

**SCHOOL OF PUBLIC HEALTH
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**TITLE: FACTORS INFLUENCING THE USE OF MEDICAL EQUIPMENT AMONG
CLINICAL HEALTH WORKERS AT SHAI OSUDOKU DISTRICT HOSPITAL**

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DECLARATION

I, Samuel Amponsah-Tuffour, hereby declare that with the exception of references to the literature and works of other researchers which have been duly acknowledged, the work in this dissertation is the result of my own work put together and that I have never before submitted it to any other tertiary institution for a degree.



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DEDICATION

I dedicate this piece of work to the memory of my father, Mr Kwadwo Agyemang Tuffour. May his soul continue to rest in peace.

ACKNOWLEDGEMENT

This work was a success due to the input, contributions, and participation of several individuals and organisations who should be acknowledged.

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TABLE OF CONTENTS	
DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
LIST OF ABBREVIATIONS	x
LIST OF TABLES	xi
LIST OF FIGURES	xii
DEFINITION OF TERMS	xiii
ABSTRACT	xiv
CHAPTER ONE	1
INTRODUCTION	1
1.0. Background	1
1.1. Problem Statement	3
1.2. Justification	3
1.3. Objectives of the study	4
1.3.1. General Objective	4
1.3.2. Specific Objectives	4
1.3.3. Research Questions	4
1.4. Outline of the dissertation	5
CHAPTER TWO	7
LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK	7
2.0. Introduction	7
2.1. Medical equipment health care institutions	7
2.1.1. Types of medical equipment available in health care institutions	8
2.1.1.1. Diagnostic/Monitoring medical devices	8

2.1.1.2 Therapeutic medical devices	9
2.1.1.3. Assistive devices	9
2.1.1.4. Life-Support medical devices	9
2.2 Factors influencing the use of medical equipment in health care institutions	9
2.2.1. Organisational factors	9
2.2.1.1 Availability of consumables/accessories/spare parts	10
2.2.1.2. Training of users	10
2.2.2. Perceptual factors	11
2.3. Conceptual framework	12
2.4. Theoretical analysis	13
2.5. Summary of the chapter	14
CHAPTER THREE	15
METHOD	15
3.1 Introduction	15
3.2 Philosophical assumption	15
3.2 Study design	15
3.3 Study site	15
3.4. Study population	17
3.4.1. Inclusion criteria	17
3.4.2. Exclusion criteria	18
3.5. Sampling strategies	18
3.5.1. Sample size determination	18
3.5.2. Sampling method	18
3.6. Study variable	19
3.6.1. Independent variables	19

3.6.2. Study outcome	21
3.7. Data collection tools	22
3.7.1. Inventory list/Checklist	22
3.7.2. Questionnaire	22
3.7.3 Data quality control	23
3.9 Data processing and analysis	23
3.10 Ethical considerations	24
3.9. Summary of chapter	24
CHAPTER FOUR	25
RESULTS	25
4.1. Socio-demographic characteristics	25
4.2. Types of Medical Equipment	26
4.3 Assessment of use of medical equipment by health workers	27
4.4. Organisational factors	30
4.4.1. Training of health personnel on medical equipment usage	30
4.4.2. Availability of accessories and consumables	32
4.4.3. Policies and guidelines for using medical equipment	32
4.4.4. Policies and guidelines for using medical equipment	33
4.5. Perceptual factors	34
4.6. Bivariate analysis: Association between Socio-demographic characteristics and use of medical equipment	35
4.7. Bivariate analysis: Organisational factors and use of medical equipment	36
4.8. Bivariate analysis: Association between perceptual factors and use of medical equipment	37
4.9. Multiple linear regression analysis: Factors influencing use of medical equipment among health workers	38

4.10. Summary of the chapter	39
CHAPTER FIVE	41
DISCUSSION OF FINDINGS	41
5.0. Introduction	41
5.1. Socio-demographic factors associated with use of medical equipment	41
5.2. Types of medical equipment	41
5.3. Organisational factors associated with use of medical equipment	42
5.4. Perceptual factors associated with use of medical equipment	43
5.6. Factors influencing use of medical equipment	43
CHAPTER SIX	45
CONCLUSION	45
6.0. Introduction	45
6.1. Summary of the study	45
6.2. Limitations to the study	45
6.3. Recommendations	46
6.3.1. Ministry of Health/Ghana Health Service	46
6.3.2. Management of Shai Osudoku District Hospital	46
6.3.3. Health workers	47
6.3.4. Future research	47
REFERENCES	48
APPENDICES	52
APPENDIX A: List of SDGs 3 and some medical devices/technologies that help in their accomplishments	52
APPENDIX B: Consent Form	54
Appendix C: Questionnaires for factors associated with the use of medical equipment among clinical health workers at Shai Osudoku District Hospital	56

APPENDIX D: Inventory List	63
APPENDIX E: Ethical Approval	64

LIST OF ABBREVIATIONS

DHRC:	Dodowa Health Research Centre
ECG:	Electrocardiogram
GHS:	Ghana Health Service
IPM:	Inspection and Prevention Maintenance
OPD:	Out-patient Department
SDG:	Sustainable Development Goals
SOP:	Standard Operating Procedure
TAM:	Technology Acceptance Model
WHO:	World Health Organisation
WIFA:	Women in Fertility Age

LIST OF TABLES

Table 2: Top ten OPD cases for WIFA at Shai Osudoku district hospital (2019).....8

Table 3.1a: Analytical framework: Socio-demographic and economic factors15

Table 3.1b: Analytical framework: organisational factors.....15

Table 3.1c: Analytical framework Perceptual factors.....16

Table 3.1d: Dependent variable.....17

Table 4.1: Type of medical equipment at Shai Osudoku District Hospital.....22

Table 4.2: Socio-demographic characteristics of respondents.....24

Table 4.3: Bivariate analysis: Association between socio-demographic factors and use of medical equipment.....32

Table 4.4: Bivariate analysis: Association between organisational factors and use of medical equipment.....33

Table 4.5: Bivariate analysis: Association between perceptual factors and use of medical equipment.....34

Table 4.6: Multiple linear regression of the factors affecting the use of medical equipment among health workers.....35

LIST OF FIGURES

Figure 2.1: Components of a maintenance programme.....12

Figure 2.2. Conceptual framework.....13

Figure 3.1: Maps of Shai Osudoku District.....17

Figure 4.1a: Availability of medical equipment when needed.....28

Figure 4.1b: Ability to use medical equipment.....29

Figure 4.1c: Use of medical equipment.....30

Figure 4.2a: Training on of medical equipment.....31

Figure 4.2b: Time of last training.....31

Figure 4.2c: Accessories and consumables.....32

Figure 4.2d: Policies and guidelines.....33

Figure 4.2e: Average repair time for medical equipment.....34

Figure 4.3: Perceptual factors.....35

DEFINITION OF TERMS

First-line maintenance: Maintenance activity that can be performed by the user of the equipment and normally takes place at the point of equipment use.

Corrective maintenance: is maintenance performed to identify and rectify a fault so that the failed equipment can be restored to an operational condition.

Preventive maintenance: is maintenance that is aimed at catching and fixing problems before they happen.

Refresher training: training taken by a person already qualified or previously assessed as competent in a field to update skills and/or knowledge.

ABSTRACT

Background: Medical equipment plays a crucial role in the diagnosis and treatment of patients in health facilities. An estimated 40% of medical equipment in hospitals in the sub-region is not in use. Optimizing its use and identifying the challenges and barriers to using them would help improve health outcomes.

Objective: To determine the factors influencing the use of medical equipment by health workers in the Shai Osudoku District Hospital

Methods: This was an explanatory cross-sectional study where structured questionnaires were administered to 108 health workers who were purposively sampled, made up of physicians, nurses, and midwives from the maternal department and female ward at the Shai Osudoku district hospital to identify guidelines and factors that influence the use of medical equipment. An inventory list was used to identify the medical equipment in the maternal health department and female ward and the proportion not in use.

The use of medical equipment was assessed by aggregating 5 points scores from the availability of medical equipment for use when needed and the ability to effectively use medical equipment. The level of use of medical equipment was measured as a continuous outcome, the higher the score the higher the level of use. The data obtained was analyzed using STATA 16. All statistical analysis were computed and reported at a 95% confidence interval and an accepted p-value of $p < 0.05$.

Results: The results showed that 20% of medical equipment in the maternal department and the female ward of Shai Osudoku district hospital were out of use. The final analysis revealed that three factors were significantly associated with the use of medical equipment. These were clinical

health workers knowledge of first-line maintenance (coefficient = 8.925, 95% CI = 1.873–15.976), refresher training (coefficient -7.932, 95% CI = -15.750 – -0.114), inaccessibility of procedure (coefficient = -8.648, 95% CI = -16.089 - -1.279). These were the only variables that showed statistical significance after adjusting for confounders.

Conclusion: The study concludes that the use of medical equipment increases with an increase in user's knowledge of first-line maintenance, which involves, proper cleaning of medical equipment, visual checks and inspections to identify defects, and performing function checks. As such training of clinical health workers on the use of medical equipment should emphasize first-line maintenance. Also, a regular inventory audit is necessary to determine critical shortages immediately.

CHAPTER ONE

INTRODUCTION

1.0. Background

Over the past two decades, there has been some improvement in maternal health-care but this improvement has been slow and as such much effort is needed if Ghana is to achieve the various health-related development goals. Some of the challenges have been the availability and utilization of medical equipment, Ghana Health Service (GHS, 2017). Medical equipment are devices used in diagnosing, monitoring, prevention, treatment or rehabilitation of the body resulting from injuries or diseases. These do not include disposable, single-use and implantable devices but can be used in combination with an accessory, consumable or other devices World Health Organisation (WHO, 2014). World Health Organisation (WHO, 2016) report on “Interagency list of medical devices for essential interventions for reproductive, maternal, newborn and child health”, observed that despite the advances in healthcare, complications from childbirth and pregnancy results in the death of about 1000 women daily and the majority of these deaths happen in the African sub-region.

Health-related development goals such as sustainable development goals (SDGs) rely on good planning, appropriate use and management of medical devices that are safe and compatible with the settings where they are being used, World Health Organisation (WHO, 2014). Therefore, it is important to ensure that medical equipment are available, accessible and being used effectively. To ensure that health systems are responsive, guaranteed access to safe and quality medical equipment are needed (Moyimane, Matlala, & Kekana, 2017).

Medical equipment and health-care delivery go hand in hand, as such its use must be maximized to ensure that patients benefit and there are quality health outcomes [ref]. One of the World Health Organisation's strategic objectives is centred on improving access, quality and use of medical devices. Health services delivery is heavily dependent on the availability, appropriateness, and acceptability of medical equipment.

Diaconu et al. (2017), in the absence of appropriate and functional medical equipment, emergency care is not the only service affected but management and interventions for both non-communicable and communicable diseases are also affected. Timely provision of primary and critical health care will be compromised in the absence of reliable medical products (Mkoka, Goicolea, Kiwara, Mwangi, & Hurtig, 2014). When used in the context of a robust health system, medical equipment improves health outcomes, World Health Organisation (WHO, 2011). This indicates the importance of equipping health professionals with the necessary skills to enable them to be conversant with the use of medical equipment.

There are several barriers to the use of medical devices in health care; availability of accessories and consumables, the type of medical equipment, well-trained staff to operate the equipment and guidelines and policies for using medical equipment (Malkin, 2007). The study done by Chaudhury and Kaul (2015) showed that there are also individual perceptual factors that should be considered as they can affect the utilization of medical equipment in facilities, there include maintenance downtime, restricted availability, availability of spare parts and the use of old equipment, among others. When considerations are not given to the needs of various hospitals in terms of medical equipment, it leads to non-use of the equipment World Health Organisation (WHO, 2010b).

1.1. Problem Statement

Perry and Malkin (2011) argue that on average, about 38.3% of medical devices in low and middle-income countries are in use. The World Health Organisation Guidelines for Healthcare Equipment Donations stated that up to 70% non-use of medical devices in the sub-region.

This is alarming, health development agendas like sustainable development goals rely on good planning, appropriate use, and management of medical devices that are safe and compatible with the settings where they are being used. The absence of functional medical devices in healthcare would result in poor patient health outcomes (Diaconu et al., 2017).

The outbreak of the Ebola virus disease in West Africa was evident of the absence of functioning medical devices for quick and accurate diagnosis, which resulted in delays in emergency responses and loss of lives (Lartey et al., 2015).

Knowledge of the state of medical equipment in health facilities and the factors affecting their use will lead to optimal usage, which will be beneficial to patients and the health care system.

1.2. Justification

Recently, the ‘no bed syndrome’ rocked the country’s health system (Quansah, 2018) though some progress has been made in addressing this challenge, it persists. The availability and functional status of medical equipment in various healthcare facilities are not given the needed attention.

Attaining universal health coverage means an increase in accessibility to medical care and ultimately an increase in the utilization of health facilities by the community. Hence, the need to ensure that supplies particularly medical equipment are enough to ensure the responsiveness of the health system

This study brings to light the types of medical equipment available for use in maternal health and the proportion not in use. The study also provides information on the factors and challenges that influence the use of medical equipment.

1.3. Objectives of the study

1.3.1. General Objective

To determine the types of medical equipment and the factors influencing the use of medical equipment by health workers in Shai Osudoku District Hospital

1.3.2. Specific Objectives

1. To identify the types of medical equipment available at the Shai Osudoku District Hospital
2. To determine the level of use and non-use of medical equipment at the Shai Osudoku District Hospital
3. To examine the association between socio-demographic characteristics and use of medical equipment at the Shai Osudoku District Hospital.
4. To examine the association between organisational factors and use of medical equipment at the Shai Osudoku District Hospital
5. To assess the association between perceptual factors and use of medical equipment at the Shai Osudoku District Hospital

1.3.3. Research Questions

This study sought to answer the following questions:

1. What is the association between socio-demographic characteristics and use of medical equipment at the SODH?

2. What is the association between organisational factors and use of medical equipment at the SODH?
3. What is the association between perceptual factors and use of medical equipment at the SODH?
4. What types of medical equipment are available at the SODH?
5. What is the level of use of medical equipment at the SODH?

1.4. Outline of the dissertation

The study is made of six parts, below is a summary of each chapter.

Introduction

The study is about understanding the factors that affect the use of medical equipment in health care institutions and knowing the types of equipment available at the institution. The state of medical equipment are not known, this study brought to light the nature of the equipment and what influence utilisation.

Literature and conceptual framework

Guided by previous studies in this area, the study focuses on organizational and perceptual factors that are associated with the use of medical equipment. The theory underlying the study was the Technology Acceptance Model (TAM).

Method

This was a cross-sectional study and study participants were purposively sampled. An inventory list was used to determine equipment available at Shai Osudoku District Hospital. Bivariate analysis using ordinarily least square regression was used to determine factors associated with the use of medical equipment.

Results

This section showed the analysis of data collected from Shai Osudoku District Hospital. The data collected showed that 80% of medical equipment were being used. Also, organisational factors affecting the use of medical equipment were refresher training and first-line maintenance. The perceptual factor associated with the use of medical equipment was identified to be procedure accessibility.

Discussion

This chapter focused on comparing the results of the study to previous studies. The types of medical equipment available were compared with the World Health Organisation list of priority medical devices. Factors affecting utilisation was also compared to previous works done in this area.

Conclusion

The final chapter summarised the previous sections to provide recommendations to policymakers, health workers, and health care institutions. It also provided the limitations to the study.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.0. Introduction

Medical equipment could potentially prevent maternal morbidity and mortality especially those due to haemorrhage and hypertension (Thairu, 2012). This chapter presents an analysis of works from previous studies on the factors that contribute to the use of medical equipment in health-care and the conceptual framework for the study. It provides an insight into the type of medical equipment in health facilities and socio-demographic, perceptual and organisational factors that affects utilisation of medical equipment.

2.1. Medical equipment health care institutions

There are several types of medical devices on the market. The definition of a medical device according to WHO encompasses instruments, apparatus, software, reagents for in-vitro use, appliances, machines, implants, materials or any related article used alone or in combination with others for medical purposes (WHO, 2014).

Medical equipment is a subset of medical devices. Their use requires regular maintenance, calibrations, user-training, and they exclude single-use/disposable and implantable devices. Medical equipment use is indispensable in efforts to achieve the health-related SDGs (WHO, 2014). In a qualitative study in South Africa on the critical shortage of medical equipment, interviewees lamented on the absence of critical equipment and also the non-functioning of available ones (Moyimane et al., 2017).

To ensure the efficiency of medical equipment, the settings in which the equipment would be used need to be carefully considered. It is also important that the purchasing and donation of medical equipment be done in collaboration with health care providers (Bauserman et al., 2015). The table below shows the top ten Out-Patient Department (OPD) cases for Women In Fertility Age (WIFA) at Shai Osudoku district hospital in 2019.

Table 2.1: Top ten OPD cases for WIFA at Shai Osudoku district hospital (2019)

Medical condition	No. of cases
Malaria	538
Acute Urinary Tract Infection	478
Upper Respiratory Tract Infections	445
Diarrhoea Diseases	362
Anaemia	295
Periodontal diseases	294
Other diseases of the Female reproductive system	202
Skin Diseases	160
Gynaecological conditions	109
Ulcer	99

Source: Health information department, Shai Osudoku district hospital

2.1.1. Types of medical equipment available in health care institutions

Medical devices can be classified based on their primary function as follow.

2.1.1.1. Diagnostic/Monitoring medical devices

These are devices used to examine or determine the cause of a particular phenomenon related to a medical condition and also to monitor the progress of such conditions (Agaronnik, Campbell, Ressalam, & Iezzoni, 2019). Examples of such devices are thermometers, blood pressure monitors, positron emission tomography and computed tomography scanners, and chemistry analyzers.

2.1.1.2 Therapeutic medical devices

As the name implies, their role is of therapeutic nature. They help restore, heal, and provide support for biological functions or structures (Santos et al., 2016). Examples of such devices are syringe and infusion pumps, artificial cardiac pacemakers, and TENS machines.

2.1.1.3. Assistive devices

Assistive medical devices are devices intended to help people overcome a handicap such as hearing loss, mobility challenges, and vision impairment (Magnier, Thomann, Villeneuve, & Zwolinski, 2010). According to this report, only 5% to 15% of individuals in developing countries who need assistive technologies can acquire them. This challenge is mainly due to the high cost of devices, limited production, which cannot satisfy the global needs, and the poor quality of some of these devices (WHO, 2005).

2.1.1.4. Life-Support medical devices

These devices are used to provide support where vital organs in the body have failed totally or partially in their required function. They take over either completely or partially in replacing the duties of the damaged organ. Life-support devices include medical ventilators, dialysis machines, and heart-lung machines.

2.2 Factors influencing the use of medical equipment in health care institutions

2.2.1. Organisational factors

Guidelines and policies are essential from the conception and design of equipment. To ensure that action plans and national strategies for medical equipment match public health priorities there is the need for an overall needs assessment. When conducting need assessment, the burden of disease data, epidemiology disease surveillance and patterns of hospital treatment practices would ensure

the closest matching of public health needs to medical equipment World Health Organisation (WHO, 2011).

2.2.1.1 Availability of consumables/accessories/spare parts

The unavailability of consumables for the operation of various medical equipment is not uncommon in developing countries (Malkin, 2007). Consumables could be in the form of a liquid or supplies but unlike accessories, they mostly are not reusable. The unavailability of consumables and accessories is a barrier to the purchase of medical equipment and it also renders existing equipment unusable (Malkin, 2007).

Malkin (2007) revealed that in most cases, the needed consumable/accessory is not available in the country. The involvement of all stakeholders when it comes to the purchasing of consumables readily available on the market is sometimes not considered. Acquiring spare parts for medical equipment in the developing world is quite difficult. For medical equipment that is approaching the stage of decommissioning and disposal, spare parts needed for repairs may no longer be available on the market. Moreover, in-house technicians may not have the expertise and the required tools to install the parts.

2.2.1.2. Training of users

The use of medical equipment requires expert skills and knowledge, which can be achieved through education, training, and experience (Malkin, 2007). Technical and end-user training is essential to ensure that medical equipment is used effectively for its intended purpose. They can be in the form of detailed training (end-user training) or recall training (refresher training). Training provided should focus on the safe and proper use of medical equipment, troubleshooting and how to perform basic preventive maintenance (Mullally, 2013).

End-user errors are the most common reported fault on medical equipment. About 90% of deaths and injuries in anesthesiology are attributed to user errors World Health Organisation (WHO, 2010a). This shows that usually, training provided for users is inadequate to meet the competency level needed to operate the increasing complexity of medical equipment. There is always the need for subsequent refresher training to make users adept in the use of medical equipment.

2.2.2. Perceptual factors

Aside from the institutional factors, there are perceptual factors that contribute to the use of medical equipment. Chandhury and Kaul (2015) identified three crucial perceptual factors that affect utilization of medical equipment; obsolete machinery, maintenance delays, and restricted availability. There is a need to identify the perceptual factors peculiar to each setting. A good maintenance programme is of high importance to any medical facility irrespective of the size. Proper maintenance would also increase the lifespan of equipment. However, studies have shown that maintenance is an issue and about 60% of low- and middle-income countries (LMIC) are understaffed in the area of clinical engineering (Meara et al., 2015).

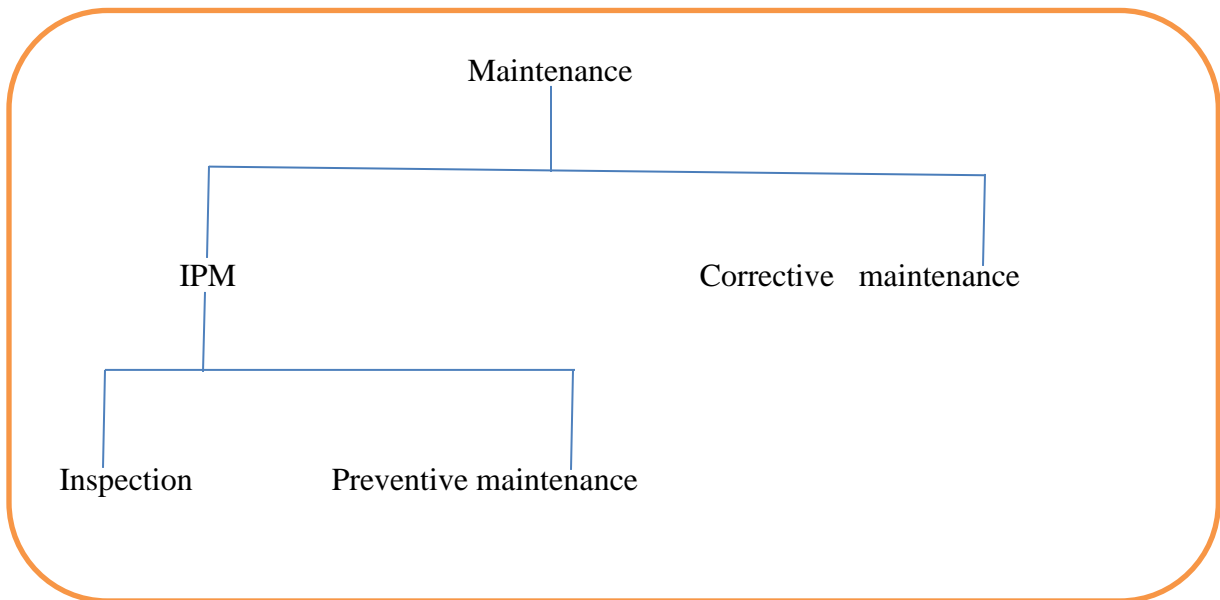


Figure 2.1: Components of a maintenance programme

Source: Medical equipment maintenance programme overview (WHO, 2011)

2.3. Conceptual framework

Several factors affect the use of medical equipment in our healthcare facilities, identifying these factors are essential in improving the quality of healthcare. There are organisational, individual and perceptual factors affecting the use of medical devices or acting as a barrier to using them. The institutional factors relate to the policies governing the use of medical devices in the healthcare facility, having the human resource with adequate training to operate and manage medical devices that are in the facility.

The availability of consumables, accessories, spare parts also affect the use of medical devices. Individual factors play a role in the use of medical equipment. These are mainly the socio-demographic factors which include the level of education of the end-user.

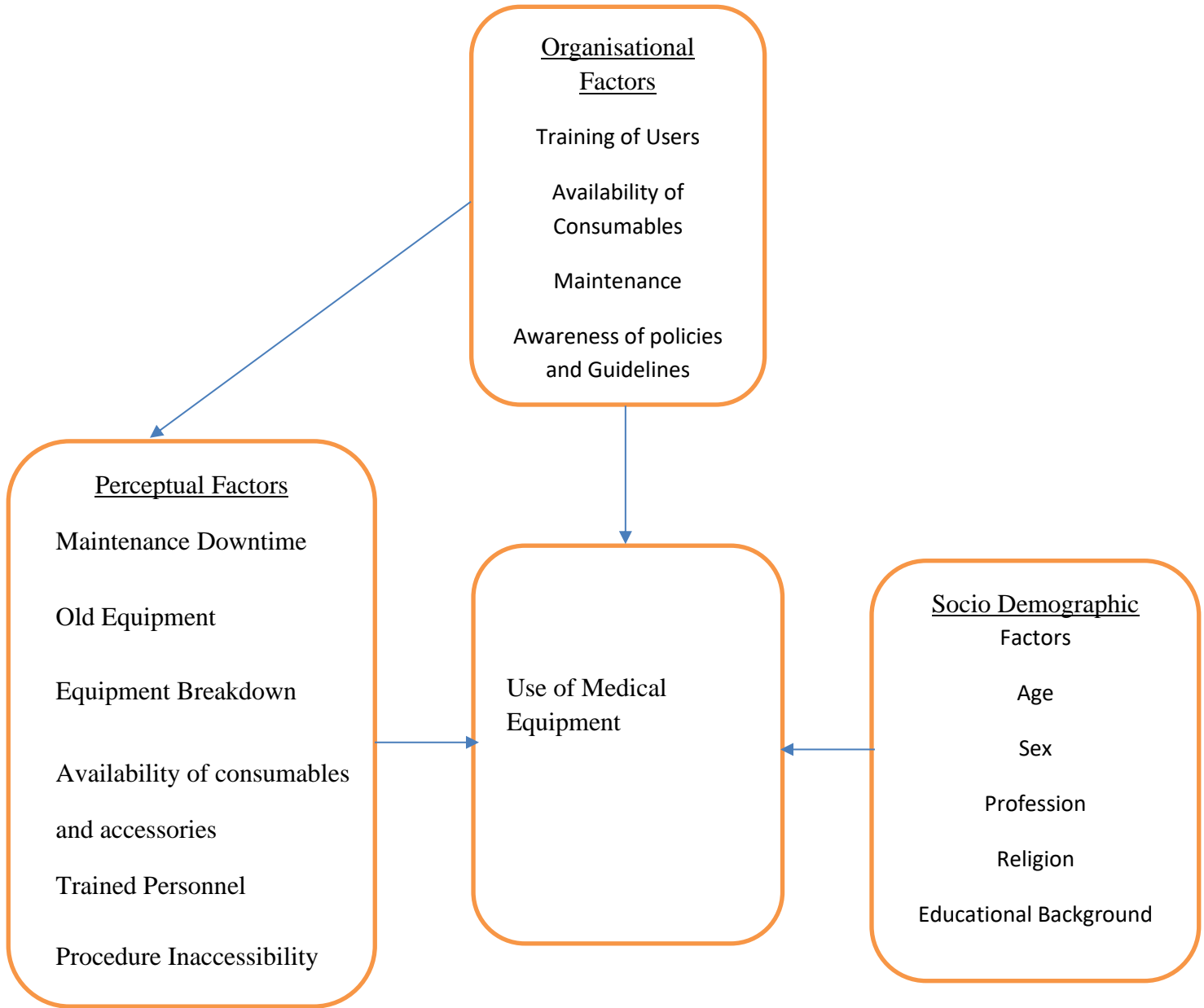


Figure 2.2: Conceptual framework

2.4. Theoretical analysis

The Model of PC utilization (MPCU) and Technology Adoption Model (TAM) conceptual model for the study is closely related to the conceptual framework of this study. The original model of

TAM (Davis, 1989), the original version of this theory looked at the perceived usefulness and perceived ease of use as the determinants for accepting a technology. The determinants of the use of medical equipment are socio-demographic, organisational and perceptual factors. The final version of this model introduced external variables as influencing perceived ease of use and usefulness. This applies to this study as organizational factors tend to influence perceptual factors.

2.5. Summary of the chapter

Though the literature on the utilisation of medical equipment is limited, this chapter has elaborated from the few studies conducted in this area, the organisational and perceptual factors associated with the use of medical equipment. The next chapter explored the data study area, study population, study design, and data management and analysis.

CHAPTER THREE

METHOD

3.1 Introduction

This chapter describes and explains the methodology of the study. It includes the study design, study population, data collection procedure and analysis.

3.2 Philosophical assumption

The knowledge paradigm used is relativism as the research seeks to understand a phenomenon. This study focuses on health workers and their understanding and experiences in the use of medical equipment. The study looked at organisational, individual and perceptual factors and how they relate to the use of equipment by health workers at the Shai Osudoku District Hospital.

3.2 Study design

This study was an explanatory cross-sectional study. This aimed at increasing knowledge on the area of medical equipment utilisation in health care institutions at a specific point in time. The aim of the study was to bring to light the equipment available and what affected their use. It was in 2 main components:

1. Identifying the types of medical equipment used in maternal health and determining the non-use.
2. Interviewing eligible participants to determine factors influencing the use of medical equipment at the maternal health department and female ward.

3.3 Study site

The study was conducted at the Shai Osudoku district hospital. The hospital is located in Dodowa which is the capital of the Shai Osudoku District. According to the 2010 Population and Housing

Census (PHC), the district has a population of 51,913. 25,272 (48.7%) are males while the remaining 26,621 (51.3) are females. The majority of the population, 76.7% reside in rural communities. 93.3% of the economically active population is employed. The census also revealed about 46.4% of the economically active population are employed in the forestry agriculture, fishing industry.

The district has a District Hospital, 5 Community-based Health Planning and Services (CHPS) Zones, 2 Health Centers, and a private maternity home. The new Shai Osudoku district hospital was commissioned to start full operation on 4th April 2016. The hospital has a bed capacity of 120. The maternal department is made up of the Maternity ward and Antenatal Care (ANC) unit.

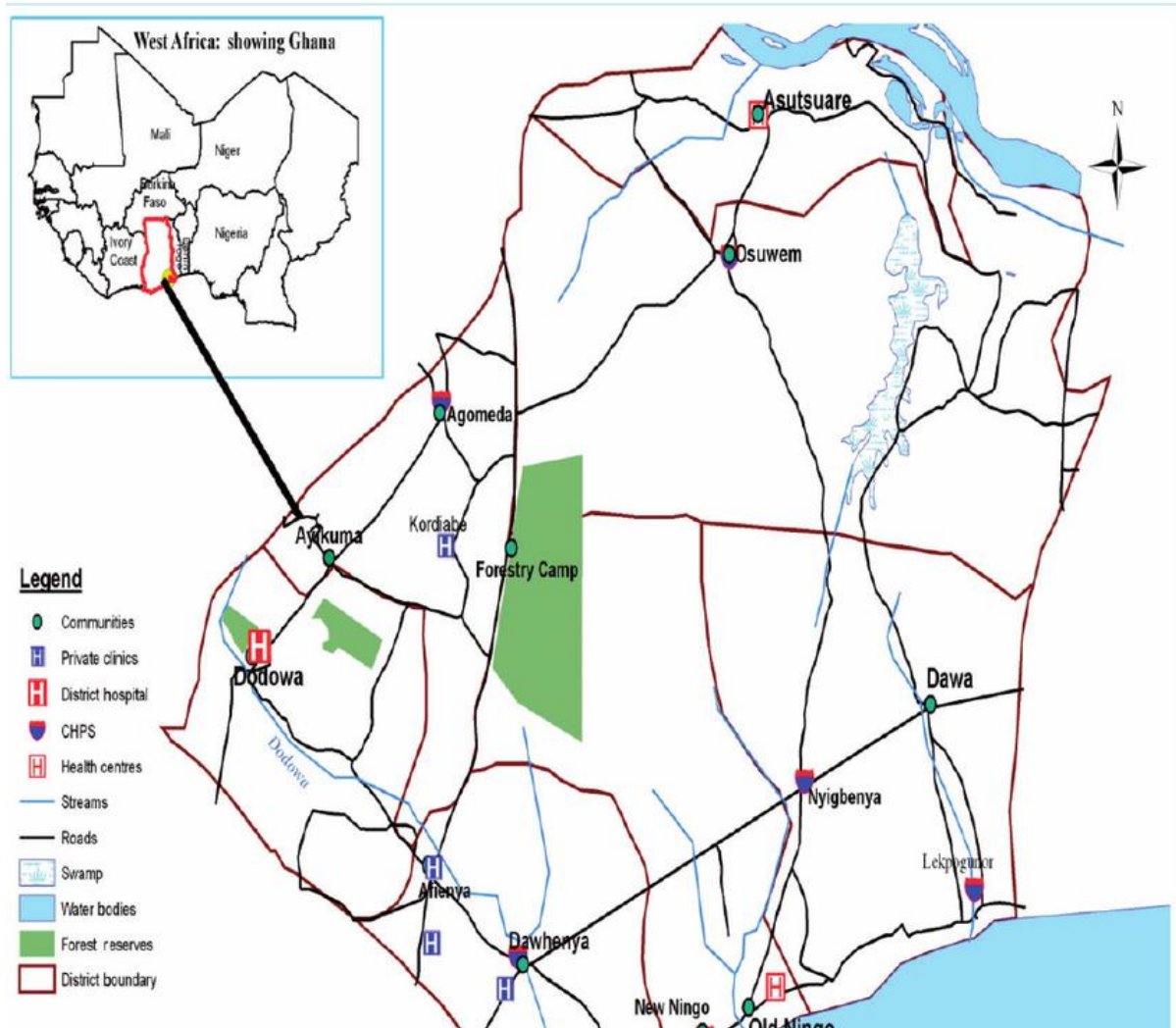


Figure 3.1: Map of Shai Osudoku District

Source: Dodowa Health Research Centre (DHRC)

3.4. Study population

The study population will comprise all health workers in the maternal department and female ward, and physicians, nurses/midwives at the two departments.

3.4.1. Inclusion criteria

1. All individuals who consent to participate in the study
2. Physicians in the maternal health department at Shai Osudoku district hospital

3. Nurses and midwives in the maternal health department at Shai Osudoku district hospital

3.4.2. Exclusion criteria

1. Individuals who do not consent to participate in the study.
2. Clinical health workers who are not in the maternal health and female ward.

3.5. Sampling strategies

This section presents the sample size determination and sampling method applied to select participants for the study

3.5.1. Sample size determination

The sample size for the study was determined using the formula provided by Yamane (1967).

$$n = \frac{N}{1 + N(e^2)}$$

n= sample size

N = sample population

e = margin of error

$$n = \frac{127}{1 + 127(0.05^2)}$$

The study used a population of 127 health workers in the maternal health department and female ward, substituting this into Yamane's formula and using a margin of error of 5% gave a sample size of 97. Adjusting for a 10% non-response gave a total sample size of 106.

3.5.2. Sampling method

Purposive sampling was used to sample eligible participants. Purposive sampling was used because there was a limited number of primary data source that could contribute to the original study. This procedure allowed individuals who meet the inclusion criteria to be selected.

3.6. Study variable

The variables measured in this study were categorized into dependent and independent. The dependent variable was the Use of medical equipment and independent variables proportion of use of medical equipment and types of medical equipment, Socio-demographic characteristics, Organisational factors, and Perceptual factors

3.6.1. Independent variables

The variables that can affect the outcome are socio-demographic variables, organisational and perceptual factors. The operational definitions and scale of measurements for the independent variables are shown in table 3.1a, 3.1b, 3.1c and 3.1d below.

Table 3.1a Analytical framework: Socio-demographic and economic factors

Variable	Operational definition	Scale of measurement	Source of data
Age	Age of Respondent at last birthday	Continuous in years	Questionnaire
	Sex of Respondent being male or female		
Sex		Nominal	Questionnaire
Educational level	Highest formal education obtained	Ordinal	Questionnaire
	Respondent's marital status		
Marital status		Nominal	Questionnaire
Religion	What is the respondent's religion?	Nominal	Questionnaire
	Christianity		
	Islam		
	Other		

	Respondent's occupation		
	Nurse		
	Midwife		
	Medical Officer		
Occupation	Physician Assistant	Nominal	Questionnaire

Table 3.1b: Analytical framework: Organisational factors

Variable	Operational definition	Scale of measurement	Source of data
Type of medical device	Name of the equipment and classification Maintenance routine, the procedure for reporting faulty	Nominal	Inventory list
Guidelines and policies	Operational definition equipment, users knowledge on the standard operating procedure of medical equipment and first-line maintenance	Nominal	Questionnaire Source of data
Training	Teaching end-user about how the safe and effective use of medical equipment	Nominal	Questionnaire
Consumable/Accessories	Materials required for using an equipment	Ordinal	Questionnaire

Table 3.1c: Analytical framework: Perceptual factors

Variable	Operational definition	Scale of measurement	Source of data
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Maintenance downtime	The time taken for equipment to be repaired and returned to users	Nominal	Questionnaire
Obsolete equipment	The use of old/worn-out equipment	Nominal	Questionnaire
Breakdown	Equipment that is not functional and has not been reported to the clinical engineer.	Nominal	Questionnaire
Availability of accessories/consumables	Materials that are required for the successful and effective operation of some medical equipment	Nominal	Questionnaire
Trained personnel	Having personnel with the skill and expertise to use medical equipment	Nominal	Questionnaire
Procedure inaccessibility	Medical equipment not been used because there is no medical condition at the hospital requiring its use	Nominal	Questionnaire

3.6.2. Study outcome

The outcome of the study was the use of medical equipment. The use of medical equipment by health workers was determined by the availability of medical equipment for use in the department when needed and health workers ability to use the equipment effectively. The scores from availability and ability to use were aggregated to give a cumulative score from 2 (minimum score) to 10 (maximum score).

Table 3.1d: Dependent variable

Variables	Operational definition	Scale of measurement	Source of data
Equipment Availability	Medical equipment available for use when needed	Ordinal	Questionnaire
Ability to use	Being able to use medical equipment safely and effectively for its intended purpose	Ordinal	Questionnaire

3.7. Data collection tools

3.7.1. Inventory list/Checklist

An inventory list from the Shai Osudoku district hospital was used to identify all the medical equipment used in the maternal department and the female ward. The proportion of medical equipment not in use was determined from this. That is, a checklist was developed to take inventory of available and functioning equipment at the hospital (see appendix C for the checklist).

3.7.2. Questionnaire

A modified version of questionnaires from Chandhury and Kaul (2015) on factors affecting utilization of medical diagnostic equipment was used to collect data from the participants. They were largely closed-ended questions. The questionnaires required that respondents chose from a pre-defined response such as less than 1 week/more 4 weeks, yes/no, and sometimes available/always available.

The questionnaires were in 4 sections. Section A asked questions related to socio-demographic characteristics. Section B asked questions that helped to measure organisational factors and Section C asked about perceptual factors. Section D asked questions that helped to measure the level of use. The questionnaires were interviewer-administered.

3.7.3 Data quality control

Two research assistants were recruited to assist with the collection of data. To ensure the reliability and validity of data collected, research assistants were trained on the ethics of conducting interviews. Also, the research assistants were through the rationale of the study and how to correctly fill all the questions. The data collected was double-checked for correct data capturing before subsequent entries into excel spreadsheet before importing into STATA for analysis.

3.9 Data processing and analysis

Univariate analysis was used for frequencies and percentages of socio-demographic characteristics, organisational factors, and perceptual factors. Bivariate analysis helped to determine factors influencing the use of medical equipment. The use of medical equipment was assessed by aggregating scores from 2 Likert-type items, the availability of medical equipment for use when needed and the ability to use medical equipment. A score of 2 to 10 was generated from cumulating the scores of equipment availability and user's ability to use medical equipment. A score of 0% to 100% was generated for each of the study participants. Therefore, converting the outcome from being categorical to quantitative continuous. Ordinarily least square regression was used to determine factors influencing the use of medical equipment and multiple linear regression to adjust for confounders. All analysis was done using STATA 16.

3.10 Ethical considerations

Ethical clearance was obtained before the commencement of data collection and informed consent was sought from study participants. Clearance was obtained from the Ghana Health Service Ethical Review Committee (GHS-ERC032/12/19).

Approval was sought from the management of the Shai Osudoku district hospital, by writing formerly to both the District Health Directorate and Medical Superintendent of the hospital. The study had minimal risk; the questionnaires completed by participants are not of a sensitive nature. There were no direct benefits, however, findings from this were aimed at shedding light on the factors that influence the use of medical equipment in health-care. No compensation was paid to participants.

All information collected was kept strictly confidential and used purposely for this study. No individual will be identified by name in the dissemination of reports or publications resulting from the study. All filled questionnaires were kept under lock and key and no third party had access to the filled questionnaires. After analyzing the data, the filled questionnaires will be stored for up to a period of 2 years and they will be destroyed by burning.

Participating in this study was entirely voluntary and withdrawal from the study at any stage was allowed. Consent forms were provided for eligible participants who were willing and agreed to be a part of the study to sign. I declare no conflict of interest in this study and it was self-funded.

3.9. Summary of chapter

This chapter outlined the process of analyzing and describing the variables for the study. The next chapter looked at the results from the data collected at Shai Osudoku District Hospital.

CHAPTER FOUR

RESULTS

4.0. Introduction

This study was aimed at determining the factors influencing the use of medical equipment at Shai Osudoku District hospital. A total of 108 participants were recruited for the study.

4.1. Socio-demographic characteristics

Out of the 108 respondents, 82 were females representing 75.9% and 26 were males which also represented 24.1%. The mean age for the participants was 32. Most of the respondents were Christians (90.7%), with 8.3% and 0.9% being Islamic and Traditional religion respectively. The dominant profession was nursing (63.9%) followed by midwifery (30.6%), and medical officers (5.5%). Most of the respondent's highest level of education was HND/Diploma (64.8%). About 44% indicated that they had been in the department for more than 12 months while those who had been there for less than 6 months were 14.8%.

Table 4.1: Socio-demographic characteristics of respondents

	Variable	Frequency (N)	Percentage (%)
Sex	Female	83	76.8
	Male	25	23.2
Age	Less than 25	25	23.2
	26-35	63	58.3
	More than 35	17	18.5
Religion	Christianity	98	90.7
	Islam	9	8.3
	Traditional	1	0.9
Occupation	Nurse	69	63.9
	Midwife	33	30.6

Education	Physician Assistant	5	4.6
	Medical Officer	1	0.9
Duration	SSSS/SHS/Vocation/Technical	1	0.9
	HND/Diploma	69	64.8
	First Degree/Higher	38	34.3
Duration	<3 months	8	7.4
	3-6 months	8	7.4
	6-12 months	44	40.7
	> 12 months	48	44.4

4.2. Types of Medical Equipment

The table below shows the list of all medical equipment in both the maternal department and female ward of Shai Osudoku district hospital. A total of 251 medical equipment were identified and 201 were in use. Collectively, about 20% of the equipment in the department is not in use.

Table 4.2: Type of medical equipment at Shai Osudoku district hospital

Type of Equipment	Total	Number in use	Percentage in use (%)
Adult Diagnostic Set	10	10	100
Delivery Bed	4	10	100
Baby Pod Transporter	2	2	100
Baby Scales	5	3	60
Blood Pressure Monitor (Aneroid)	8	8	100
Blood Pressure Monitor (Digital)	8	4	50
Desktop Autoclave	2	2	100
Infusion Pump	8	0	0
Interpretive ECG Machine	1	0	0

Ultrasound Unit (combination doppler)	12	4	33
Secure Refrigeration (82 litre pharmacy)	4	3	75
Electric Bed	17	16	94
Mechanical Bed	62	62	100
Scales (basic)	5	4	80
Stretcher	4	4	100
Wheelchair	8	8	100
Transport Ventilator	3	0	0
Syringe Driver/ Digital Injection Device	4	2	50
Examination Light Wall Mounted	8	8	100
Infant Incubator	7	7	100
Examination/Treatment Couch	1	1	100
High Spec Patient Monitor	10	6	60
Gynaecology Chair	4	3	75
Thermometer	8	3	38
Flow Meter	16	15	94
Pulse Oximeter	9	7	78
Phototherapy Unit	4	3	75
Manual Sphygmomanometer	8	3	38
Glucometer	6	6	100
Medical Gas	1	1	100

4.3 Assessment of use of medical equipment by health workers

The level of use of medical equipment by health workers was determined by the availability of medical equipment for use in the department when needed and users' ability to use the equipment

effectively. These were measured on a scale of 1 to 5 with 1 being “Never available” and 5 being “Always available” for availability and 1 being “Poor” and 5 being “Excellent” for the ability to use medical equipment.

As shown in figure 4.1a respondents indicated medical equipment are often available when needed (28.7%), 28 indicated rarely available (25.9%), 25 indicated sometimes available (23.1%), 17 indicated always available (15.8%), and 1 indicated never available (6.5%). On the ability to use medical equipment, 35 respondents indicated excellent (32.4), 29 indicated average (26.9%), 25 indicated below average (23.1%), 11 indicated excellent (10.2%), and 8 indicated poor (7.4%).

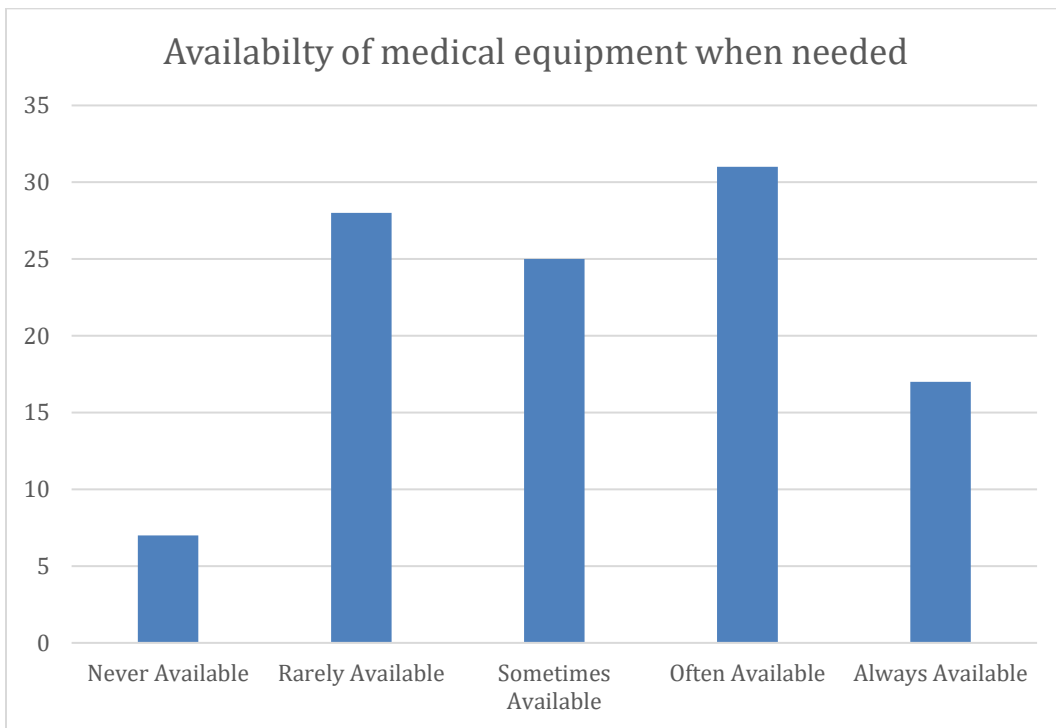


Figure 4.1a: Availability of medical equipment when needed

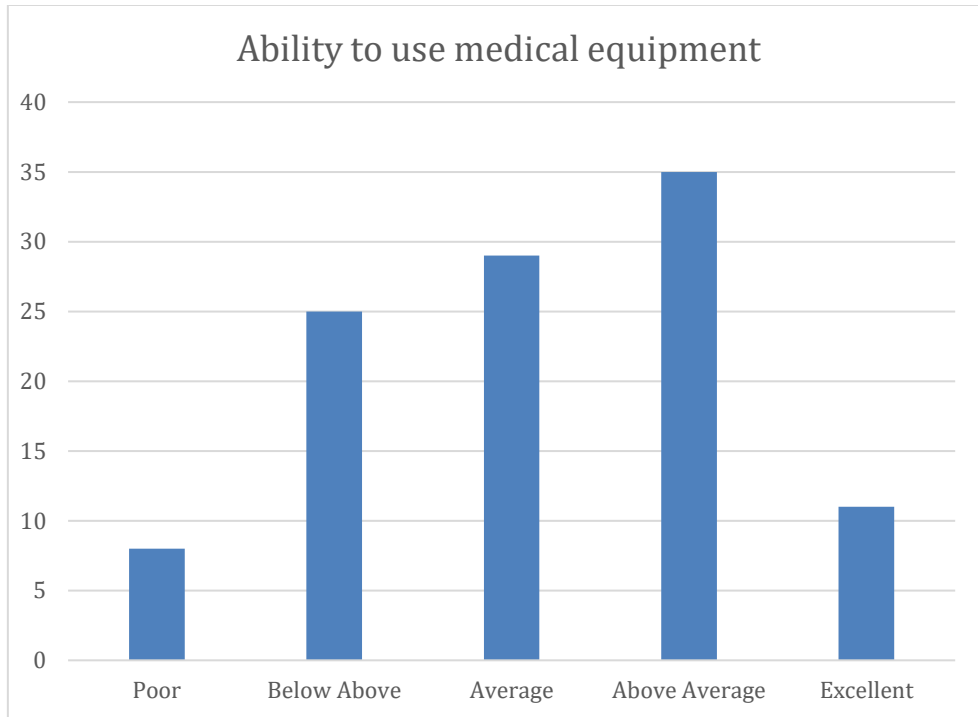


Figure 4.1b: Ability to use medical equipment

The scores from availability and ability to use were aggregated to give a cumulative score from 1 (minimum score) to 10 (maximum score), the higher the score the higher the level of use. The mean score for the use of medical equipment for the study was 6.36 with a 95% confidence interval of 5.98 – 6.75, the level of use for medical equipment is medium.

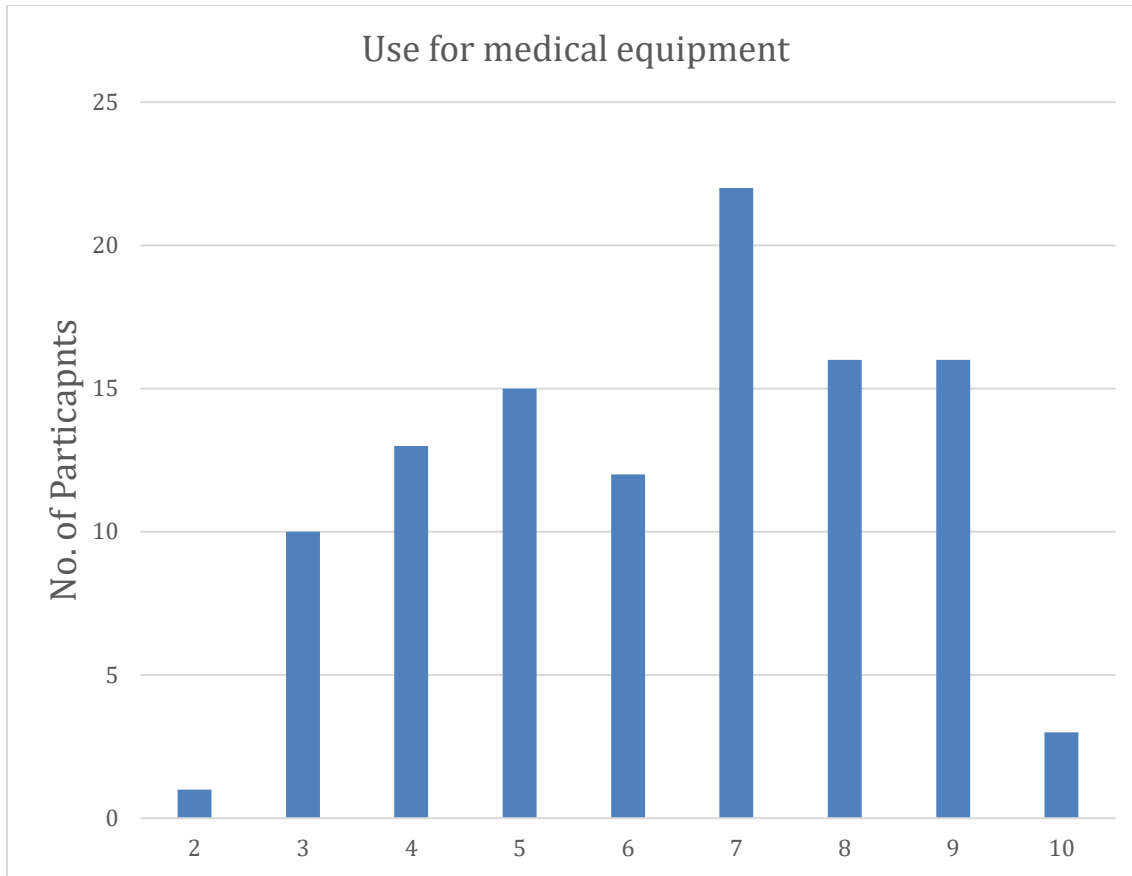


Figure 4.1c: Use of medical equipment

4.4. Organisational factors

4.4.1. Training of health personnel on medical equipment usage

Figure 8 below presents a summary of the number of respondents who had received training on the use of medical equipment and the time for the training. Out of the 108 respondents, 61 (56.5%) indicated that they had received an end-user training on the use of medical equipment. Also, 32 (29.6%) had received refresher training on the use of medical equipment.

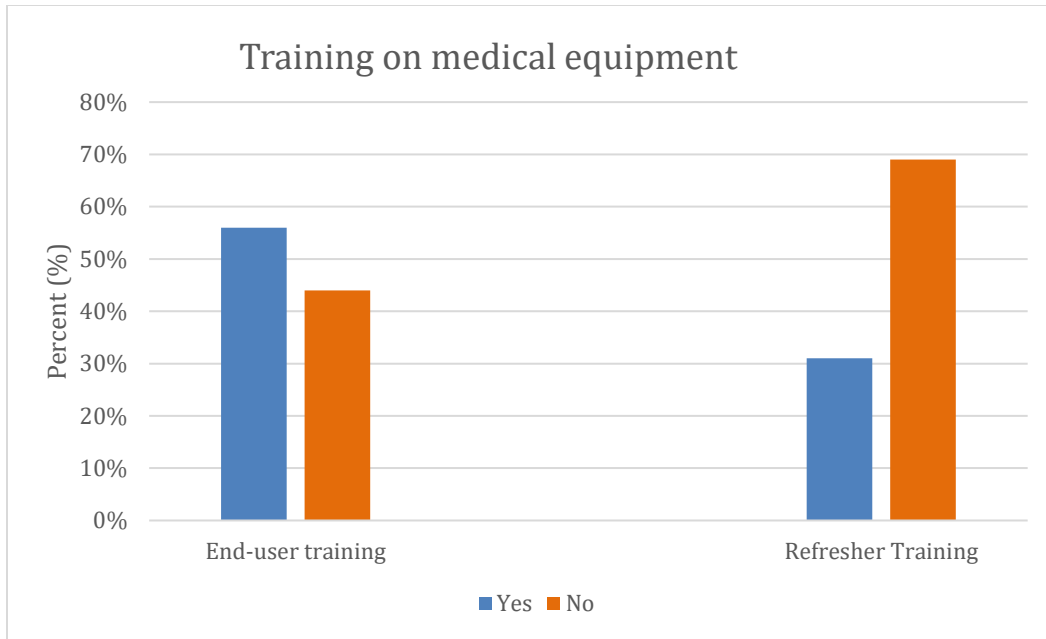


Figure 4.2a: Training on medical equipment

Majority of the respondents (46%) who had received either an end-user training, refresher training or both indicated that the training was more than 12 months ago.



Figure 4.2b: Time for last training

4.4.2. Availability of accessories and consumables

Figure 6 presents results on the response of participants on the availability of consumables and accessories to be used with medical equipment when needed on a scale of 1-5 with “5=Always available and 1=Never available”. As shown, the majority (43%) of them indicated that consumables and accessories were sometimes available.

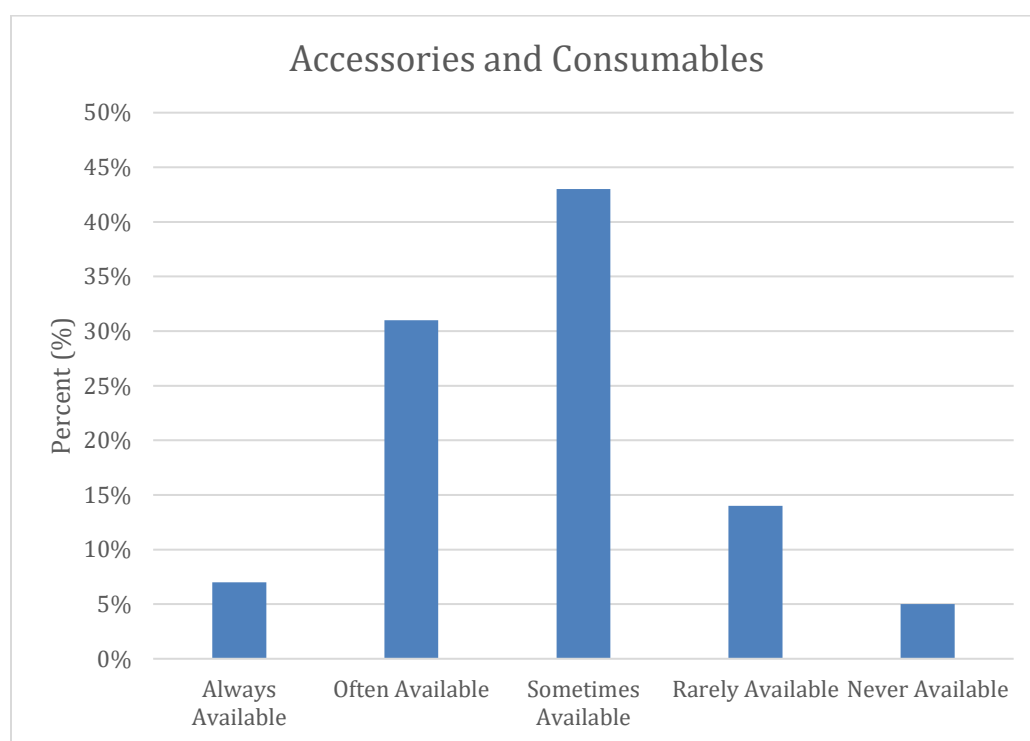


Figure 4.2c: Accessories and consumables

4.4.3. Policies and guidelines for using medical equipment

Health workers' awareness of guidelines and policies on the use of medical equipment were assessed on these aspects; knowledge and awareness of the procedure for reporting faulty equipment, knowledge of the Standard Operating Procedure (SOP) for medical equipment,

knowledge of first-line maintenance, and the average time for faulty equipment to be returned to the unit. Out of 108 respondents, 97 (90%) indicated that they are aware of the procedure for reporting faulty equipment to the clinical engineering department. Fifty-five respondents (51%) indicated knowledge of the standard operating procedure for medical equipment in their respective unit while 52 (48%) had knowledge of first-line maintenance of medical equipment.

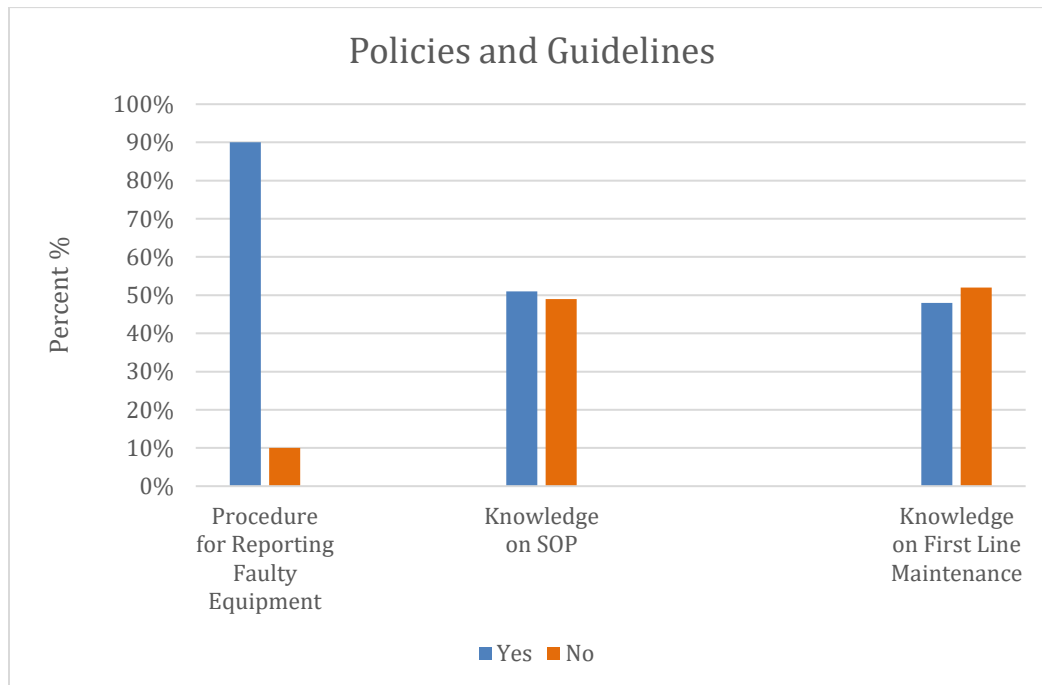


Figure 4.2d: Policies and guidelines

4.4.4. Policies and guidelines for using medical equipment

Out of 108 respondents, 34 (31%) indicated that the average time for equipment to be serviced and returned to users was less than a week. Respondents who indicated that the average time for servicing medical equipment was 1-2 weeks were 32 (30%), 26 (24%) disclosed that the average time was 2-4 weeks, and 16 (15%) indicated that it took more than 4 weeks.

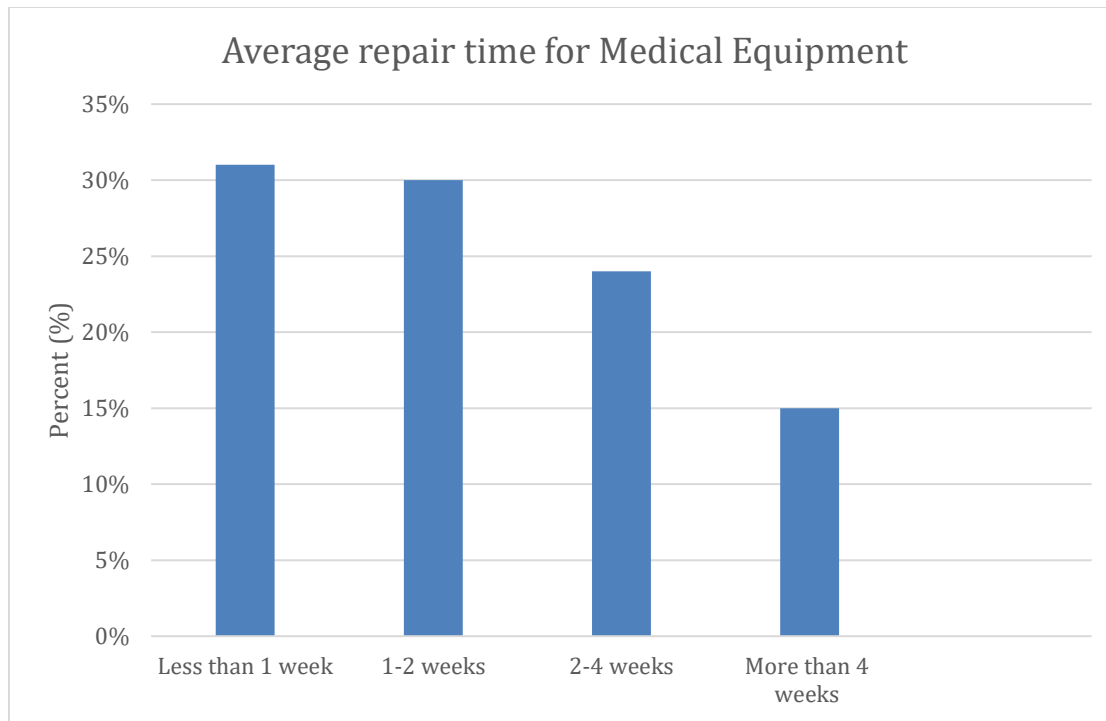


Figure 4.2e: Average repair time for medical equipment

4.5. Perceptual factors

Six perceptual factors considered, figure 10 below shows the responses from participants. About 100 (92.6%) respondents indicated that maintenance delays influence the level of use of medical equipment, 20 (18.5%) indicated that using obsolete equipment does not influence the level of use, respondents whom indicated that breakdown influence the level of use of medical equipment were 85 (78.7%). While 57 (52.8%) respondents indicated that the availability of consumables and accessories affect the level of use of medical equipment, only 34 (31.5%) responded divulged that trained personnel influence the level of use of medical equipment. Also, 52 respondents (48.1%) indicated that inaccessibility of procedure affects the level of use of medical equipment.

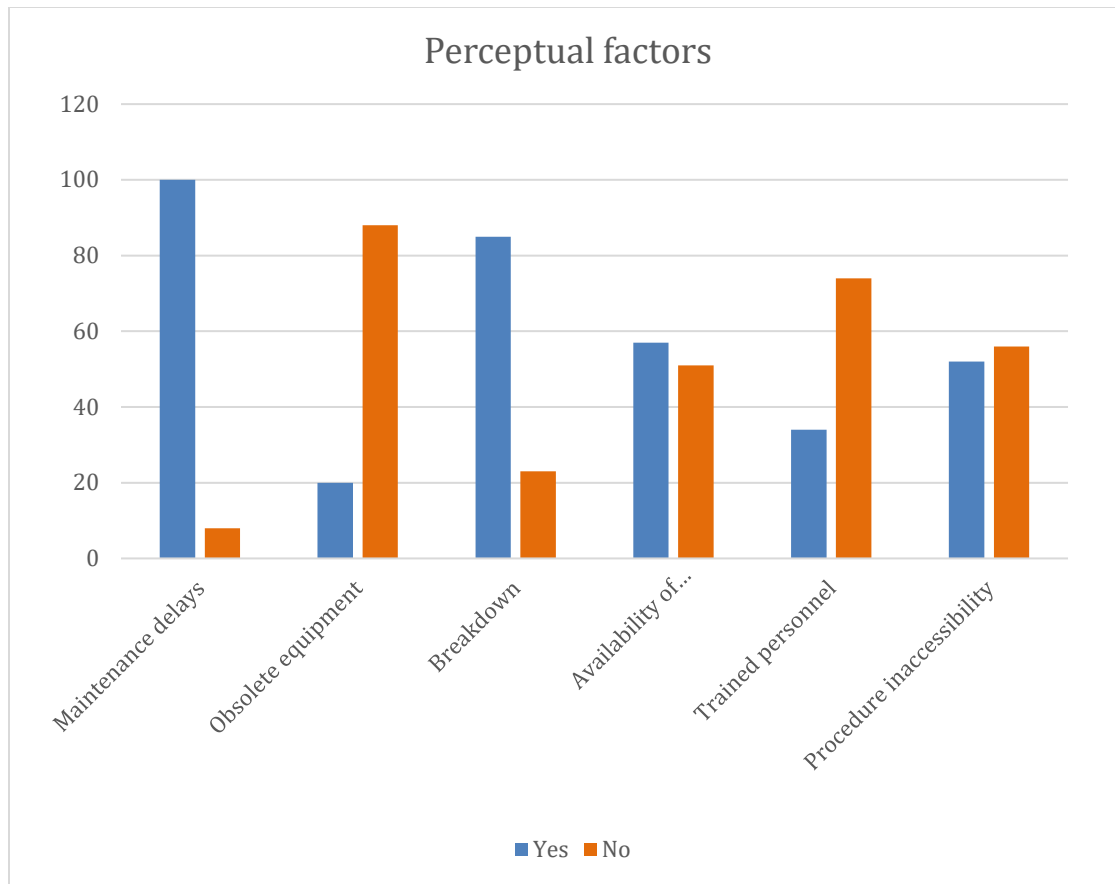


Figure 4.3: Perceptual factors

4.6. Bivariate analysis: Association between Socio-demographic characteristics and use of medical equipment

None of the socio-demographic characteristics of health workers in the maternal and female department of Shai Osudoku district hospital showed a significant association ($p < 0.05$) with the use of medical equipment.

Table 4.3: Bivariate analysis: Association between Socio-demographic characteristics and use of medical equipment

Variable	Use of Medical Equipment		
	Coefficient	95% Confidence Interval	p-value
Age Group (Years)	2.414	-3.584 – 8.411	0.427
Sex	3.628	-5.527 – 12.785	0.434
Religion	9.283	-2.258 – 20.824	0.114
Occupation	-1.954	-9.740 – 5.831	0.620
Educational Level	2.308	5.574 – 10.189	0.563
Years in the Department	-1.114	-4.742 – 2.514	0.544

4.7. Bivariate analysis: Organisational factors and use of medical equipment

Among the areas of policies and guidelines for using medical equipment, refresher training and respondent's knowledge of first-line or user maintenance showed a statistical significance with the use of medical equipment with a $p=0.030$ and $p=0.034$ respectively.

Even though there was no statistically significant association between knowledge of the procedure for reporting faulty equipment, knowledge of the SOP for medical equipment, and end-user training, important patterns were identified. For instance, 56.4% of clinical health workers with knowledge of the Standard Operating Procedure (SOP) of medical equipment had a level of use of

medical equipment above the point estimate for the use of medical equipment as compared to 49.1 of those who had no end-user training.

Table 4.4: Bivariate analysis: Association between organisational factors and use of medical equipment

Variables	Use of Medical Equipment		
	Coefficient	95% Confidence Interval	p-value
End-user Training	-0.250	-8.044 – 7.544	0.949
Refresher Training	-9.127	-17.350 – -0.905	0.030*
Knowledge of Standard Operating Procedure	0.422	-7.325 – 8.169	0.914
Awareness of the Procedure for Reporting Faulty Equipment	1.996	-10.804 – 14.796	0.758
Knowledge of First-line Maintenance	8.242	0.654 – 15.829	0.034*

*significant at $p < 0.05$.

4.8. Bivariate analysis: Association between perceptual factors and use of medical equipment

Statistically significant factors were time taken for the maintenance of medical equipment ($p=0.018$), the availability of accessories and consumables for medical equipment ($p=0.032$), accessibility of procedures at the hospital ($p=0.004$), and obsolete equipment ($p=0.010$).

Table 4.5: Bivariate analysis: Association between perceptual factors and use of medical equipment

Variable	Use of Medical Equipment		
	Coefficient	95% Confidence Interval	p-value
Maintenance Downtime	17.40	2.995 – 31.840	0.018*
Obsolete/Old Equipment	12.750	3.086 – 22.414	0.010*
Equipment Breakdown	3.483	-5.953 – 12.920	0.466
Availability of consumables\accessories	8.328	0.737 – 15.919	0.032*
Trained Personnel	-4.412	-12.708 – 3.884	0.294
Procedure Inaccessibility	-11.044	-18.498 – -3.590	0.004*

*significant at $p < 0.05$

4.9. Multiple linear regression analysis: Factors influencing use of medical equipment among health workers

Multiple linear regression was performed to establish the relationship between the use of medical equipment and the statistically significant factors associated with the use, controlling for all confounders. The factors that remained significant in the model were time taken for maintenance, using obsolete/old medical equipment, availability of accessories/consumables, inaccessibility of procedure, refresher training, and clinical health worker's knowledge of first-line maintenance. The results of the regression indicated that refresher training, the inaccessibility of procedures, and users' knowledge of first-line maintenance had a statistically significant association with the use of medical equipment while controlling for maintenance downtime, obsolete equipment and

availability of consumable or accessories. Holding all other factors constant, for a unit increase in knowledge of first-line maintenance the use of medical equipment by clinical health workers increases by 8.925 units. A unit increase in the inaccessibility of procedures decreases the use of medical by 8.648 units while a unit increase in refresher training also decreases the use of medical equipment by 7.932 units, holding all other factors constant. The results are shown in the table below.

Table 4.6: Multiple linear regression of the factors affecting the use of medical equipment among health workers

Variable	Use of Medical Equipment		p-value
	Coefficient	95% Confidence Interval	
Maintenance Downtime	11.519	-2.154 – 25.192	0.098
Obsolete/Old Equipment	7.047	-2.430 – 16.525	0.143
Procedure Inaccessibility	-8.648	-16.089 – -1.279	0.022*
Availability of Consumables/Accessories	2.823	-4.757 – 10.404	0.462
Refresher Training	-7.932	-15.750 – -0.114	0.047*
Knowledge of First-line Maintenance	8.925	1.873 – 15.976	0.014*

*significant at $p < 0.05$

4.10. Summary of the chapter

The study showed that most medical equipment (80%) available at the Shai Osudoku District were being used. Organisational factors such as refresher training and knowledge of first-line

maintenance were associated with the use of medical equipment. Also, availability of consumables and accessories was associated with the use of medical equipment. The next chapter looked at the significance of the findings of this study in relation to previous studies.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0. Introduction

Even with the few studies available on medical equipment in health facilities, no studies have been conducted in Ghana on the factors affecting their use and their functional status. Using the Yamane (1967) formula, 108 health workers were recruited for the study which was conducted at the Shai Osudoku district hospital to determine the types of medical equipment that are available and are in-use at the maternal and female wards and the factors affecting their use.

5.1. Socio-demographic factors associated with use of medical equipment

The socio-demographic factors that were considered in this study were age, sex, religion, educational level, time spent in the department, and occupation/profession. At a 95% confidence level and $p < 0.05$ as the significant level, none of the factors were statistically significant.

5.2. Types of medical equipment

In high-income countries, admissions to medical wards are mainly as a result of non-communicable diseases. While in low- and middle-income countries it is mainly due to communicable diseases. The work of Ali and Woldie (2011) shows that this trend is changing in some low- and middle-income countries. As such the type of medical equipment available for use should be subjective, depending on the morbidity trends.

A report by the WHO (2016) lists priority medical devices for interventions for maternal and reproductive health according to the level of health care delivery. The equipment listed in the report is essential to strengthening the health system and improving the quality of care provided. The type of medical equipment identified at the Shai Osudoku district hospital was consistent with the report.

Malaria, anaemia, and diarrhoea were among the top ten cases that were reported at Shai Osudoku district hospital in 2019. Management of severe malaria and diarrhoea include intravenous infusion at a controlled rate and regular checks of vitals among others. The maternal and female wards have medical equipment such as thermometers, infusion pumps, and high spec patient monitors to assist with these procedures. Dopplers and fetal heart rate detectors for determining the real-time heart rate of the fetus were also available at the maternal department.

From the inventoried medical equipment about 80% of the equipment in the maternal and female departments were in use. This non-use of medical equipment appeared in the form of lack of training, maintenance delays, and the lack of accessories and consumables needed to operate the medical equipment. Thirty different types of medical equipment were identified in both departments, 13 out of the 30 had 100% use. The study showed that some critical medical equipment such as infusion pumps were not in use, having a 100% non-use, the same was the case for therapeutic ECG machine, and transport ventilator.

The result of this study is consistent with the work of Perry and Malkin (2011) which reported that on average 38.2%, ranging from 0.83% to 47% of medical equipment in developing countries are not in-use. However, it did not collaborate a report of WHO (2000) indicating that up to 70% of medical equipment in sub-Saharan Africa are not in use.

5.3. Organisational factors associated with use of medical equipment

The areas of focus were knowledge and awareness of the procedure for reporting faulty medical equipment to the clinical engineering unit, the average time taken for medical equipment to be serviced, equipment causing injury, knowledge of first-line maintenance, and knowledge of standard operating procedures for medical equipment. Despite the lack of definitive literature on

organisational factors influencing use of medical equipment, the study revealed that awareness of first-line maintenance and refresher training was associated with a high level of use of medical equipment with $p=0.014$ and $p=0.47$ respectively.

However, less than half of the respondents indicated that they had knowledge of first-line maintenance (48%), the same was the case for refresher training (33%). Although end-user training was not associated with high use of medical equipment, training for health workers on first-line maintenance should be done regularly.

5.4. Perceptual factors associated with use of medical equipment

Based on an earlier study, the perceptual factors that were taken into account were maintenance downtime, obsolete equipment, breakdown of equipment, the availability of accessories/consumables, trained personnel, and inaccessibility of procedure (Chandhury & Kaul, 2015).

The study revealed a significant association between four of the perceptual factors and the use of medical equipment by clinical health workers at Shai Osudoku district hospital. The factors were maintenance downtime, the availability of consumables and accessories, and the accessibility of procedure, and obsolete equipment.

5.6. Factors influencing use of medical equipment

The use of medical equipment measured on a continuous scale was from 2 to 10, the average use of medical equipment was 6.36. Based on the scale of measurement adopted for this study, 2 being minimum and 10 the maximum, the use of medical equipment is medium.

To control for confounders, a multiple linear regression was done and the model contained all the statistically significant factors. These findings are not consistent with the study conducted by

Chaudhary and Kaul (2015) which reported obsolete medical equipment, maintenance delays, and non-availability of consumables and accessories as the factors affecting utilization. These differences in findings could be as attributed to the methodology that was used. When there are no medical procedures requiring the use of medical equipment, its use will be low. Also, refresher training had a negative correlation with the use of medical equipment, this may be attributed to the fact that 69.4% of respondents had no refresher training.

5.7. Summary of the chapter

The study showed that training of users with a focus on first-line maintenance improves the use of medical equipment. Based on the inventoried equipment at the hospital, about 80% of the medical equipment are functional and being used. The final chapter looked at the significance of the study, recommendations and limitations of the study.

CHAPTER SIX

CONCLUSION

6.0. Introduction

The study has successfully identified the types of medical equipment that are at the maternal and female wards of Shai Osudoku district hospital and also the proportion of the equipment that is in use. This chapter elaborates on the summary of the study, recommendations to the appropriate institutions, and limitations of the study.

6.1. Summary of the study

Percentages indicating the indicating equipment in use and not in use were determined from an inventory list. Bivariate analysis was used to identify socio-demographic, organisational and perceptual factors influencing the use of medical equipment before performing a multiple regression to eliminate confounders. The study has shown that 20% of the medical equipment at Shai Osudoku District Hospital are not in use. The factors that have been identified to affect the use of medical equipment in the hospital are refresher training, the inaccessibility of medical procedure by clients, and knowledge of first-line maintenance.

6.2. Limitations to the study

1. The selection of study participants was done by purposive sampling, this being a judgemental task makes the selection procedure vulnerable to some biases. As such the findings from the study cannot be generalized to other population groups.
2. The study utilizes cross-sectional data, therefore responses from participants can be different when measured at a different time.

3. Due to the paucity of literature exploring the availability of medical equipment and the factors affecting the use in health facilities, there were few previous studies to relate the study to.

6.3. Recommendations

The following recommendations are made based on the findings from the study for consideration by Shai Osudoku district hospital, policymakers and health workers working with medical equipment.

6.3.1. Ministry of Health/Ghana Health Service

1. The ministry should ensure that health facilities are equipped with the needed medical equipment, taking into consideration the location and context where the equipment will be used.
2. Develop and ensure the implementation of guidelines and policies for using medical equipment

6.3.2. Management of Shai Osudoku District Hospital

1. There should be a regular audit of medical equipment to determine the shortages and functional status.
2. Training provided for health workers should focus on first-line maintenance of medical equipment. First-line maintenance should also be in the Standard Operating Procedure (SOP) for medical equipment and be made available to users.
3. For effective use, procurement and donation of medical equipment should be based on the public health needs of the health facility.

6.3.3. Health workers

1. Clinical health workers should insist on refresher training on medical equipment and also training on first-line maintenance

6.3.4. Future research

1. Future research should examine the use of medical equipment by health workers in other health facilities to give a wider view of the factors facilitating its use.
2. More in-depth research should be carried out on the impact of medical equipment shortage and unavailability on the health system.

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APPENDICES

APPENDIX A: List of SDGs 3 and some medical devices/technologies that help in their accomplishments

Target	Example of health technology/medical device
3.1 By 2030 reduce the global maternal mortality ratio to less than 70 per 100,000 live births	Blood pressure meters, pregnancy tests, surgical instruments, cord clamps
3.2 By 2030 end preventable deaths of newborns and under-five children	Neonatal resuscitation devices, warming devices/incubators, diagnostics
3.3 By 2030 end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases	In-vitro diagnostics to initiate the right treatment
3.4 By 2030 reduce by one-third premature mortality from non-communicable diseases (NCDs) through prevention and treatment and promote mental health and wellbeing	<p>Diagnostics: in vitro, blood glucose meters, pathology; x rays...imaging,</p> <p>Treatment: surgical instruments, implants, radiotherapy, inhalers</p> <p>chemotherapy, cardiac support</p>

<p>3.7 By 2030 ensure universal access to sexual and reproductive health care services, including family planning, information and education, and the integration of reproductive health into national strategies and programmes</p>	<p>From condoms to contraceptive devices</p>
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APPENDIX B: Consent Form

Study Title: Factors Affecting Use Of Medical Equipment Among Health Workers In Shai

Osudoku District Hospital

Participants' Statement

I acknowledge that I have read or have had the purpose and contents of the Participants' Information Sheet read and satisfactorily explained to me in a language I understand (.....). I fully understand the contents and any potential implications as well as my right to change my mind (i.e. withdraw from the research) even after I have signed this form. I voluntarily agree to be part of this research.

Name or Initials of Participant..... ID Code

Participants' SignatureOR Thumb Print.....

Date:.....

Interpreters' Statement

I interpreted the purpose and contents of the Participants' Information Sheet to the aforementioned participant to the best of my ability in the language to his proper understanding.

All questions, appropriate clarifications sort by the participant and answers were also duly interpreted to his/her satisfaction.

Name of Interpreter.....

Signature of Interpreter.....

Date:.....

Contact Details

Statement Of Witness

I was present when the purpose and contents of the Participant Information Sheet were read and explained satisfactorily to the participant in the language he/she understood (.....)

I confirm that he/she was given the opportunity to ask questions/seek clarifications and the same were duly answered to his/her satisfaction before voluntarily agreeing to be part of the research.

Name:

Signature..... OR Thumb Print

Date:.....

Investigator Statement And Signature

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

Researcher's name.....

Signature

Date.....

Appendix C: Questionnaires for factors associated with the use of medical equipment among clinical health workers at Shai Osudoku District Hospital

Dear Respondent, I am Samuel Amponsah-Tuffour, a Master of Public Health student from the University of Ghana, I am conducting a study on the factors affecting the use of medical equipment at the Shai Osudoku district hospital.

Any information provided will be treated confidentially and be used solely for the study. Thank you very much for your participation and kind responses.

Date of Interview.....

Interviewer.....

Qn No.	Questions	Response
Respondent ID:		
Section 1: Socio-demographic characteristics		
1	What was your age on your last birthday?	<input type="text"/>
2	Sex of respondent 1. Male 2. Female	<input type="text"/>
3	What is your religion? 1. Christianity 2. Islam 3. Traditional 4. Other (specify).....	<input type="text"/>

4	What is your occupation? 	
5	What is your highest level of formal education? 1. No formal education 2. Primary 3. Middle/JSS/JHS 4. SSS/SHS/Vocation/Technical 5. HND/Diploma 6. Degree/Higher	<input data-bbox="1224 436 1338 512" type="checkbox"/>
6	How long have you been working in this unit? 1. Less than 3 months 2. 3-6 months 3. 6-12 months 4. More than 12 months	<input data-bbox="1224 982 1338 1058" type="checkbox"/>
Section 2: Organisational factors associated with the use of medical equipment		
7	Have you received end-user training in the use and operation of medical equipment in your unit? 1. Yes 2. No	<input data-bbox="1224 1325 1338 1400" type="checkbox"/>
8	Have you received refresher training in the use and operation of medical equipment 1. Yes 2. No	
9	If yes, when was either or both of these training? 1. Less than 3 months ago 2. Between 3-6 months ago 3. 6-12 months ago	<input data-bbox="1224 1822 1338 1898" type="checkbox"/>

	4. More than 12 months ago	
10	<p>Does the unit have written guidelines and policies on the use of medical equipment?</p> <p>1. Yes 2. No</p>	<input type="checkbox"/>
11	<p>Is there a procedure for reporting faulty medical equipment?</p> <p>1. Yes 2. No</p>	<input type="checkbox"/>
12	<p>Has there been an incident of any medical equipment causing harm to a patient or yourself?</p> <p>1. Yes 2. No</p>	<input type="checkbox"/>
13	<p>If yes, was this incident reported and investigated?</p> <p>1. Yes 2. No</p>	<input type="checkbox"/>
14	<p>Do you have knowledge of the Standard Operating Procedures for medical equipment in the unit?</p> <p>1. Yes 2. No</p>	<input type="checkbox"/>
15	<p>If yes, are these Standard Operating Procedures in writing?</p> <p>1. Yes 2. No</p>	<input type="checkbox"/>
16	<p>How long does it take for a reported faulty/non-functioning medical equipment to be repaired and returned to the unit?</p> <p>1. Less than a week 2. 1-2 weeks</p>	<input type="checkbox"/>

	<p>3. 2-4 weeks</p> <p>4. More than 4-weeks</p>	
17	<p>Do you have adequate knowledge of first-line maintenance of medical equipment?</p> <p>1. Yes</p> <p>2. No</p>	<input type="checkbox"/>
18	<p>If yes to Question 17, tick which of the listed first-line maintenance practice(s) you know of and can perform effectively. Tick all that are applicable.</p> <p>1. Cleaning of medical equipment</p> <p>2. Visual checks and inspections to identify any defects</p> <p>3. Performing function checks</p> <p>4. Troubleshooting user errors</p> <p>5. Replacing/Restocking consumables/accessories</p>	<input type="checkbox"/>
19	<p>Are accessories and consumables for medical equipment available when needed?</p> <p>1. Always available</p> <p>2. Often available</p> <p>3. Sometimes available</p> <p>4. Rarely available</p> <p>5. Never available</p>	<input type="checkbox"/>

Section 4: Perceptual factors that influence the use of medical equipment

20	<p>Does the time taken for maintenance such as repairing, installing accessories, and calibration of medical equipment affect the use of medical equipment?</p> <p>1. Yes</p> <p>2. No</p>	<input type="checkbox"/>
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21	Does using obsolete/old equipment affect their utilization? 1. Yes 2. No	<input type="checkbox"/>
22	Does the availability/unavailability of accessories and consumables affect the use of medical equipment? 1. Yes 2. No	<input type="checkbox"/>
23	Is the use of medical equipment affected by having received training in using the medical equipment? 1. Yes 2. No	<input type="checkbox"/>
24	Does the accessibility of medical procedures by patients affect the use of medical equipment? 1. Yes 2. No	<input type="checkbox"/>
25	Does the breakdown of equipment affect its use? 1. Yes 2. No	<input type="checkbox"/>

Section 5: Use of Medical Equipment

26	How will you describe the availability of medical equipment when needed for use? 1. Never available 2. Rarely available 3. Sometimes available 4. Often available 5. Always available	<input type="checkbox"/>
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27	Rate your ability to use medical equipment safely and effectively? 1. Poor 2. Below average 3. Average 4. Above average 5. Excellent	<input data-bbox="1198 474 1312 548" type="text"/>
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APPENDIX D: Inventory List

Type of medical equipment	Total	Number in-use
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APPENDIX E: Ethical Approval

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

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



Research & Development Division
Ghana Health Service
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Email: ethics.research@ghs.gov.gh
20th January, 2020

My Ref: GHS/RDD/ERC/Admin/App/20/48
Your Ref. No:

Samuel Amponsah-Tuffour
University of Ghana
Legon, Accra

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

GHS-ERC Number	GHS-ERC032/12/19
Project Title	Factors Affecting Use of Medical Equipment among Health Workers in Shai Osudoku District Hospital
Approval Date	20 th January, 2020
Expiry Date	19 th January, 2021
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator

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

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

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

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

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

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