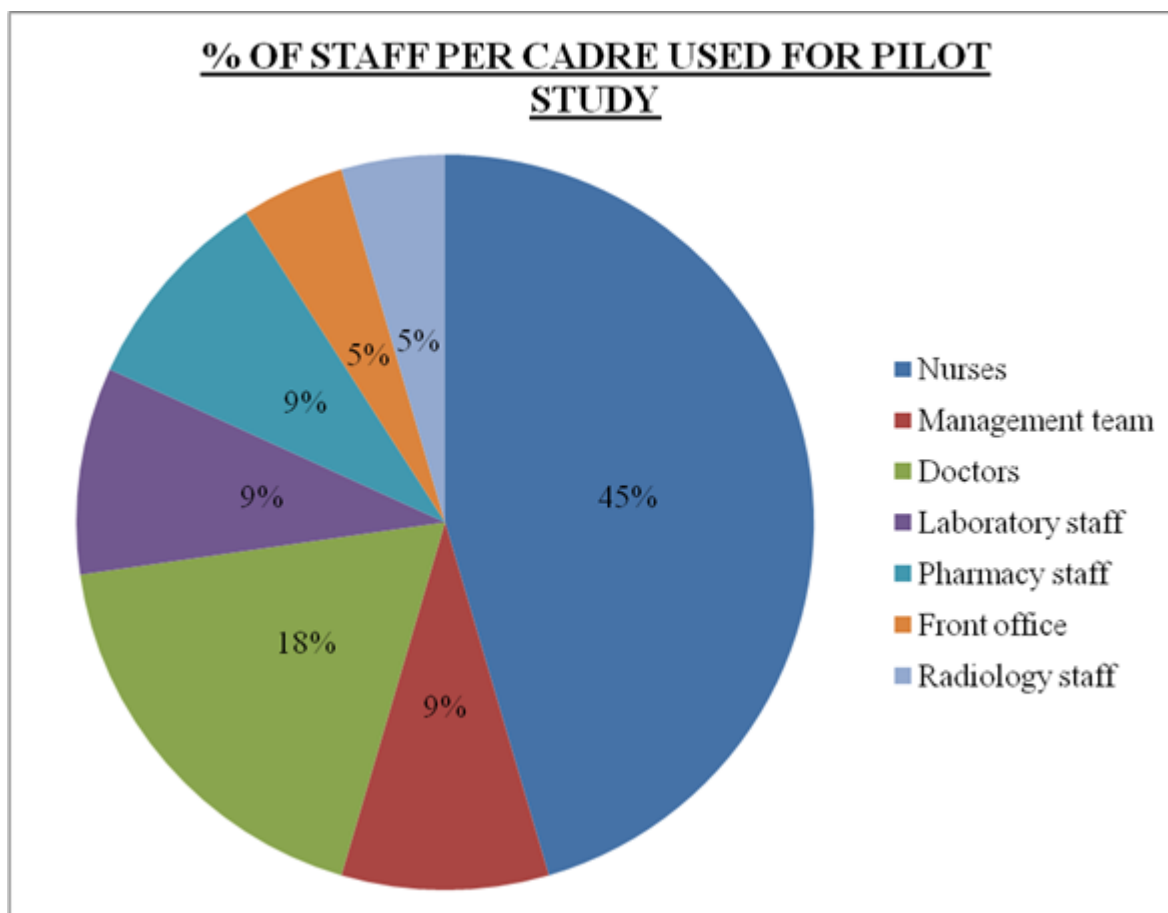
Feedback from the pilot was considered and the questionnaires were reviewed where necessary to ensure that they help achieve the set study objectives.

Data collection

The researcher administered the questionnaires to the sampled staff after they had read and filled the consent forms. The questionnaires were administered in sealable envelopes which the participants were expected to use for their filled questionnaires. After completing the questionnaires, the participants were instructed to put the questionnaires in the envelopes and seal them to ensure confidentiality. The participants were given a period of one week to complete the questionnaires within which several reminders where sent to them to ensure good response. A total of 199 completed questionnaires out of a target 208 questionnaires were collected. These included 18 questionnaires from the management team and 181 questionnaires

from the front line staff. The 9 missing questionnaires were as a result of front line staff who failed to return their questionnaires despite the several reminders.

Data Analysis

The researcher edited the data collected to ensure that it was error-free. The completed questionnaires were then numbered appropriately. This was followed by the coding process to mark and categorize information as well as enhance anonymity of provided information. The data was first entered into Excel sheets and then exported into the Statistics package for the social sciences (SPSS) version 22 system for analysis. This helped analyze the data using descriptive statistics. One Way ANOVA was used to establish the relationship between demographics (age, cadre, employment period and gender) and care, service, management and decision-making processes as well as barriers to healthcare quality. One Sample T-test was used to reject the null hypothesis that "HIS implementation does not have any impact healthcare quality".

Trustworthiness of the method

The researcher sort for authorization from the GCH Ethics Review Committee to conduct the research.

1. **Validity**

An instrument is valid if it measures what it is intended to measure and accurately achieves the purpose for what it was designed. The research instruments were validated through application of content validity determined by expert judgment and inclusion of supervisors' suggestions. Further, pilot testing was used to enhance the validity of the questionnaires.

2. Reliability

The internal reliability of the study results was established using Cronbach alpha during the analysis of the data using SPSS. The reliability test considered questions on care and service processes as well as barriers to healthcare quality. All parameters were found to have an acceptable Cronbach alpha of above 0.7.

3. Ethical consideration

The researcher requested for permission from the Gertrude's Children's Hospital Ethics Review Committee to conduct the research. The researcher ensured compliance with the committee's rules and regulations as well as those of the University of Liverpool's dissertation and ethical considerations.

In line with organization's patient and family rights policies, the researcher did not include patients as study subject. Random sampling was used to identify participants in order to ensure that the researcher was not biased. Sampling and analyzing methods and steps are clearly outlined in the study report. The researcher educated the participants in advance on the importance of the study and how confidentiality of information provided will be ensured. This was done using the Participant information sheet (Appendix 3). Informed consent was gotten from each participant through a consent from (Appendix 4). The researcher did not influence the respondents and allowed them to give their feedback in private and independently. The researcher has utilized information from participants as it is and has avoided manipulation of collected data. Anonymity was ensured on collected data to enhance confidentiality. Data collected during the study was stored safely and a password only known to the researcher was used to access it. A hard disk was used as a backup for data storage. Information gathered will only be shared with persons authorized by the senior management of GCH.

PRESENTATION OF RESULTS

208 questionnaires were administered to the sampled participants, 190 questionnaires were administered to the front line staff and 18 were administered to the management team. 199 questionnaires were completed, 18 of which were from the management team and 181 from the front line staff. This is illustrated in the table below;

Table 4.1: Table showing the number of staff per cadre used for the study pilot

	MANAGEMENT TEAM	FRONT LINE STAFF	TOTAL
Administered questionnaires	**18**	**190**	208
Completed questionnaires	**18**	**181**	199
No. of questionnaires not returned	**0**	**9**	9

The data collected based on demographics was as follows;

Table 4.2: Table showing the percentage of respondents per gender

	Female	**Male**
No. of respondents per gender	125	55
% of respondents per gender	69%	31%

Figure 4.1: A figure representation showing the number of respondents based on gender

NO. OF RESPONDENTS PER GENDER
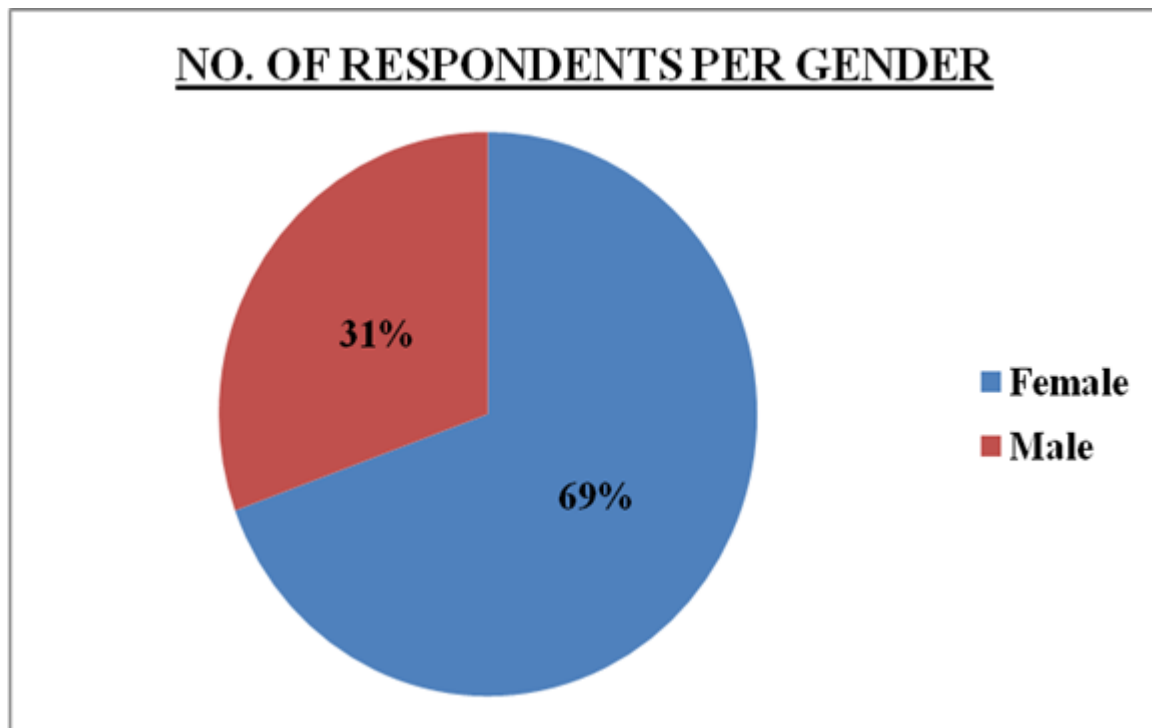
Table 4.3: Table showing the percentage of respondents per age

	20-30 yrs	31-40 yrs	41-50 yrs	51 yrs and above
No. of respondents per age	58	90	25	6
% of respondents per age	32%	50%	14%	3%

Figure 4.2: A figure representation showing the percentage of respondents based on age
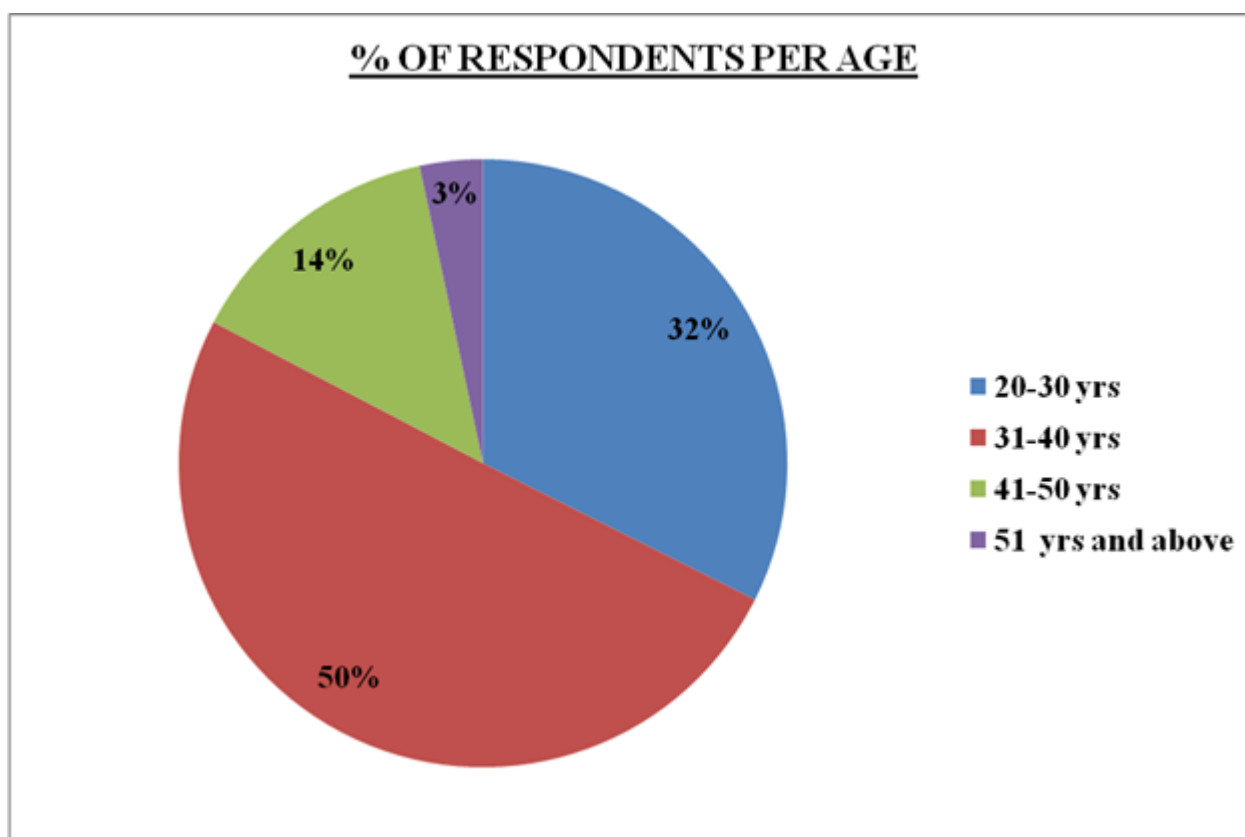
Table 4.4: Table showing the percentage of respondents per cadre

	Nurses	Doctors	Pharmacy staff	Lab staff	Front office staff	Radiology staff	Management staff
No. of respondents per cadre	90	24	25	18	4	1	18
% of respondents per cadre	50%	13%	14%	10%	2%	1%	10%

Figure 4.3: A figure representation showing the percentage of respondents based on cadre

% OF RESPONDENTS PER CADRE

- Nurses
- Doctors
- Pharmacy staff
- Laboratory staff
- Front office staff
- Radiology staff
- Management staff
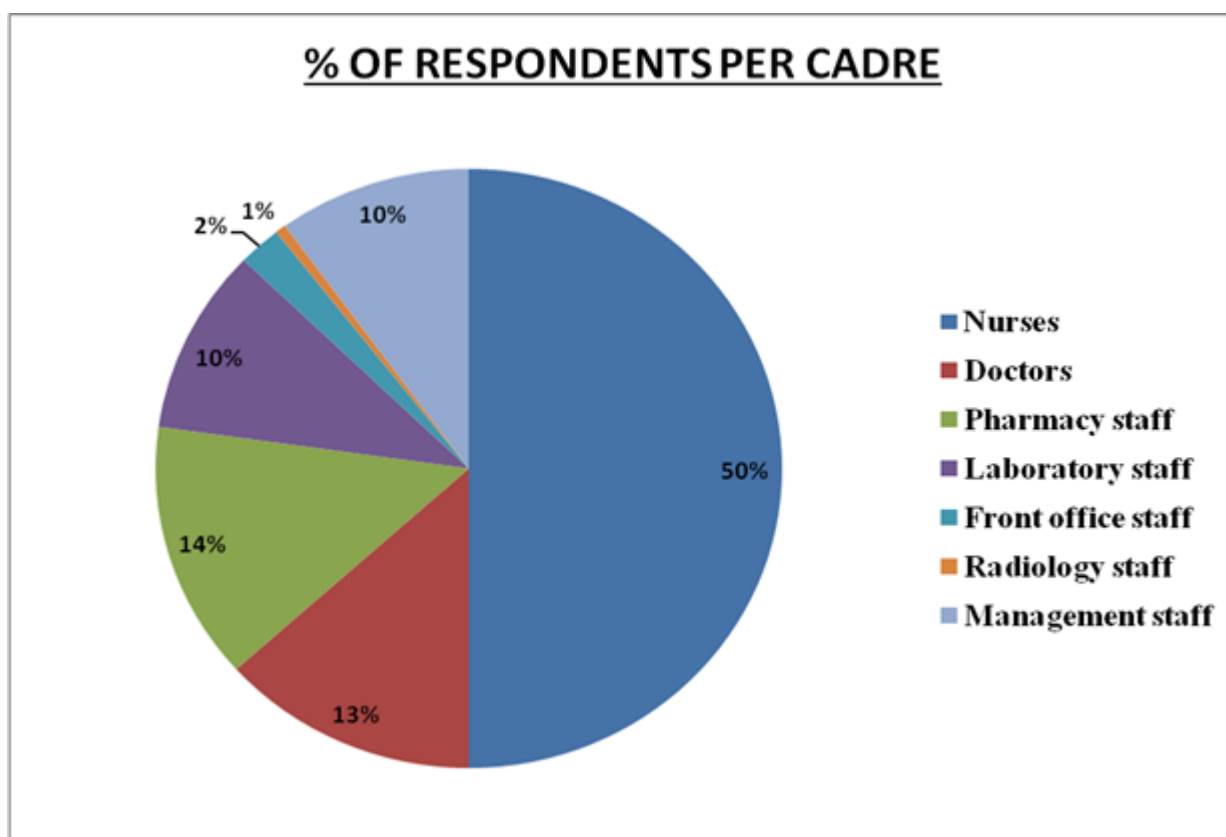
Table 4.5: Table showing the percentage of respondents based on employment period

	0-3 yrs	4-5 yrs	6-10 yrs	10 yrs and above
No. of respondents based on employment period	61	34	48	35
% of respondents based on employment period	34%	19%	27%	20%

Figure 4.4: A figure showing the number of respondents based on employment period
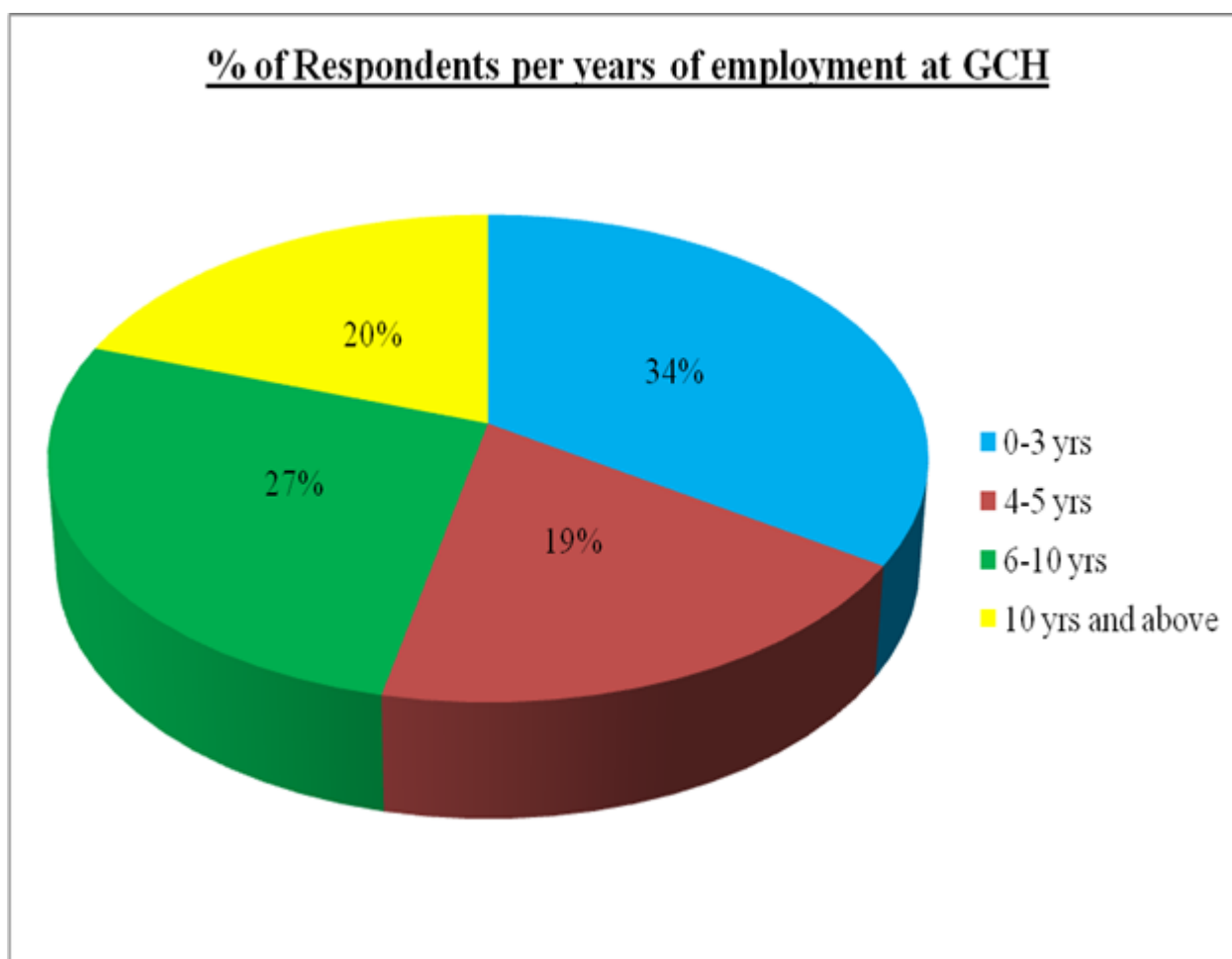
ANALYSIS OF DATA

Demographic characteristics of study participants

The study involved 208 participants selected from the various branches of GCH. Eighteen of

the participants consisted of the management team and 190 consisted of the front line staff.

As shown below in tables 5.1 and 5.2, the mean age for both groups was between 31-40 years.

Table 5.1: Table showing age of study participants from the front line staff

n= 181		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
Valid	Between 20- 30yrs	58	32.0	32.4	32.4
	31-40yrs	90	49.7	50.3	82.7
	41-50yrs	25	13.8	14.0	96.6

		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
	51yrs and above	6	3.3	3.4	100.0
	Total	179	98.9	100.0	
Missing	System	2	1.1		
Total		181	100.0		

Table 5.2: Table showing age of study participants from the management team

n= 18		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
Valid	Between 20-30yrs	1	5.6	6.3	6.3
	31-40yrs	9	50.0	56.3	62.5
	41-50yrs	4	22.2	25.0	87.5
	51yrs and above	2	11.1	12.5	100.0
	Total	16	88.9	100.0	
Missing	System	2	11.1		
Total		18	100.0		

Both the management team and front line staff had female participants as the majority represented by 81.3% and 69.4% respectively. This is elaborated further in the tables 5.3 and 5.4 below.

Table 5.3: Table showing gender of study participants from the management team

n= 18		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
Valid	Female	13	72.2	81.3	81.3
	Male	3	16.7	18.8	100.0
	Total	16	88.9	100.0	
Missing	System	2	11.1		
Total		18	100.0		

Table 5.4: Table showing gender of study participants from the front line staff

n= 181		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
Valid	Female	125	69.1	69.4	69.4
	Male	55	30.4	30.6	100.0
	Total	180	99.4	100.0	
Missing	System	1	.6		
Total		181	100.0		

From the information in tables 5.5 and 5.6 below, most of the participants (50%) of the

management team had worked at GCH for more than 10 years whereas the highest number of

participants (34%) of the front line staff had worked at GCH for less than 3 years.

Table 5.5: Table showing employment period of study participants from the management team

n= 18		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
Valid	Between 0-3yrs	3	16.7	18.8	18.8
	6-10yrs	5	27.8	31.3	50.0
	More than 10yrs	8	44.4	50.0	100.0
	Total	16	88.9	100.0	
Missing	System	2	11.1		
Total		18	100.0		

Table 5.6: Table showing employment period of study participants from the front line staff

n= 181		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
Valid	Between 0-3yrs	61	33.7	34.3	34.3
	4-5yrs	34	18.8	19.1	53.4
	6-10yrs	48	26.5	27.0	80.3
	More than 10yrs	35	19.3	19.7	100.0
	Total	178	98.3	100.0	
Missing	System	3	1.7		
Total		181	100.0		

As demonstrated in the table below, different cadres were represented in the study with the

majority being nurses (56%) followed by Pharmacy (14%) (Table 5.7).

Table 5.7: Table showing cadre of study participants from the front line staff

n= 181		Frequency	Percent (%, 95% CI)	Valid Percent	Cumulative Percent
Valid	Nursing	90	49.7	55.6	55.6
	Doctor	22	12.2	13.6	69.1
	Pharmacy	23	12.7	14.2	83.3
	Lab and radiology	21	11.6	13.0	96.3

	Front office	6	3.3	3.7	100.0
	Total	162	89.5	100.0	
Missing	System	19	10.5		
Total		181	100.0		

Impact of HIS implementation on service processes

Most of the participants (44.7%) strongly agreed that they found Kranium and Q-pulse helpful to their jobs. The highest percentage of participants (51.9%) agreed that Kranium and Q-pulse had given them greater control of their work and 45.9% agreed that both softwares helped them remember to perform their tasks as expected. Fifty-one percent of the frontline staff consisting of different cadres (61% nurses, 13% Laboratory staff, 13% Pharmacy staff, 12% doctors and 1% front office staff) . Consequently, 52% of the staff agreed that they were able to monitor their inventory effectively as a result of Kranium implementation. From this percentage, 52 were nurses (62%) and 13 (15%) were pharmacy staff. Staff perception towards documentation time by use of Kranium software, showed that there was no significant raise in the time they spend on data entry. Majority of the participants (39%) strongly believe that their productivity was not negatively affected by use of Kranium (Table 5.8).

Table 5.8: Table showing staff perception of impact of HIS implementation on service processes

n= 181	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
	%	%	%	%	%	%
Kranium has helped decrease patient waiting times in my unit	2.8	10.1	16.9	51.1	19.1	100.0
Kranium and Q-pulse help me remember to perform my tasks as expected	1.7	2.8	16.6	45.9	33.1	100.0
Kranium has led to a significant increase in the time I spend on data entry.	19.7	25.8	20.8	24.2	9.6	100.0
I find it a challenge to access data using Kranium	28.9	53.3	6.7	7.2	3.9	100.0

Kranium enables me to monitor my inventory effectively.	1.7	3.4	16.2	52.0	26.8	100.0
Kranium has improved coordination between units	.6	2.8	7.2	47.2	42.2	100.0
My productivity has been affected negatively as a result of using Kranium	39.0	37.3	8.5	9.0	6.2	100.0
I find Kranium and Q-pulse useful for my job	2.2	1.1	8.4	43.6	44.7	100.0
Using Kranium and Q-pulse gives me greater control over my work		2.6	11.7	51.9	33.8	100.0

95% Confidence Interval

The table below (5.9) shows the mean, median and standard deviation of impact of HIS on service processes as perceived by the frontline staff. The study indicated that majority of the respondents based on gender had a median of above 3.8 indicating that they agreed that HIS implementation had a positive impact on service processes. Similarly, the study revealed that most (median above 3.4) of the respondents in the different age groups perceived HIS to have had a positive impact on service processes. Various cadres also displayed similar perceptions with a median of above 3.8. Lastly, most respondents with different employment periods (median above 3.8) indicated their agreement to this perception.

Table 5.9: Table showing mean, median and standard deviation of front line staff perception on impact of HIS implementation on service processes based on the different demographics

Research objective	Gender	Mean	Median	Std. Deviation	n=181
Impact of HIS implementation on service processes:	Female	3.8686	3.8750	.54961	125
	Male	3.9870	4.0000	.54624	55
	Total	3.9048	3.8889	.54978	180
Research objective	**Age**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on service processes:	Between 20- 30yrs	3.8063	3.7778	.57401	58
	31-40yrs	3.9624	3.8889	.52326	90
	41-50yrs	4.0473	4.0000	.48198	25
	51yrs and above	3.4352	3.3611	.71528	6
	Total	3.9060	3.8889	.55066	179
Research objective	**Cadre**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on service processes:	Nursing	3.7262	3.7500	.50803	90
	Doctor	3.9719	3.8819	.54764	22
	Pharmacy	4.2415	4.3333	.46772	23
	Lab and radiology	4.1575	4.2222	.69136	21
	Front office	4.0023	4.0069	.35923	6
	Total	3.8989	3.8889	.56423	162
Research objective	**Employment period**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on service processes:	Between 0-3yrs	3.9841	3.8889	.50167	61
	4-5yrs	3.8276	3.7778	.67255	34
	6-10yrs	3.9474	3.8889	.53686	48
	More than 10yrs	3.7929	3.8750	.51941	35
	Total	3.9067	3.8889	.55161	178
	More than 10yrs	4.0197	4.1429	.54730	35
	Total	4.0454	4.1429	.58123	178

The table below (5.10) shows Cronbach alpha for the 9 items on impact of HIS on service processes was 0.768.

Table 5.10: Table showing reliability test of 9 items on front line staff perception of impact of HIS

implementation on service processes using Cronbach Alpha

Cronbach's Alpha	n of Items
.768	9

One Way ANOVA was used to establish the association between the age and cadre of the study

participants and HIS impact on service processes. Based on these three parameters, the p values

were 0.265 and 0.118 respectively. This means that there was no significant relationship

between the various age groups and cadres in the study and the impact of HIS implementation

on service processes. This is illustrated in the tables 5.11 and 5.12 below.

Table 5.11: Table showing Association between age and perceived impact of HIS implementation on service processes
(One Way ANOVA)

Age	n=181	*P-value	
		1	2
51yrs and above	6	3.4352	
Between 20- 30yrs	58	3.8063	3.8063
31-40yrs	90		3.9624
41-50yrs	25		4.0473
Sig.		.265	.641

*P-value <0.05

Table 5.12: Table showing Association between cadre and perceived impact of HIS implementation on service processes
(One Way ANOVA)

Cadre	n=181	*P-value
		1
Nursing	90	3.7262
Doctor	22	3.9719
Front office	6	4.0023
Lab and radiology	21	4.1575
Pharmacy	23	4.2415

Sig.			.118

*P-value <0.05

Impact of HIS implementation on care processes

The highest percentage of staff (55.3%) agreed that they were able to access new information that was critical for their work. As a result of Kranium implementation, 43.3% of the frontline staff agreed that they were able to get critical results on patients' conditions during care processes. Majority (51.4%) of the staff agreed that they were able to capture more relevant patient information using Kranium. A significant percentage of staff (52.5%), agreed that Kranium helps them to remember key aspects of care, 41.6% agreed that it helped them to monitor the patients' conditions better and 52.8% agreed that they were able to manage patient information better with Kranium. A bulk of the participants (48%) however, indicated that they found it a challenge accessing information where they needed it due to Kranium implementation (Table 5.13).

Table 5.13: Table showing front line staff perception of impact of HIS implementation on care processes

n= 181	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
	%	%	%	%	%	%
Kranium has generated new information which is critical to my work		3.9	10.6	55.3	30.2	100.0
I am able to get critical alerts about the patient's condition in a timely manner by use of Kranium.	.6	9.0	10.7	43.3	36.5	100.0
Kranium helps me remember key aspects of care	.6	2.2	12.8	52.5	31.8	100.0
I find it a challenge to access information where I need it when using Kranium.	5.0	11.7	14.0	48.0	21.2	100.0
I am able to monitor the patients' conditions better with Kranium	.6	6.9	20.8	41.6	30.1	100.0

I find it easy to manage patient information using Kranium			2.8	8.4	52.8	36.0	100.0
I am able to capture more relevant information using Kranium	.6	.6	10.7	51.4	36.7	100.0

95% Confidence Interval

The mean, median and standard deviation of impact of HIS implementation on care processes as perceived by the frontline staff is displayed in table 5.14 below. Findings from the study showed that the bulk of the respondents based on gender had a median of above 4.0 demonstrating that they agreed that HIS implementation had a positive impact on care processes. Similarly, most of the respondents in the different age groups perceived that HIS implementation had a positive impact on care processes (median of above 3.6). The different cadres also displayed related perceptions with a median of above 4.0. In addition, majority respondents with different employment periods (median above 4.0) displayed similar perception.

Table 5.14: Table showing mean, median and standard deviation of front line staff perception on impact of HIS implementation on care processes based on the different demographics

Research objective	Age	Mean	Median	Std. Deviation	n=181
Impact of HIS implementation on care processes	Between 20- 30yrs	4.0538	4.0000	.61910	58
	31-40yrs	4.0527	4.0000	.52142	90
	41-50yrs	4.2086	4.1429	.46926	25
	51yrs and above	3.5238	3.6429	.70373	6
	Total	4.0571	4.1429	.56134	179
Research objective	**Cadre**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on care processes	Nursing	4.0011	4.1429	.56919	90
	Doctor	4.0660	4.0000	.57284	22
	Pharmacy	4.1232	4.0000	.56429	23
	Lab and radiology	4.0977	4.1667	.74050	21
	Front office	3.9246	4.0714	.50179	6
	Total	4.0369	4.0000	.58668	162
Research objective	**Employment period**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on care processes	Between 0-3yrs	4.1199	4.1429	.54380	61
	4-5yrs	3.9559	4.0714	.71193	34
	6-10yrs	4.0327	4.0000	.55543	48
	More than 10yrs	4.0197	4.1429	.54730	35
	Total	4.0454	4.1429	.58123	178
Research objective	**Gender**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on care processes	Female	4.0497	4.1429	.59249	125
	Male	4.0455	4.0000	.55225	55
	Total	4.0484	4.1429	.57896	180

The table below (5.15) shows Cronbach alpha for the 7 items on impact of HIS implementation

on care processes was 0.798.

Table 5.15: Table showing reliability test of 7 items on front line staff perception of HIS impact on care processes using Cronbach Alpha

Cronbach's Alpha	n of Items
.798	7

One Way ANOVA was used to establish the association between the age and cadre of the study participants and the impact HIS implementation on care processes. The p values were 0.054 and 0.925 for age and cadre respectively. This means that age and cadre did not extensively sway the staff perception on the impact of HIS implementation on care processes. This is shown in the tables 5.16 and 5.17 below.

Table 5.16: Table showing association between age and perceived impact of HIS implementation on care processes (One Way ANOVA)

Age	n=181	*P-value	
		1	2
51yrs and above	6	3.5238	
31-40yrs	90	4.0527	4.0527
Between 20- 30yrs	58	4.0538	4.0538
41-50yrs	25		4.2086
Sig.		.054	.880

*P-value <0.05

Table 5.17: Table showing association between cadre and perceived impact of HIS implementation on care processes (One Way ANOVA)

Cadre	n=181	*P-value
		1
Front office	6	3.9246
Nursing	90	4.0011
Doctor	22	4.0660
Lab and Radiology	21	4.0977
Pharmacy	23	4.1232
Sig.		.925

*P-value <0.05

Impact of HIS implementation on elimination of barriers to healthcare quality

The highest percentage of front line staff (46.4%) agreed that Kranium implementation had improved timely and accurate transmission of data. In addition, most the front line staff (51.7%) agreed that Kranium implementation had resulted to generation of clearer data. A significant

percentage of front line staff (41.1%), agreed that information was more secure and confidential in Kranium. Forty seven percent of the front line staff agreed that HIS had helped reduce a lot of paper work. Quite a large percentage of front line staff (50.8%), agreed that Kranium and Q-pulse improved their overall confidence and professionalism. Results from the front line staff indicate that 48.3% of the participants disagreed that use of Kranium and Q-pulse had increased the risk of making errors and 43.6% of them agreed that the likelihood to detect errors was less with Kranium. However, 40.5% of the front line staff agreed that Kranium implementation had reduced their ability to appropriately interact with the patients during service delivery (Table 5.18).

Table 5.18: Table showing front line staff perception on impact of HIS implementation on eliminate barriers to quality healthcare

n= 181	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
	%	%	%	%	%	%
Kranium has improved timely and accurate transmission of data	1.1	3.9	12.7	46.4	35.9	100.0
Kranium implementation has resulted to generation of clearer data		2.2	15.2	51.7	30.9	100.0
Kranium has reduced duplication of information	2.8	9.4	24.3	39.2	24.3	100.0
Information is more secure and confidential in Kranium	1.7	12.8	18.9	41.1	25.6	100.0
The risk of making errors has increased with use of Kranium and Q-pulse	17.2	48.3	20.0	12.2	2.2	100.0
The likelihood to detect errors is less with Kranium	9.5	43.6	27.9	13.4	5.6	100.0
Kranium has enhanced continuity of care		1.1	5.0	56.1	37.8	100.0
Kranium has reduced my ability to appropriately interact with the patients I serve	12.7	40.5	10.4	20.8	15.6	100.0
Policies and procedures are easier to access using Q-pulse	.6	5.6	9.4	39.4	45.0	100.0
Kranium, Q-pulse and the Human resource information system has helped reduce a lot of paperwork	2.8	5.0	6.1	47.0	39.2	100.0

Kranium and Q-pulse have improved my overall level of confidence and professionalism with my work		.6	2.2	17.7	50.8	28.7	100.0

95% Confidence Interval

As per table 5.19 below, findings from the study showed that most of the respondents based on gender had a median of above 4.0 signifying that they approved that HIS implementation had a positive impact on care processes. The study also illustrated that most (above 3.6) of the respondents in the different age groups perceived HIS implementation to have had a positive impact on care processes. The different cadres also displayed related perceptions with a median of above 4.0. Majority of the respondents with different employment periods (median above 4.0) concurred to this perception.

Table 5.19: Table showing mean, median and standard deviation of front line staff perception on impact of HIS implementation on barriers to healthcare quality based on the different demographics

Research objective	Age	Mean	Median	Std. Deviation	n=181
Impact of HIS implementation on barriers to quality healthcare	Between 20-30yrs	3.8271	3.8182	.52541	58
	31-40yrs	3.9226	3.9091	.53909	90
	41-50yrs	3.9600	4.0000	.42888	25
	51yrs and above	3.4545	3.4545	.61925	6
	Total	3.8812	3.9091	.52736	179
Research objective	**Gender**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on barriers to quality healthcare	Female	3.8479	3.9091	.54165	125
	Male	3.9524	4.0000	.48622	55
	Total	3.8798	3.9091	.52620	180
Research objective	**Cadre**	**Mean**	**Median**	**Std. Deviation**	**n=181**
Impact of HIS implementation on barriers to quality healthcare	Nursing	3.7461	3.8182	.50296	90
	Doctor	3.9376	3.9091	.47074	22
	Pharmacy	4.1094	4.1818	.51821	23
	Lab and radiology	4.1126	4.1000	.56234	21
	Front office	3.9697	3.9545	.53526	6
	Total	3.8795	3.9091	.52817	162
Research objective	**Employment period**	**Mean**	**Median**	**Std. Deviation**	**n=181**

Impact of HIS implementation on barriers to quality healthcare	Between 0-3yrs	3.9205	3.9091	.43994	61
	4-5yrs	3.8387	4.0000	.61980	34
	6-10yrs	3.8554	3.9091	.56783	48
	More than 10yrs	3.8857	3.9091	.53572	35
	Total	3.8805	3.9091	.52824	178

The table below (5.20) shows Cronbach alpha for the 11 items on front line staffs' perception on the impact of HIS implementation on barriers to healthcare quality was 0.773.

Table 5.20: Table showing reliability test of 11 items on front line staffs' perception of impact of HIS implementation on barriers to healthcare quality using Cronbach Alpha

Cronbach's Alpha	n of Items
.773	11

Using One Way ANOVA, age and cadre had p values of 0.051and 0.395 respectively which means that they did not significantly influence the staff perception on the impact of HIS implementation on barriers to healthcare quality. This is illustrated in the tables 5.21 and 5.22 below.

Table 5.21: Table showing association between age and perceived impact of HIS implementation on barriers to healthcare quality for the front line staff (One Way ANOVA)

Age	n=181	*P-value
		1
51yrs and above	6	3.4545
Between 20- 30yrs	58	3.8271
31-40yrs	90	3.9226
41-50yrs	25	3.9600
Sig.		.051

*P-value <0.05

Table 5.22: Table showing association between cadre and perceived impact of HIS implementation on barriers to healthcare quality for the frontline staff (One Way ANOVA)

Cadre	n=181	*P-value
		1
Nursing	90	3.7461
Doctor	22	3.9376
Front office	6	3.9697
Pharmacy	23	4.1094
Lab and radiology	21	4.1126
Sig.		.395

*P-value <0.05

As illustrated in the table 5.23 below, majority of the management team (38.9%) strongly agreed that Kranium had enhanced continuity of care. Equally, most of the participants from the management team (41.2%) approved that Kranium implementation had improved confidentiality and privacy of patient information. On the same breath, 61.1% of the management staff strongly agreed that HIS implementation had helped reduce paper work and that Q-pulse implementation made it easier to communicate policies and procedures to staff.

Table 5.23: Table showing management team's perception on impact of HIS implementation on barriers to healthcare quality

n= 18	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
	%	%	%	%	%	%
New errors have emerged as a result of using Kranium	11.1	38.9	11.1	27.8	11.1	100.0
HIS has improved collaboration across the organization		5.6		55.6	38.9	100.0
Kranium has enhanced continuity of care				38.9	61.1	100.0
Kranium has improved confidentiality and privacy of patient information		11.8	11.8	41.2	35.3	100.0
HIS implementation has contributed to negative work practices	27.8	38.9	16.7	16.7		100.0
Data generated through HIS is not accurate	11.1	50.0	22.2	16.7		100.0

HIS has helped eliminate a lot of paper work			5.6	5.6	27.8	61.1	100.0
Q-pulse has helped reduce equipment downtimes	5.9	17.6	35.3	41.2		100.0
Q-pulse has made it easier to communicate policies and procedures to staff within the organization				38.9	61.1	100.0

95% Confidence Interval

The mean, median and standard deviation of impact of HIS implementation on barriers to healthcare quality as perceived by the management team is displayed in table 5.24 below. Findings from the study showed that majority of the respondents based on gender had a median of above 3.8 indicating that they agreed that HIS implementation had a positive impact on barriers to healthcare quality. Likewise, the study indicated that most (above 3.8) of the respondents in the different age groups perceived HIS to have had a positive impact on barriers to healthcare quality. This perception was similarly displayed by most respondents with different employment periods (median above 3.6).

Table 5.24: Table showing mean, median and standard deviation of Management team's perception on impact of HIS implementation on barriers to healthcare quality based on the different demographics

Research objective	Gender	Mean	Median	Std. Deviation	n=18
Impact of HIS implementation on barriers to quality healthcare	Female	3.8707	3.7778	.45479	13
	Male	4.0370	4.0000	.50103	3
	Total	3.9019	3.7778	.45104	16
Research objective	**Age**	**Mean**	**Median**	**Std. Deviation**	**n=18**
Impact of HIS implementation on barriers to quality healthcare	31-40yrs	3.8565	3.7778	.45027	9
	41-50yrs	3.9722	3.8333	.48326	4
	51yrs and above	3.9167	3.9167	.82496	2
	Total	3.8954	3.7778	.46608	15
Research objective	**Gender**	**Mean**	**Median**	**Std. Deviation**	**n=18**
Impact of HIS implementation on barriers to quality healthcare	Between 0-3yrs	4.1111	4.0000	.40062	3
	6-10yrs	3.6889	3.5556	.39597	5
	More than 10yrs	3.9566	3.8333	.49587	8
	Total	3.9019	3.7778	.45104	16

One Way ANOVA was used to establish the association between the age and employment period of the management team and HIS implementation impact on barriers to healthcare quality. The two parameters had p values of 0.955 and 0.398 respectively. This means that age and employment period did not significantly influence the management's perception on the impact of HIS implementation on barrier to healthcare quality. This is illustrated in the tables 5.25 and 5.26 below.

Table 5.25: Table showing association between age and perceived impact of HIS implementation on barriers to healthcare quality for the management team (One Way ANOVA)

Age	n=18	*P-value
		1
31-40yrs	9	3.8565
51yrs and above	2	3.9167
41-50yrs	4	3.9722
Sig.		.955

*P-value <0.05

Table 5.26: Table showing association between employment period and perceived impact of HIS implementation on barriers to healthcare quality for the management team (One Way ANOVA)

Employment period	n=18	*P-value
		1
6-10yrs	5	3.6889
More than 10yrs	8	3.9566
Between 0-3yrs	3	4.1111
Sig.		.398

*P-value <0.05

Impact of HIS implementation on decision making processes

The highest percentage (70.6%) of the management team agreed that they were more empowered as a result of using HIS. Fifty percent of the staff strongly agreed that HIS implementation had helped improve staff accountability. Likewise, 50% of the participants strongly agreed that Q-pulse had helped identify system gaps and 50% of them agreed that Q-pulse and Navision helped inform training needs. Of the management staff, 61.1% strongly

agreed that Kranium and Q-pulse had improved staff compliance and adherence to policies and procedures .Out of the management team, 38.9% strongly disagreed that Kranium significantly led to delays in transmission of critical information (Table 5.27).

Table 5.27: Table showing management team's perception of impact of HIS on decision-making processes

n= 18	Disagree	Neutral	Agree	Strongly agree	Total
	%	%	%	%	%
Staff using HIS are more empowered to make decisions during service delivery.		5.9	70.6	23.5	100.0
Kranium and Q-pulse have improved staff adherence and compliance to policies and procedures			38.9	61.1	100.0
HIS has helped improve staff accountability		5.6	44.4	50.0	100.0
Q-pulse and human resource information system help inform staff training needs	16.7	22.2	50.0	11.1	100.0
Q-pulse helps identify system gaps	16.7	11.1	22.2	50.0	100.0
Kranium significantly delays transmission of critical reports	38.9	33.3	11.1	16.7	100.0

95% Confidence Interval

As per the table 5.28 below showing the mean, median and standard deviation of impact of HIS implementation on decision-making processes as perceived by the management team, most of the respondents based on gender had a median of above 4.2 indicating that they agreed that HIS implementation had a positive impact on decision processes. The study indicated that most (above 4.0) of the respondents in the different age groups perceived HIS implementation to have had a positive impact on decision-making processes. Majority of respondents with different employment periods (median above 3.8) we equally agreed to this impact.

Table 5.28: Table showing mean, median and standard deviation of Management team's perception on impact of HIS implementation on decision-making processes based on the different demographics

Research objective	Gender	Mean	Median	Std. Deviation	n=18
Impact of HIS implementation on decision-making processes	Female	4.1077	4.1667	.46729	13
	Male	4.2222	4.1667	.41944	3
	Total	4.1292	4.1667	.44752	16
Research objective	Age	Mean	Median	Std. Deviation	n=18
Impact of HIS implementation on decision-making processes	31-40yrs	3.9444	4.0000	.45644	9
	41-50yrs	4.3750	4.2500	.43833	4
	51yrs and above	4.4500	4.4500	.07071	2
	Total	4.1267	4.1667	.46312	15
Research objective	Employment period	Mean	Median	Std. Deviation	n=18
Impact of HIS implementation on decision-making processes	Between 0-3yrs	4.2778	4.1667	.34694	3
	6-10yrs	3.7667	3.8333	.48016	5
	More than 10yrs	4.3000	4.2500	.35546	8
	Total	4.1292	4.1667	.44752	16

Based on employment period and age, the p values were 0.167 and 0.338 respectively. This means that age and employment period did not significantly influence the management's perception on the impact of HIS implementation on decision-making processes. This is illustrated in the tables 5.29 and 5.30 below.

Table 5.29: Table showing association between staff employment period and perceived impact of HIS implementation on decision-making processes for the management team (One Way ANOVA)

Employment period	n=18	*P-value
		1
6-10yrs	5	3.7667
Between 0-3yrs	3	4.2778
More than 10yrs	8	4.3000
Sig.		.167

*P-value <0.05

Table 5.30: Table showing association between age and perceived impact of HIS implementation on decision-making processes for the management team (One Way ANOVA)

Age	n=18	*P-value 1
31-40yrs	9	3.9444
41-50yrs	4	4.3750
51yrs and above	2	4.4500
Sig.		.338

*P-value <0.05

Impact of HIS implementation on management processes

Most participants (72.2%) strongly agree that Q-pulse implementation contributed to improvement of error reporting rate. According to the analysis, 66.7% of the participants agreed that Kranium implementation led to a significant reduction in clinical errors. Results also indicate that 41.2% of the management staff agreed that HIS implementation resulted in significant improvement in staff productivity. Most of the participants (72.2%) agreed that implementation of Navision led to easy monitoring of staff performance whereas 66.7% agreed that HIS implementation improved consistency in work processes. The largest percentage (58.8%) agreed that Kranium has helped improve inventory management processes.Likewise, 62.5% agreed that HIS supported them in achieving their goals. Fifty percent of the participants disagreed that there was no significant improvement in staff productivity as a result of Kranium implementation but 50% of them disagreed that there was no significant improvement in the rate of documentation following Kranium implementation (Table 5.31).

Table 5.31: Table showing Management team's perception of impact of HIS implementation on management processes

n= 18	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
	%	%	%	%	%	%
Q-pulse has contributed towards improvement of error reporting rate		5.6	11.1	11.1	72.2	100.0
There is no significant improvement in documentation rate as a result of Kranium implementation	38.9	50.0	5.6	5.6		100.0
There has been significant reduction in clinical errors as a result of using Kranium		11.1	11.1	66.7	11.1	100.0
Patient service times have increased as a result of using Kranium	17.6	17.6	23.5	35.3	5.9	100.0
There is no significant improvement in staff productivity as a result of using Kranium	27.8	50.0	16.7	5.6		100.0
There is significant improvement in staff satisfaction as a result of HIS implementation		11.8	29.4	41.2	17.6	100.0
It is easy to monitor staff performance using the human resource information system	5.6	5.6	11.1	72.2	5.6	100.0
HIS have improved consistency in work processes				66.7	33.3	100.0
HIS have improved record management processes				50.0	50.0	100.0
Kranium has helped improve inventory management processes		5.9	5.9	58.8	29.4	100.0
I believe that HIS implementation has helped save the hospital money			23.5	41.2	35.3	100.0
HIS support me to achieve my goals.		6.3	6.3	62.5	25.0	100.0

95% Confidence Interval

The mean, median and standard deviation of impact of HIS implementation on management processes as perceived by the management team is displayed in table 5.32 below. Findings from the study showed that majority of the respondents based on gender had a median of above 4.0 indicating that they agreed that HIS implementation had a positive impact on management processes. Likewise, the study indicated that most (above 4.0) of the respondents in the different age groups perceived HIS to have had a positive impact on management processes.

Most respondents with different employment periods (median above 4.0) were in agreement.

Table 5.32: Table showing mean, median and standard deviation of Management team's perception on impact of HIS implementation on management processes based on the different demographics

Research objective	Gender	Mean	Median	Std. Deviation	n=18
Impact of HIS implementation on management processes	Female	3.9583	4.0000	.27732	13
	Male	4.0556	4.0000	.17347	3
	Total	3.9765	4.0000	.25899	16
Research objective	**Age**	**Mean**	**Median**	**Std. Deviation**	**n=18**
Impact of HIS implementation on management processes	31-40yrs	3.9204	3.9167	.24605	9
	41-50yrs	3.9583	4.0000	.30807	4
	51yrs and above	4.2538	4.2538	.23035	2
	Total	3.9749	4.0000	.26800	15
Research objective	**Employment period**	**Mean**	**Median**	**Std. Deviation**	**n=18**
Impact of HIS implementation on management processes	Between 0-3yrs	4.0833	4.0000	.14434	3
	6-10yrs	3.8233	3.9167	.28102	5
	More than 10yrs	4.0322	4.0455	.25972	8
	Total	3.9765	4.0000	.25899	16

One Way ANOVA was used to establish the association between the employment period and age of the management team and HIS implementation impact on management processes. The p value based on employment period was 0.331 whereas the p value based on age was 0.281. Age and employment period, therefore, did not considerably influence the management's perception on the impact of HIS implementation on management processes. This is illustrated in the tables 5.33 and 5.34 below.

Table 5.33: Table showing association between employment period and perceived impact of HIS

implementation on management processes for the management team (One Way ANOVA)

Employment period	n=18	*P-value
		1
6-10yrs	5	3.8233
More than 10yrs	8	4.0322
Between 0-3yrs	3	4.0833
Sig.		.331

*P-value <0.05

Table 5.34: Table showing association between age and perceived impact of HIS implementation on

management processes for the management team (One Way ANOVA)

Age	n=18	*P-value
		1
31-40yrs	9	3.9204
41-50yrs	4	3.9583
51yrs and above	2	4.2538
Sig.		.281

*P-value <0.05

Null hypothesis

One sample T-test was used to disapprove the null hypothesis that HIS implementation has not

had any impact on care processes, service processes and barriers to healthcare quality as

perceived by the front line staff (Table5.35).

Table 5.35: Table showing Front line staff One-Sample T-Test

n= 181	Test Value = 3.4				
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
					Lower
Impact of HIS implementation on service processes:	12.382	180	.000	.50459	.4242

	T	Df	Sig. (2-tailed)	Mean Difference	Lower
Impact of HIS implementation on care processes	15.002	180	.000	.64541	.5605
Impact of HIS implementation on barriers to quality healthcare	12.241	180	.000	.47797	.4009

Likewise, One Sample T-test was also used to disapprove the null hypothesis that HIS implementation has not had any impact on management processes, decision making processes and barriers to healthcare quality as perceived by the management team (Table 5.36).

Table 5.36: Table showing Management team One Sample T-Test

n= 18	Test Value = 3.4				
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
					Lower
Impact of HIS implementation on decision-making processes	7.331	17	.000	.73333	.5223
Impact of HIS implementation on management processes	9.686	17	.000	.59470	.4652
Impact of HIS implementation on barriers to quality healthcare	5.170	17	.000	.53133	.3145

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the findings of this study ,both management and frontline staff perceive that HIS has had a positive impact on care, service, management and decision making processes as well as reduction of barriers to health care quality.

Similar to studies by Glaser, Drazen and Cohen (1986), Garrelts et. al. (2010), Nguyen, Bellucci and Nguyen (2014) and Goldsack and Robinson (2014), the results of this study have shown that HIS implementation at GCH has had a positive impact on service processes by reducing waiting time for services following decrease in the time spend on data entry and access to data and improved collaboration between units. Just as in the findings by Ratnaningtyas and Surendro (2013), Haskew et. al. (2015), Oluoch et. al. (2014), Waneka and Spetz (2010), Roberts, et. al., (2010) and Karuri (2014) where HIS was noted to improve the quality of health information, Kranium implementation at GCH has helped avail critical information which helped staff deliver care more effectively as they were able to get critical alerts and new information to inform decisions. Georgiou et. al., (2015), Kossman and Scheidenhelm (2008), Stevenson, et. al. (2016) and Bouamrane and Mair (2013) however noted that HIS implementation led to challenges in data accessibility. Such a finding was also noted in this study where a small percentage (7.2% and 3.9% respectively) of the front line at GCH agreed and strongly agreed that they found it a challenge to access data following Kranium implementation.

Similar to a study by Polimeni et.al. (2009) which noted improved uncovering of errors post HIS implementation, results from this study show HIS implementation has helped reduce barriers which can affect the quality of care by enhancing the detection of errors, improving collaboration across the organization hence promoting continuity of care and staff interaction with patients, timely transmission of clear and accurate data, ensuring security and confidentiality of patient information. This is contrary to a studies by Herrick, Gorman and Goodman (2010) and Winter (2011 pp. 34) which showed that HIS implementation introduced new errors and increased the risk on privacy of patient information. This is also not the case in findings by Niazkhani et. al., (2011) that showed delays in orders and poor collaboration

between service providers and reduced staff interaction with patients (Reychav, et.al., 2016) and inaccurate data (Stephen, et. al., 2016) post HIS implementation.

Parallel to findings by Glaser, Drazen and Cohen (1986) and Garrelts et. al. (2010), HIS implementation at GCH has also been noted to impact positively on management processes by improving inventory, cost containment and staff satisfaction. Nutley, McNabb and Salentine (2013) as well as Bogucki, Jacobs and Hingle (2004) also noted a positive impact of HIS implementation on inventory management. Similar to findings from this study that HIS implementation improved consistency in work processes and staff satisfaction, Cline and Luiz (2013) noted that HIS implementation enhanced staff workflow and overall staff morale. HIS implementation at GCH has been found to reduce clinical error. This is comparable to a study by Georgiou et.al. (2008) and Devine, et. al. (2010), where HIS implementation was seen to reduce the number of unfulfilled test requests, duplication of requests use of inappropriate use of abbreviations and reduce errors of illegibility.

In addition to previous studies, the results of this study showed that HIS implementation had enhanced records management, staff productivity and performance monitoring as well as error reporting rate which improves culture of safety. Implementation of Q-pulse has made it easier for staff to access relevant policies and procedures which support them in decision making during care hence promoting professionalism and at the same time making the staff more confident with their work. Similar to a compliance system studied by Al Salman, et.al. (2015), Q-pulse helped improve staff compliance to policies and procedures. HIS has improved staff accountability which through access controls such as use of passwords which motivates the staff to make right decisions during service delivery. Through Q-pulse, staffs are able to send timely communications on faulty equipment and reduce equipment downtime. Findings however show that staff had difficulties accessing information where it was needed which is contrary to the findings from a study by Khalifa and Alswailem (2015). These challenges might

have been due to lack of bedside computers at GCH to support access of information during service.

The above results can be generalized to a population outside GCH because a representative sample size was arrived at after calculation using Fischer et. al. for population less than 10,000 people.

Recommendations

This study has revealed the importance of bedside documentation. HIS at GCH do not support bedside documentation. To help facilitate better access of patient information where it is needed which can in turn improve patient safety during service delivery, it is important that hospitals invest in HIS such as computers on wheels or personal data assistants. Such resources will enable easy and timely accessibility of relevant patient information as noted in a study in Kenya by Diero, et. al. (2006) as well as reduce errors due to transcribing hence improving care and service processes. In addition, these resources help control unnecessary costs due to transcribing and time spend by care givers moving to computer stations.

Similar to a study by Herrick, Gorman and Goodman (2010) which showed risks such as data overload, hacking of systems and introduction of new errors following HIS implementation, findings from this study also shown that some management staff (27.8%) agreed that Kranium implementation had resulted to new errors. Such errors can be eliminated by adequate involvement of the stakeholders during HIS implementation in order to pick any gaps in such systems, frequent audits and modifications of the systems where necessary as well as creating a feedback process for users to raise feedback about the systems and ensure that the feedback is acted upon to improve the systems.

To promote the time staffs spend with patient, there is need for health institutions to modify their HIS to make it easy to use, train and involve staff more on software. Staff involved in the

implementation stage improves their ownership towards using the system. When systems are easy to use and staffs are well trained, staffs end up facing fewer challenges while working with them making it easier for them to execute their duties faster and better in turn improving staff satisfaction which contributes positively to healthcare quality.

Key to note is that, basic information technology is not a taught function in most curriculums. It is therefore necessary for organization intending to utilize HIS to invest in staff training on basic information technology skills which can help empower staff and increase staff satisfaction. Key skills and competencies include typing and navigation skills which can help staff to execute their tasks well as well work efficiently.

APPENDICES

APPENDIX 1

QUESTIONNAIRE

<div style="border:1px solid;">

Information in this section is voluntary:

Gender: F ☐   M ☐

Age: Between   20- 30yrs ☐   31-40yrs ☐   41-50yrs ☐   51yrs and above ☐

Employment period at GCH: Between 0-3yrs ☐   4-5yrs ☐   6-10yrs ☐   More than 10yrs ☐

</div>

NOTE: HIS in this questionnaire stands for Health Information Systems used at Gertrude's Children's Hospital (GCH), namely; **Kranium, Q-Pulse and Human Resource Information management System.** Please note that the questionnaire has been divided into **three sections** based on the area of focus.

Kindly **TICK (v)** the number that best describes your perception of HIS at GCH.

Ticking **5** means you **strongly agree** with the statement while **1** means that you **strongly disagree**.

Impact of HIS implementation on decision-making processes:	5 **Strongly agree**	4 **Agree**	3 **Neutral**	2 **Disagree**	1 **Strongly disagree**
1. Staff using HIS are more empowered to make decisions during service delivery.					
2. Kranium and Q-pulse have improved staff adherence and compliance to policies and procedures					
3. HIS has helped improve staff accountability					
4. Q-pulse and human resource information system help inform staff training needs					
5. Q-pulse helps identify system gaps					
6. Kranium significantly delays transmission of critical reports					
Impact of HIS implementation on management processes:	5 **Strongly agree**	4 **Agree**	3 **Neutral**	2 **Disagree**	1 **Strongly disagree**
7. Q-pulse has contributed towards improvement of error reporting rate					
8. There is no significant improvement in documentation rate as a result of Kranium implementation					
9. There has been significant reduction in clinical errors as a result of using Kranium					
10. Patient service times have increased as a result of using Kranium					
11. There is no significant improvement in staff productivity as a result of using Kranium					
12. There is significant improvement in staff satisfaction as a result of HIS implementation					
13. It is easy to monitor staff performance using the human resource information system					
14. HIS have improved consistency in work processes					
15. HIS have improved record management processes					
16. Kranium has helped improve inventory management processes					
17. I believe that HIS implementation has helped save the hospital money					
18. HIS support me to achieve my goals.					
Impact of HIS implementation on barriers to quality healthcare:	5 **Strongly agree**	4 **Agree**	3 **Neutral**	2 **Disagree**	1 **Strongly disagree**
19. New errors have emerged as a result of using Kranium					

20. HIS has improved collaboration across the organization					
21. Kranium has enhanced continuity of care					
22. Kranium has improved confidentiality and privacy of patient information					
23. HIS implementation has contributed to negative work practices					
24. Data generated through HIS is not accurate					
25. HIS has helped eliminate a lot of paper work					
26. Q-pulse has helped reduce equipment downtimes					
27. Q-pulse has made it easier to communicate policies and procedures to staff within the organization					

Thank you for taking time to give your feedback.

APPENDIX 2

QUESTIONNAIRE

Information in this section is voluntary:

Gender: F ☐ M ☐

Age: Between 20-30yrs ☐ 31-40yrs ☐ 41-50yrs ☐ 51yrs and above ☐
Cadre: ………………………………………………………………………………

Employment period at GCH:
Between 1-3yrs ☐ 4-5yrs ☐ 6-10yrs ☐ More than 10yrs ☐

NOTE: HIS in this questionnaire stands for Health Information Systems used at Gertrude's Children's

Hospital (GCH), namely; **Kranium, Q-Pulse and Human Resource Information management**

System. Please note that the questionnaire has been divided into **three sections** based on the area of

focus.

Kindly **TICK (v)** the number that best describes your perception of HIS at GCH.

Ticking **5** means you **strongly agree** with the statement while **1** means that you **strongly disagree**.

Impact of HIS implementation on service processes:	5 Strongly agree	4 Agree	3 Neutral	2 Disagree	1 Strongly disagree
1. Kranium has helped decrease patient waiting times in my unit					
2. Kranium and Q-pulse help me remember to perform my tasks as expected					
3. Kranium has led to a significant increase in the time I spend on data entry.					
4. I find it a challenge to access data using Kranium					
5. Kranium enables me to monitor my inventory effectively.					
6. Kranium has improved coordination between units					
7. My productivity has been affected negatively as a result of using Kranium					
8. I find Kranium and Q-pulse useful for my job					
9. Using Kranium and Q-pulse gives me greater control over my work					
Impact of HIS implementation on care processes:	5 Strongly agree	4 Agree	3 Neutral	2 Disagree	1 Strongly disagree
10. Kranium has generated new information which is critical to my work					
11. I am able to get critical alerts about the patient's condition in a timely manner by use of Kranium.					
12. Kranium helps me remember key aspects of care					
13. I find it a challenge to access information where I need it when using Kranium.					
14. I am able to monitor the patients' conditions better with Kranium					
15. I find it easy to manage patient information using Kranium					
16. I am able to capture more relevant information using Kranium					
Impact of HIS implementation on barriers to quality healthcare:	5 Strongly agree	4 Agree	3 Neutral	2 Disagree	1 Strongly disagree
17. Kranium has improved timely and accurate transmission of data					
18. Kranium implementation has resulted to generation of clearer data					
19. Kranium has reduced duplication of information					
20. Information is more secure and confidential in Kranium					
21. The risk of making errors has increased with use of Kranium and Q-pulse					
22. The likelihood to detect errors is less with Kranium					

23. Kranium has enhanced continuity of care					
24. Kranium has reduced my ability to appropriately interact with the patients I serve					
25. Policies and procedures are easier to access using Q-pulse					
26. Kranium, Q-pulse and the Human resource information system has helped reduce a lot of paperwork					
27. Kranium and Q-pulse have improved my overall level of confidence and professionalism with my work					

Thank you for taking time to give your feedback.

APPENDIX 3

PARTICIPANT INFORMATION SHEET

RESEARCHER: Angela Ndungwa Kyongo

RESEARCH TOPIC:

Health information systems (HIS) implementation as a contributing factor to healthcare quality in a private hospital.

Assignment Description/Research Purpose

I, Angela Ndungwa Kyongo, have enrolled in the Msc Management Program at the University of Liverpool in partnership with Laureate.

I have entered the program in order to develop masters-level depth of knowledge and research skills across areas in business such as change management, leadership, organizational theory and finance. Students are required, as part of this program, to undertake a research project as a final assessment of the program. This project will provide an opportunity for me to reflect on critical issues that I encounter in the context of my work;

apply my scholarly learning to these issues; and, in the end, be a force of positive change in our organization.

Gertrude's Children's Hospital (GCH), Kenya, will be used for this study. GCH has invested largely in HIS. It is therefore important to demonstrate the return on investment of HIS. This study will further link our healthcare processes and measures to the HIS. The HIS that will be used for this study include the Information management system (Kranium) which is used for management of patient information, inventory management and generation of relevant management reports, the Human resource information management system (Navision) which is used for tracking staff performance as well as leave management and the Compliance software (Q-pulse) which is used for events reporting and communication of organization's policies and procedures. The study will use sampled staff from the various cadres that actively use HIS. The sample frame will be identified from the human resource department records of staff establishment. Fischer et.al test will therefore be used to identify the sample frame after which stratified random sampling will be used to indentify sample sizes of each cadre. Random sampling will then be used to get a representative sample of each group based on their populations. Data collection tools will include structured questionnaires, face-to-face interviews and observation checklists. The interviews and surveys completion will take around 30 minutes each. The findings of the study will be shared with the management of the organization and other relevant institutions to inform decision making on the importance of HIS as well as help build up on information from previous similar studies. The beneficiaries of this information will be management and staff of these institutions. This study will add onto available knowledge on the impact of HIS on quality improvement.

This research project requires the researcher to:

1. Ensure that they have no conflict of interests associated with the study

2.   Get consent from the organization's Ethic's Review Committee before conducting the research

3. Use unbiased methods to identify participants to provide the data for the study

4. Answers all questions that the participants might have about the study and see documented informed consent from the participants before involving them in the study

5. Maintain anonymity of participant information to ensure confidentiality

6. In no way waive any legal rights for the participants

7. Use participant information as it is without making any alterations

8. Allow participants information and independence when participating in the study

9. Handle all exclusions from participants without stigma

10. Justify the exclusion of participants

11. Acknowledge that the discontinuation or declining of participation by the participant will have no negative impact on the relationship between the researcher and the participant

12. Store collected data confidentiality

The research activities are intended to help the researcher:

1. Utilise relevant skills and competencies acquired throughout the MSc Management program

2. Gather information relevant to the topic of interest

3. Analyse collected data to inform findings

4. Add knowledge to already existing knowledge on the study topic

For their final research paper, the researcher should have collected sufficient data to be able to:

Demonstrate the impact of HIS implementation on healthcare quality.

Data Collection Procedures

To achieve this goal, I will engage in the following data collection processes;

1. Undertake a pilot study to ensure reliability and validity of data collection tools

2. Structured questionnaires to be filled by participants

Ethical Concerns

1. **Permission Granted**

   I have been granted permission through an authorisation letter from the Gertrude's

   Children's Hospital Ethics Review Committee to collect relevant data access at GCH

   and use the personnel time for research purposes.

2. **Potential Conflicts of Interest**

   In order to avoid ethical complications, I will consult the organisation's requirements

   for ethical approval of research.

3. **Confidentiality**

   In all cases, company information will be anonymised, no proprietary

   information will be shared and the privacy of the interviewee will be

   safeguarded. Additionally, no results of the research will be made publically

   available without specific approval from the organisation and the

   interviewee. Data will be stored for at least 5 years with adequate provisions

   to maintain confidentiality.

4. **Reasonably Foreseeable Risks and Anticipated Benefits and Costs to Participant
   or Others**

There are no foreseeable risks by way of physical or psychological harm to

the participant or to others in the organisation. The nature of the research involves

evaluation of the organisation so as to principally benefit the organisation.

Contact Details
My contact details are:

>   **Cell phone:** +254727 477319
>   **Email address:** akyongo@gerties.org
>   **Work address:** P. O. Box 42325-00100, Nairobi, Kenya

The contact details of the research participant advocate at the University of Liverpool are:

>   001-612-312-1210 (USA number)
>   Email address liverpoolethics@ohecampus.com

Please keep/print a copy of the Participant Information Sheet for your reference.

Please contact me and/or the research participant advocate at the University of

Liverpool with any question or concerns you may have.

 Signature: _____

 Researcher: ANGELA NDUNGWA KYONGO   **Date** : 4/4/2017

APPENDIX 4

MODEL CONSENT FORM

>   **Title of Research Project:** Health information systems (HIS)
>
>   implementation as a contributing factor to healthcare quality in a
>
>   private hospital.   **Please**
>   **initial**
>   **box**

Researcher(s):

1. I confirm that I have read and have understood the information sheet   ☐
   dated [DATE] for the above study. I have had the opportunity to
   consider the information and ask questions, and I have had these
   answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to   ☐
   withdraw at any time without giving any reason, without my rights
   being affected.

3. I understand that, under the Data Protection Act I can at any time   ☐
   ask for access to the information I provide, and I can also request the
   destruction of that information if I wish.

4. I agree to take part in the above study.   ☐

Participant Name	Date	Signature
Name of Person Taking Consent	Date	Signature
Researcher	Date	Signature

The contact details of lead researcher (principal investigator) are:

Name of researcher: Angela Ndungwa Kyongo

Cell phone: +254727 477 319

Email address: akyongo@gerties.org

Work address: P. O. Box 42325- 00100, Nairobi, Kenya.

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