Assessment of medical equipment management practice in Tulu bolo general hospital, south west Shoa zone, central Ethiopia

By

Sirnan Humnesa Kabeta

A research thesis submitted to institute of health, faculty of public health, department of health policy and management, Jimma University, in partial fulfillment for the requirement for masters of health care and hospital administration

June, 2022

Jimma, Ethiopia

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Abstract

Background: Medical equipment are a wide range of instruments, equipment, machinery or apparatus whether used alone or in combination including the software necessary for the purpose of diagnosis, prevention, monitoring, treatment, or alleviation of the disease or used for medical and Para-medical purposes. The importance of proper management of medical equipment has brought health facility attention. However its management practices are not known in this health facility.

Objective: To assess medical equipment management practices and related factors in Tulu bolo general hospital, south west Shoa, central Ethiopia.

Methods: The study was conducted in Tulu bolo general hospital, south west Shoa, central Ethiopia, from December 13 up to January 2022. Cross-sectional study designs using mixed quantitative and qualitative methods were utilized. About 199 medical equipment and 156 workers were included. Adapted and pre-tested structured English version checklist for medical equipment management practices and document review as well as interview guide for in-depth interview were used for data collection. Data were collected by observation of availability of medical equipment, interviewing selected core heads in Tulu bolo general hospital. Data were entered using EPI DATA version 3.1 and analyzed using SPSS version 23.Data were presented in chi-square and binary logistic regression.

Results: The overall functionality of medical equipment was 57.3%. According to the respondents finding procurement, utilization and storage were not well practiced. The results were significant at (P=0.000, B1=1.47, OR =4.349 and CI 95% =2.047-9.241) and (p =0.033, B2=0.790, OR= 2.203 and CI 95% 1.065-4.556) for procurement and utilization practices respectively.

Conclusion and Recommendations: The majority of medical equipment in Tulu bolo general hospital was out of services. Medical equipment management practices like procurement practice, utilization practices and storage practices were not fully practiced. Lack of training, spare parts and technicians were among reported reasons for non-functional medical equipment. Tulu bolo general hospital should follow guide lines like EHSTG and conserve medical equipment and capacitate the medical equipment users and operating technicians.

Key words: medical equipment management, procurement, utilization, functionality of medical equipment

Acknowledgements

My greatest gratitude goes to my family after God. I thank my advisors Mr Fikru Tafese and Mr Temesgen Kabeta for their constructive guidance and comments. I would also like to appreciate the hospitals' staffs, those who share me the information and data I requested. The last but not the least, I'm most grateful to my spouse Hawi Sori and all my friends who were there for me right from the beginning until the end!

Acronyms

CCO-Chief Clinical Officer

CEO-Chief Executive Officer

DALYs -Disability Adjusted Life Years

EDP-Equipment Development Plan

EFY -Ethiopian Fiscal Year

EHF-Equipment History File

EHSTG-Ethiopian Hospitals Transformation Guidelines

EU-European Union

HSTP-Health Sector Transformation plan

IHCS-International Healthcare systems

IPM-Inspection and Preventive Maintenance

IT- Information Technology

MDR- Multi Drug Resistance

MEM- Medical Equipment Management

ME-Medical equipment

MEMM-Medical Equipment Maintenance Management

MEMU- Medical Equipment Management Unit

MRI -Magnetic Resonance Imaging

NICU-Neonatal intensive care unit

SOP- Standard Operational Procedure

WHO -World Health Organization

ZHD-Zonal Health Department

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Chapter One: Introduction

1.1 Background

Medical equipment is a core asset for any healthcare facility. Effectively managed medical equipment ensures the safety and quality of care in health facilities. Medical equipment management (MEM) consists of adequate planning, management and implementation which are essential for providing good health services and saving scarce resources(1,2). The important contributions of medical equipment (ME) to health care delivery ranges from small and simple devices such as sphygmomanometer to complex and big devices such as magnetic resonance imaging (MRI) machine (1,3).

Medical equipment is “essential requirements” of safety, performance, and quality and aims of “ensuring the functioning of the internal market and a high level of protection of human health and safety(4) and considered a crucial part of healthcare industry because it provides the quality health care that all stakeholders expect. It can be used either alone or in combination with any accessory, consumable, or other piece of medical equipment and excludes implantable, disposable or single-use medical devices (5,6).

World health organization defines the term 'medical equipment' as a wide range of instruments, equipment, machinery or apparatus whether used alone or in combination including the software necessary for the purpose of diagnosis, prevention, monitoring, treatment, or alleviation of the disease or used for medical and Para-medical purposes (3,7)and are one of the six building blocks identified by WHO as essential for all health systems (along with financing, health workforce, information, service delivery and leadership/governance). If one (or more) of these six components is missing or inadequate, health systems cannot function at the level necessary to improve the health of populations in a sustainable way (8).

Currently, the rapid and continuous technological evolution, which affects most production sectors, also involves healthcare(9) and has contributed immensely in improving the quality of health care and state of health profile of nations. A quality patient diagnosis and clinical management are largely relays on the availability of reliable on diagnostic ME (7). The complexity of the technological assets found in healthcare facilities, in terms of number and diversity, is due to the fact that it involves organizations with multiple areas with great interface and interdependence of work processes, for example, the infrastructure of facilities, medical

equipment, human resources, financial and essentially the mission to prevent or recover health and must be efficient so that the equipment can always be used safely and appropriately (9,10).

Worldwide, medical device demand will increase significantly due to a pronounced rise in the world aging population especially aged 60 and over are increasing faster than any age groups everywhere. Globally, there were 901 million aged populations in 2015 and this is expected to increase by 56% and reach 1.4 billion by 2030. The aging population in Sub-Sahara Africa is also projected to increase by 64% between 2015 and 2030(11).

In Africa, next to Nigeria, Ethiopia is the second most populous country of Africa and ranks 12th in the world with a population of about 101 million in 2020. Ethiopia is now facing a huge problem of triple burden of communicable diseases, non-communicable disease (NCD) and injuries affecting all age groups but with disproportionate burden on children and women of reproductive age group and experiences cyclical hazards that affect households, infrastructure, and systems resilience. Like many countries in the world, the global COVID-19 pandemic has also tested Ethiopia's health system resilience (12).

Before 20 years, service coverage and the quality of health services in Oromia was very low. Like other regions in the county, the health care system in Oromia faces many challenges like limited budget allocation from the government to the health sector, inefficient and inequitable use of health resources. Poor health service quality is due to shortages of medical equipment, drugs, and medical supplies, and lack of modern and improved health care services (13).

The role of the Biomedical Engineering Department in a hospital is to manage the hospital's ME and its goal is to provide electrically safe, calibrated and well-functioning equipment with the purpose of delivering best healthcare for patients and to present the best cost effective manner of maintaining equipment in a hospital(6,14). A biomedical engineer, basically, is an equipment manager, whose job is to provide the end-users or clinical staff with medical equipment(6). Biomedical equipment management thus presents a challenge for many countries, especially those with low technical resources like Ethiopia in both human and infrastructural. These challenges could broadly be classified into four categories: high rates of dysfunctional medical equipment, low density of biomedical engineering workforce, difficulty in procurement of spare and inventory management and difficulty in budget estimation for maintenance (15).

The Medical Equipment Management System (MEMS) is the way in which ME are acquired, used and conserved. MEM practices were important as human resource management to function a hospital in a maximum capacity. Accurate and comprehensive data are needed in order to have a good equipment management. It has several domains such as, procurement, accept, inspect, install, ensure performance within the accepted standards, safe and effective use, maintenance and service, repair, eventual retirement and disposal. Quality hospital equipment management is also important to reduce accidents caused by improper handling of unsafe equipment to the patients and staff (16).

Even though these all are the importance of medical equipment management practices, there were certain gaps. Savings Derived from Effective Procurement practices and Commissioning of medical equipment are purchase of sophisticated equipment for which operating and maintenance staff have no skills 20–40% of equipment remains under-utilize or unused, impact on equipment and buildings during installation(17). In utilization practice phase, training is basic one for the users, medical equipment maintainers and storage managers. The technician should learn application of equipment and basic background of medical matters. In general, about 70 – 80% of equipment are troubled by misuse or misunderstanding of equipment(3).

1.2. Statement of Problem

Worldwide Medical equipment management practices were the major problem in the current situation of health care services. On the other hand the demands of medical equipment were highly increasing due to aged population(11). 40 to 70 % of medical equipment in low- and middle-income countries are broken, unused or unfit for purpose; this impairs service delivery to patients and results in lost resources(18). The health care literature provides numerous examples of the poor performance of medical equipment in developing countries. In the case of Brazil 20 to 40 percent of the $2 billion to $3 billion worth of public sector medical equipment is not functioning(19).

The other major problem in MEM cycle is that safety issues. In 2012, among 51,944 medical device incident reports in England, 313 deaths and 4,577 sever injuries related to medical devices. Among these incidents, failure of the devices and user error represents 40% (20,574 incidents) and 15% (7,610 incidents) of total causes of the incidents. These incidents are supposed to be increased in developing countries(20).

A recent case study in Cameroon shows that 20 to 40 percent of their medical equipment stock is not operational. 60 percent of the equipment in medical units in a typical Third World country is not usable(19). The reported reasons for the increase in downtime of the equipment are mal-practices in medical device management system like insufficient availability of biomedical staffs, inefficient planning, incomplete inventory and documentation, reference materials, training, maintenance activity.

In the lowest performing country like Yemen, nearly half of the total stock of medical equipment is presently unused, representing wastage in monetary terms of over 30 million US dollars. The main problem is that lack of the inventory value of medical equipment in all hospitals(10). Poorly resourced equipment results in poor service delivery and low-quality patient care that can jeopardize patients' safety. There can be significant risk to patient health when equipment is misused For example, study in 2012, found that defective equipment, unavailable equipment, and dysfunctional hospital services were contributory factors resulting in adverse events to patients(21). Every year, 2.5 million neonates die, mostly in low- and middle-income Countries (LMIC) due to lack of good quality antenatal and intrapartum care as well as inadequacy of effective medical equipment like neonatal resuscitation ,radiant warmer for thermal care, nasal continuous positive airway pressure (CPAP). Implementing these requires education and training, particularly at the bottom of the healthcare pyramid, and advocacy at the highest levels of government for health policies supporting better newborn care(22).

Although medical equipment donations to low-resource settings have some merit, the WHO estimates that at least half of the medical equipment donated to low-income countries is unusable. Many factors contribute to this, with the key components being a shortage of biomedical technicians in developing nations as well as ill-regard to the true needs of the recipient hospital staff(23).

According to the WHO's efficiency rating used to measure overall health system performance, Ethiopia ranks 180th out of the 191 countries surveyed(24). The shortage and ineffective management of basic medical equipment accounts, in part, for the poor performance of the Ethiopian healthcare system. As an example, a 2014 study revealed that only 75% of general outpatient services of health facilities had thermometers and stethoscopes. At Health posts, which are small health facilities in Ethiopia serving rural communities, only 66% had the

aforementioned supplies available. Only 48% of health facilities had child scales in their outpatient area(11). Furthermore, in Ethiopian public hospitals, a WHO study showed that there are only two MRI machines and 12 computerized tomography scanners per 1,000,000 people(25).

In Ethiopia, significant reforms have been made in the healthcare infrastructure over the past few decades(26). For example a reform like Ethiopian health services transformation guide lines (EHSTG), Health Sector Transformation Plan (HSTP) were serve as a main guidelines even though there were some challenges like inefficient facility management and weak accountability, shortage of medical equipment, pharmaceuticals and lab supplies, inadequate number and management of ambulances, inadequate intensive care unit (ICU) equipment (12).

In a survey of 98 health care facilities in Ethiopia, only 27% had an available heat source in their delivery room, 12% did not assess breathing at birth, and only 66% had the recommended low-cost, essential equipment for neonatal resuscitation like radiant warmer, suction machine, composed of a self-inflating ventilation bag. Currently, these figures are expected to have worsened with the recent COVID-19 pandemics bringing a shortage of basic care and equipment. (22).

Only about 72% of medical equipment found in Addis Ababa public hospitals functional and in some hospital in the region functional equipment near to 50%. The rising number of these non-functional equipment are due to Poor equipment handling and utilization, frequent power surges, the age of the equipment, lack of operator training, lack of preventive maintenance, lack of spare parts, lack of maintenance capacity, and minimal knowledge regarding sophisticated equipment are factors that contribute to equipment breakdowns(27).

Well-functioning health systems must ensure access to safe and appropriate equipment for medical care. Without this important component of broader health technologies, countries cannot hope to achieve Sustainable Development Goal to ensure healthy lives and promote well-being for all, at all ages. However, in many low-income countries, health sector workers lack the practical skills to operate equipment effectively and technicians who can fix broken equipment either lack know-how or are unavailable(28).

As different study states, due to high importance of MEM, enough attention paid to this issue, especially in developing countries to provide comprehensive framework for MEM(2). However its management practices are not known in this health facility and the aim of this study is to assess level of medical equipment management practice in Tulu bolo hospital of Southwest Shoa, central Ethiopia and propose comprehensive frame work and recommendations.

1.3. Significance of the study

A successful MEM requires careful analysis of the underlying causes for the weaknesses of the existing system, to produce the desired outcome. The results from the study will assist and benefit in: Providing a baseline of performance against which subsequent quality improvements can be measured in planning, procurement and utilization of the study area, enhancing the capacity and skills of participants at health facilities, providing recommendations for improving the functioning of medical equipment and management.

The results of this study are believed to be of great benefit to: Hospital managers as they will be updated with major issues that affect health care delivery in their facilities and therefore be in a position to make sound judgments and decisions on the problem faced. Health sector partners supporting in the provision of will have better understanding of the current status of the hospital's medical equipment

The public will be benefited from the finding of this study after the concerned body utilizes the findings to improve medical equipment management Policy makers and researchers should use as the references about MEM practices in central Ethiopia

The reader will benefit from learning about different factors which are barriers and facilitators of management in the health facilities. Furthermore, the document is intended to illustrate the role of an accurate, detailed inventory, storage system, maintenance procedure and quality control in health care technology management and serve as supportive for decision making. Thus, the information in this study would be useful to researchers who might want to undertake further research into the area of MEM in public hospital.

Chapter two: Literature Review

Overview of medical equipment Management

Medical equipment management is an important issue for safety and cost in modern hospital operation(29). The four phases of MEM are planning, procurement, utilization and decommissioning(27). The systematic way to manage ME is to study and optimize all the above phases in the use full life of that equipment(1). Managing medical equipment's properly and efficiently, ultimately ensures that health care services are presented in a secured and successful manner(6).It is very crucial to implement MEM in the hospitals to manage and coordinate its cycle and follow procedures or cycle below to appropriately manage their medical equipment, allowing for the extension of services while ensuring the safety of its patients(27).

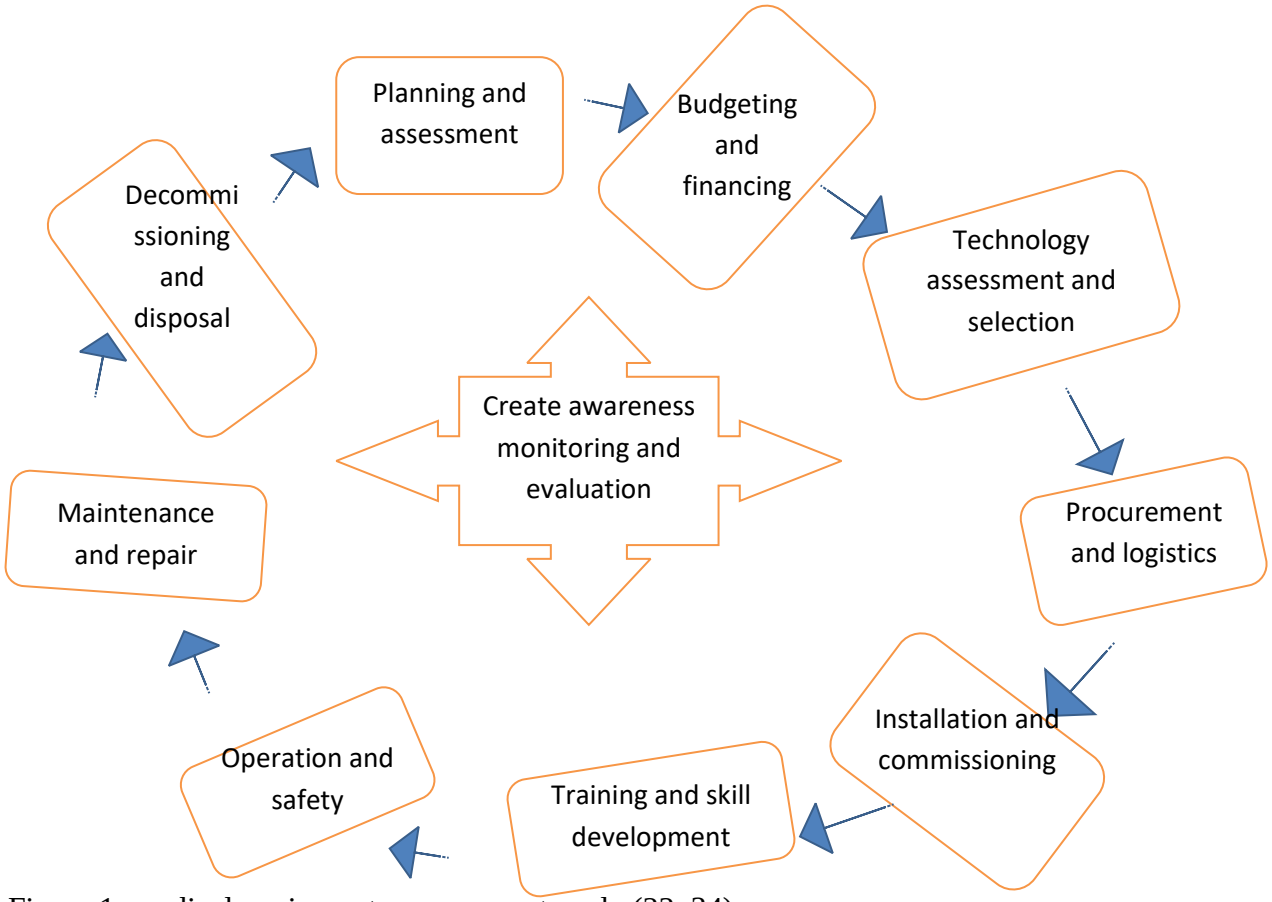

Figure 1: medical equipment management cycle (22, 34).

Planning phase

Planning practice of MEM includes the first two major activities which are planning and assessment, and budgeting and financing(30). The organization develops a plan for monitoring and updating software on medical devices, work closely with the organization's information technology team to research updates(10).The Head of Equipment Management Unit is responsible to implement the plan; with the assistance of other departments where relevant (for example administration and finance)(31).

Planning tools are used to determine the equipment that should be replaced or/and purchased. Whereas, the cost allocated for purchasing or replacing the equipment are determined by budgeting tools. Insufficient budget allocation for purchasing and replacing equipment will result absence of required equipment for the service and underutilization of the new equipment purchased(11).

Procurement practice of medical equipment

The technology assessment and selection, procurement and logistics, installation and commissioning are grouped under procurement(30). Procurement process starts by preparing the procurement document and ends by accepting the equipment and after acceptance process is completed and the equipment will start its lifetime. A first step in designing an effective equipment management program is documenting what equipment you have(32,33).

During financial limitation for purchasing medical equipment, the health facilities use system of prioritization in order to select the most important devices for delivering the intended services. Medical equipment prioritization is decided based on equipment availability to provide health services but not the costs or the technology advancement to provide the basic health cares. Based on this factor, equipment is classified as vital, essential and desirable or not so essential(11).

Utilization practice of medical equipment

Training and skill development, operation and safety, maintenance and repair are included in the utilization phase where the actual life time starts(27,30). The user and biomedical engineer training that include "technical and practical training." Engineers or technicians must undergo additional training because medical equipment is highly specialized and if improperly maintained or repaired, it may have adverse consequences on human life. Technical training

implies the principles and methods of maintenance, calibration; initial repairs and medical equipment management concepts(2).

The experience is inherent in medical training, but there is concern with current technologies. The nursing staff has little contact with equipment handling and practical knowledge(10). A key feature of a successful MEM system is that extensive use is made of Information Technology (IT). The use of an efficient IT effectively promotes the managing performance(29). Effective MMME is one of the major issues for quality of care and cost-effectiveness especially in modern hospitals. Hospitals should ensure that ME is kept in working condition, and is safe, accurate, and reliable and operates at the required level of performance effectively(2).

Improper maintenance of medical equipment leads to equipment downtime reduces the level of device performance, and wastes costs and resources. MEM, has different types: inspection and preventive maintenance (IPM) and corrective maintenance (15). The most common cause of medical equipment downtime is poor maintenance, planning, and management. To solve this problem, it is necessary to establish and regulate a system of proper maintenance(1,2).

Quality control practice is the key in maintenance and **today's** business environment; the biomedical engineer has the full support from technical manager and division director to provide and arrange high quality calibration and testing for medical devices at the hospital(15,34).The quality control tests include tests of safety, performance and calibration (35).

If the electrical safety is not guaranteed, the patient may be injured from it and also users can't use the device with confidence. Performance tests of medical equipment require special training and equipment that include technical, functional, laboratory and clinical tests(2).The MEM requires an organizational structure that ensures the effective acquisition, evaluation, qualification, transportation, cleaning, sterilization, maintenance, as well as during the procedures and operation of equipment (10).

The goal of medical equipment store management is to protect stored items from loss, damage, theft, or wastage and to manage the reliable movement of equipment from source to user in the most economical and expeditious way. A fully developed storage system has three key components: The first one is an inventory control system(36). The inventory management includes initial data collection, information update and annual audit/review on which the responsible department performs review of all the information about equipment inventory(5). The second one is a warehouse management system monitors the physical flow of goods within

the system such as recipients, store and issue. Warehousing and storage is an act of storing and assorting the finished goods so as to create maximum time utility at minimum cost. The third one is a performance monitoring system checks that the systems are operating effectively(36).

Decommissioning and Disposal of medical equipment

The last major activities are called decommissioning and disposal after the end of its life time (29). The health facility should establish Medical Equipment Disposal Committee to oversee the disposal of all medical equipment that is no longer required by that health facility. In effectively managed storage system, any items which are not functional is isolated from the normal equipment and stored in separate class until disposal(27).

Barriers or challenging factors

The Current Challenges faced by Health Care Technology Management System, especially in the developing countries are so many factors in the health facilities that can affect the effectiveness of MEM unless the health facilities control them through regular monitoring and evaluating. These factors include characteristics of facilities, management system, education (knowledge), resources, individual behaviors and the like(14).

The Components having an impact on the equipment management system primarily concentrates on institutional infrastructure, organization, human resources development and financial and logistics. Considering the research done on developing countries in five series, factors of ineffectiveness are: Factors related to Technology**,** Lack of equipment standardization, equipment Obsolescence, and factors related to hospital characteristics are site and size of health facilities, difference in Performance of hospitals, Poor equipment conservation culture, Weak infrastructure and organization, lack of trained maintenance staff, lack of trained equipment operators. The most common factors that can affect the practice of MEM are health facility context, resources, skill, individual behavior, and administrative system(10,19,37).

Contextual factors can be viewed from a variety of perspectives. Barriers to using medical devices are largely interrelated and stem from a mix of factors. The relative importance of each factor will vary with the context: geographical, social, cultural, economic, demographic, medical, reimbursement in which a medical device will be used. Devices to be used in a primary health-care center are likely to differ in design from those to be used in a hospital and so on(38).

Empirical literature review

Even though different research identifies gaps in each phase of MEM cycles, management practices are not known in this health facility. Either medical equipment or pharmaceutical is not managed effectively, unless the health facilities have enough storage capacity, more space, proper shelving. From assessment in Addis Ababa governmental hospitals: standard guidelines for storage(less than 45.45%), training for store managers (45.5%) and inadequate warehouse for equipment. However, new health facilities are not being equipped with sufficient shelving, and the facility management faces many competing priorities for their limited financial resources(39,40). Users sometimes failed to report equipment problems to technicians or administrators and regular preventative maintenance schedules were rarely followed(41).

A mixed quantitative and qualitative methods in Jimma Zone hospitals on 299 medical equipment finding, 196 (65.6 %) of them were available in Jimma University Specialized Hospital whereas, 57 (19.0 %) and 46 (15.4 %) were available in Limu Genet hospital and Shenen Gibe hospital respectively. Among 196 available medical devices in JUSH, 127 (64.8 %) were functional and the rest; 63 (32.1 %) and 6 (3.1 %) were not functional and not in use respectively. Similarly, 28 (60.9 %) and 30 (52.6 %) of the devices in Shenen Gibe hospital and Limu Genet hospital respectively were functional. The core part of MEM which is monitoring and evaluation is weak. The indicator is only 3 (1.01 %) of devices were monitored either once or twice per year in the three hospitals.it also identifies the failure in procurement phase of the cycle like purchase of unnecessary equipment(42).

The recent study in south west Oromia JUSH indicates that only 45% of the medical equipment's obtained by donation are functional and being utilized for their intended purpose while about 55% of the equipment's are found out of service due to different factors like equipment condition during receiving, lack of spare parts at local market, lack of well-trained professionals in the organization, maintenance and operation manual not accompanying the equipment(43).

Medical equipment lifetime will be reduced from 30 to 80 percent as a consequence of insufficient training and there will be a rise of nonfunctional equipment from 25 percent to 35 percent because of poor preventive maintenance activities(30). For national competitive biddings will take from four months to ten months and for international competitive biddings, it will last from five months to one and half year(44). Unforeseen at the initial tender stage extra

modifications or additions required for 10–30% of equipment, improper use of equipment by operating and maintenance staff who lack the necessary training loss of 30–80% of the potential lifetime of equipment(17).

In most systems, administrators or donors were left making procurement decisions without technical advice(32). A situational analysis indicates that cost equipment, lack of training, underdeveloped infrastructure, poor policies are the leading challenging factors in access and utilization of medical equipment in each country(45).

A study finding on effective MEM, comparison of the performance of three countries namely costa Rica, Ghana and Yemen using the method of central sources of information, direct enquiries at individual medical centers and interviews with health officials at central, regional and local level indicates 86.4%,74.1%,and 55.7% performance respectively. There is recognition that health technology management, including medical equipment is one of the areas of concern in health reform to transform(41).

Identified gaps from different literatures

Various studies reviewed previously have not adequately indicated extensively the role played by medical equipment management in improving the healthcare service in Ethiopia. Some studies done on medical equipment are from the point of the manufacturer; they didn't explore barrier factors of affecting MEM practice from the health facility perspective(38,46).

There is no published paper done specifically in south west Shoa zone, central Ethiopia on medical equipment management practice. Studies done on medical equipment Jimma zone hospitals, Southwest Ethiopia, conceders the availability and utilization, didn't touch the core of medical equipment management cycle and indicates that the limitation of difficult to fully understand and recommend the challenges in the MEM (42).

A study on the supply chain management of medical equipment in Addis Ababa city administration hospitals, conceders' only four factors like procurement, inventory, warehouse and transportation, which are not sufficient for understanding effective management of medical equipment and didn't include the effect of maintenance, documentation and planning system (47). Unless effectively managed, medical equipment has adversely affected the health sector in Ethiopia and contributed to poor performance. Therefore, it needs great need to investigate

further to get a solution. No study that have been comprehensively been done on barriers that affect medical equipment management in the health sector, in particular in south west Shoa, central Ethiopia and hence this study intend to fill these gaps.

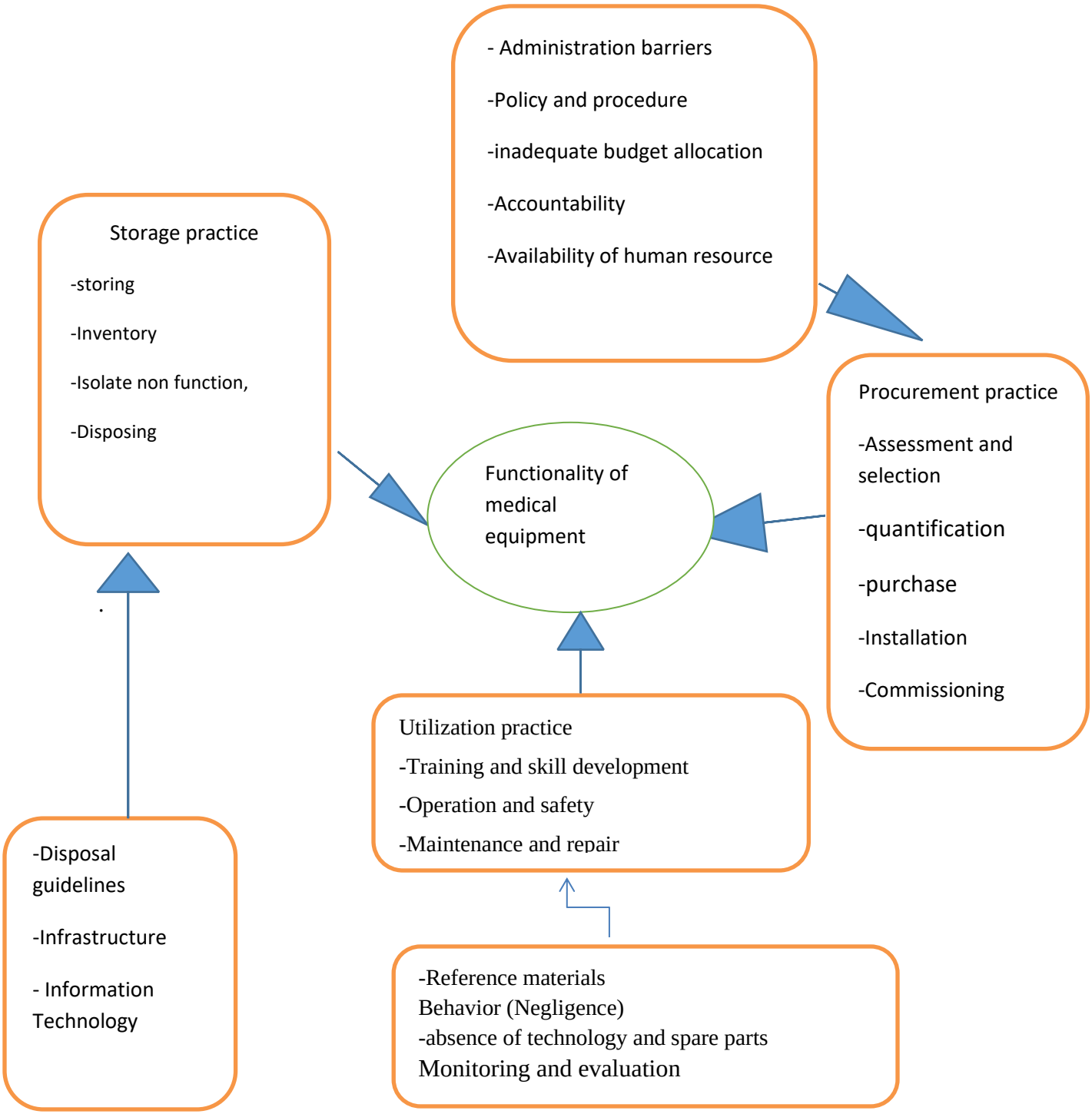

Figure 2:.conceptual frame work of medical equipment management practices(27,30,47) .

Chapter Three: Objective of the study

3.1. General objective

To assess medical equipment management practice and related factors in Tulu bolo general hospital, south west Shoa, central Ethiopia, 2022

3.2. Specific objectives

To assess medical equipment procurement practice in Tulu bolo general hospital, south west Shoa zone, central Ethiopia

To assess medical equipment utilization practice in Tulu bolo general hospital, south west Shoa zone, central Ethiopia

To assess medical equipment storage practice in Tulu general bolo hospital, south west Shoa zone, central Ethiopia

To assess factors affecting medical equipment management practices in Tulu bolo general hospital, south west Shoa zone, central Ethiopia

Chapter four: Methods

4.1. Study area and period

This study was conducted from 13/4/2014 to 30/5/2014 EFY in Tulu bolo general hospital southwest Shoa, central Ethiopia. According to the 2007 census conducted by central statistical agency of Ethiopia the catchment population of the zone is estimated to be 1,101,129 of whom 556,194 are men and 544935 women. Around 13.61% 0f populations are urban inhabitants(48). During this study, south west Shoa zone consists of eleven woreda and one city administration and has one general hospitals which is Tulu bolo general hospital and three primary hospitals namely Amaya hospital, Bantu hospital and Leman hospital which are recent and also has one missionary hospital woliso St. Luke hospital and fifty three health centers (50). Tulu bolo hospital is found in south west Shoa zone, Oromia Region, 81km from Finfinne. Established in 2002 EFY with Catchment population 1 million, has 106 beds (medical, surgical, gynecological and obstetrics, Pediatrics, neonatal intensive care unit (NICU), and multi drug resistance tuberculosis (MDR TB). The hospital has total human power of around 249 during the study.

4.2 Study design

Mixed qualitative and quantitative methods were employed to identify any causal links between variables and outcomes. Regarding the time dimension facility based cross-sectional study design was utilized.

4.3. Source population

Tulu bolo hospital heath workers and medical equipment on inventory list

4.4. Study population

All health professionals working in Tulu bolo general each service unit are study population and categorized as follows:

A. Professionals working as pharmacy head/medical equipment managers in Tulu bolo general hospital

B. biomedical engineers head, finance head, matron, hospital CCO and CEO of Tulu bolo general hospital.

C. Health service givers in all units (pharmacy unit, biomedical unit, outpatient unit, inpatient unit, delivery unit, operation room unit, laboratory unit, laundry unit of Tulu bolo general hospital.

4.5. Sample size determination and Sampling technique /Sampling procedures

In this study, census survey was the suitable sampling technique for small populations (200 or less) and minimizes sampling error.

Thirteen study participants specifically CEO,CCO, Quality officer, Finance head, Human resource head, Matron, Pharmacy head, Laboratory head, Operation room head, store manager, radiology team head and Biomedical team head were selected purposely for in depth interview due to their knowledge for the subject matter of this study(49). To capture a wide range of perspectives and gain greater insights into this study the participants will be grouped based on their expertise(47). Thirty types of capital medical equipment were selected purposely from the inventory and medical equipment history file. These thirty medical equipment account 199 in number (7,42).

Table 1: Total number respondents in Tulu bolo hospital with their specified profession and positions

Study population	Tulu bolo general hospital
Specialists	5
General practitioners	17
Emergency surgery officers	3
All pharmacists and druggists	12
All type of nurses and midwiferies	90
Anesthetics	5
Biomedical engineers and technicians	1
Laboratory technologists and technicians	11
Others i.e. radiology ,environmental, laundry personnel, electricity,	9
Subtotal	152
CEO, CCO, Pharmacy head, biomedical head, Finance head, matron, medical equipment store manager, QU	13

head, HR head, Dental clinic head, radiology head, OR head, Lab head	
total	165

Total study population in Tulu bolo general hospital (Obtained From respective human resource departments of Hospitals)

For qualitative part purposive technique was used. The respondents to be interviewed was selected purposely from care heads (CCO, CEO, ,finance head, store manager, biomedical engineering department head , lab head, radiology team head, matron and OR head were included. The rationale to use both types of sampling technique is because of the characteristics of the respondent to be used in this research.

4.6. Data collection methods and procedures (Instrument, personnel, data collection technique)

In this study both primary and secondary data collection methods were utilized. The Primary data collection method includes questionnaires, checklists, interviews and personal observation; whereas secondary data were obtained from various documents such as books, Journals, files and other written reports. Moreover, each variable has its own; computable questionnaires which were aggregated to percentage and then examined the effect of intervening variable and dependent variable. In addition, face to face interview were applied based on interview guidelines with key department heads.

4.6.1. Data collection tool

Adapted and pre-tested structured English version checklist for MEM practice. Document review, observation of medical equipment, interview were utilized in data collection from the study health facility. In this study, yes/no questionnaires, open ended questioners check lists were adapted from different articles. From 165, instrument was given to 156 health workers. The questionnaires were adapted and designed to collect both qualitative and quantitative data(11,27,47) and the questionnaire was administered only at work place of study participants.

4.6.2. Data collectors

Data was collected by four data collectors from the newly emerging waliso general hospital covid-19 treatment center. Their profession is two BSC nurses, one clinical pharmacist and one biomedical technician those who have ample experience on MEM practice. To assure the quality

of the data collected two professionals (one senior pharmacist and one biomedical engineer were assigned as supervisors from waliso zonal health department.

4.6.3. Data collection techniques

Data was collected through: Self-administered questionnaire, document review, in depth interview and observation of the medical devices(42).

4.7. Eligibility criteria

4.7.1. Inclusion criteria

All health professionals who worked in hospital and had experience of greater than 6 months are eligible to participate in the study

All medical equipment having generic name, were included.

4.7.2. Exclusion criteria

Medical equipment not in invoice and on shipping were not included

4.8. Study variables

Independent variables were procurement practice, utilization practice and storage practice. The associated factors which may influence MEM practice included were human resource, budget, administration and management, individual behaviors, policy and procedures, infrastructures, use of technology.

Functionality of medical equipment was the dependent variable or outcome.

4.9. Operational definitions

Procurement practice -Activities for availing medical equipment and assessed by Yes/No check list and was judged as good practice if ≥80% practiced.(50).

Utilization practice- Utilization is the way in which the medical equipment managers, primary users, maintaining personnel can manage, operate, and use from initial to disposal. Assessed by yes/no check list properly utilized if ≥80% practiced.

Storage practice- The way in which the health facility can handle the stock in the warehouse or service units' .This was assessed by yes/no check list properly managed if ≥80% practiced.

Functionality: Is the functional status of medical equipment to give the intended quality services and measured in terms of the operational performance.

Assessed from complete checkup 199 selected capital medical equipment from the inventory and computed as follows,

Functionality= (functional medical equipment/total selected equipment) x100

If ≥80 functional and ≤79.99 not functional. Finally judged compared the percentage perception of respondents on procurement, utilization, storage practices in hospital(50,51).

4.10. Data analysis procedures

The data was cleaned, coded and entered by using EPI data version 3.1. Then data was exported to SPSS version 23 statistical software for analysis. Results were presented in tables and figures. P value less than 0.05 will be considered as significant relationship and the odds ratio greater than one indicated there were positive relationship and the odds ratio less than one indicated the independent variables negatively affect the outcome.

The data was analyzed and presented by using descriptive statics like tables, percentages, averages, and charts. By using inferential statistics logistic regression and odds ratio to find out if there is significant effect between the determinants factors constructed as the independent variable with functionality in medical equipment management practice constructed as the outcome variable and finally the association of performance practices and functionality status of medical equipment in Tulu bolo general hospital.

Generally, the model that applied in the analysis provides the extent to which the independent variables affect dependent variable and presented in equation (1) as follows:

$$Odds\ of FUN = \frac{e^{B0+B1\ PRO+B2\ \mathrm{UTIL}+B3\ \mathrm{STOR}}}{1+e^{B0+B1\ PRO+B2\ \mathrm{UTIL}+B3\ \mathrm{STOR}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

FUN=Functionality of medical equipment management (dependent variable here)

Independent variables

PRO = Procurement

UTIL = Utilization

STOR = Storage system

ϵ=error term, which captures other variables not included in the model that affects the dependent variable

β0 =constant term or slope of the dependent variable

β1, β2, β3, estimate regression coefficients: Procurement, utilization and storage respectively

For valid hypothesis testing and to make data available for reliable results, the test of the assumption of regress ion model is required. The simple linear regression was not appropriate when the value of dependent is dichotomous variable because the expected value (or mean) of Y is the probability that Y=1 and therefore, is limited to the range 0 through 1 inclusive(52).

Validity test

The instruments were from guidelines and used by other researchers for similar studies. And some modifications were undertaken to fit with study area. Face validity was checked by experts. Pretest was undertaken in Amaya hospital by distributing instruments to 16 personnel and then communicated with colleagues. Frequent checks to ensure the completeness and consistency

Reliability Test

The logistic regression was different from linear regression. Parametric inferential tests were carried out on data that follow certain parameters: We do not need to assume linearity, homoscedasticity or normality

The scale produced Omnibus test chi-square 47.409 degree of freedom 20 with p value 0. 000 which was significant and the Nagelkerke suggested the outcome variable explained by 35%. The Hosmer & Lemeshow test of the goodness of fit is non-significant (Chi-square =13.456, df=8, p-value=0.097, which was >0.05) suggested that the model is a good fit to the data. Therefore the questionnaires were reliable (table2).

Table 2: test of goodness of fit

Omnibus test coefficient			
	Chi-square	df	P value
Step	47.409	20	0.001
block	47.409	20	0.001
model	47.409	20	0.001
Model summery			
Step 1	-2log likeli hood	Cox and Snell R	Nagelkerke R

		square	square
	168.62	0.262	.350
Hosmer & Lemeshow test			
Step 1	Chi-square	df	P value
	13.456	8	0.097

Df –degree of freedom

4.11. Data quality management

Questionnaires were pre tested in Amaya hospital by distributing to sixteen health workers to ensure the validity of the tool. After the data collection tool pretest, appropriate modification made, and vagueness was avoided and it became easily understandable. Data collectors were trained and provided the guide line for how to collect data. Principal investigator made frequent checks on the data collection process to ensure the completeness and consistency of the gathered information. Data was double entered to enable cross-checking during analysis as well.

4.12 Ethical consideration

Ethical approval was obtained from the Jimma University Institutional review board (IRB). Permission for the study was also guaranteed from Oromia regional health bureau and South west Shoa zonal health department and official letter was written to Tulu bolo general hospital to conduct a research. After getting permission from the hospital, participants were given informed consent form after the data collectors explained the aim of the study.

In this study, the researcher is ethical enough. The dignity, right and secrecy of individuals and institutions were respected. The researcher clarified the reasons and objectives of undertaking this research to respondents. Any person involved should be assured as nothing will happen on their right, security and psychology. At the beginning of the survey, the enumerators were trained and instructed to explain the purpose of the research to the respondents and to request their verbal consent before conducting the questionnaire.

Confidentiality of the information that respondents provided were ensured and their freedom of terminating the questionnaire /interview at any point and skipping any questions that they would not wish to respond to. Lastly, respondents were informed that any data they provide was kept confidential. The analysis undergone without mentioning names and the information they

provide was not use for anything, other than research purpose**.** All other sources of data and ideas were fully acknowledged.

4.13. Dissemination plan

These researches finding were presented and given in both hard copy and soft copy to Jimma University. Again the findings were given to Tulu bolo general hospital and Oromia regional health bureau.

Chapter five: Results

Socio Demographic Characteristics of Respondents

Table 3: summary of socio-demography of the respondents of assessment of medical equipment management practice of Tulu bolo general hospital

	Categories	Frequency	Percentage
Sex	Female	56	35.9%
	Male	100	64.1%
Age	20-25	18	11.5%
	26-30	78	50.0%
	31-35	43	27.6%
	36 and above	17	10.9%
profession	Nurses and midwifery	87	55.7%
	Physician	23	14.7%
	Pharmacy profession	13	8.3%
	Laboratory profession	12	7.7%
	others	21	13.465
Work experience	7month-5 years	58	37.2%
	6-10years	73	46.8%
	11-15 years	22	14.1%
	16 and above	3	1.9%
Marital status	Single	53	34.0%
	Married	100	64.1%
	Divorced	2	1.3%
	Widowed	1	0.6%
Educational level	Masters and above	9	5.8%
	Degree	114	73%
	Level/diploma	33	21.2%
Total		156	100%

Source: survey 2022

From the total 165 population of health professionals and other workers who have direct contact with medical equipment, 156 were completely responded to the questionnaires. When changed to percentage 94.54% response rate. 100(64.1%) were male. From the age categories the majorities of the workers were younger age. Only 17 workers were beyond 36 of age, while all the left 139 were under 35 ages. Majority of the respondents 87 (55%) were nurses while 23 (14.7 %) are physicians, and 13(8.3 %) were also pharmacy personnel. 12 (7.7%) were also laboratory professionals. The remaining 21 (13.46%) are other staffs. This may assure that the respondents are the right persons to provide information pertaining to the topic investigated (**table 3**).

Furthermore, it was evident that most of the respondents 73 (46.8%) had work experience of between 6-10 years, while 58 (37.2%) of the employees have served between 7month-5years. About 22 (14.1) served for 11-15 years .Moreover, 3 (1.9%) were served more than 16 years. The majority of respondents were married 100(64.1%). About 53(34%) were single while two of respondent are divorced and one was widowed. More than half of respondents (73%) have first degree while 21.2% of respondents were diploma holders and 5.8 % were master's degree holders and specialists (**table 3**).

5.1. Procurement practice

The respondents were asked whether Medical equipment requested and delivered timely or not. In this regard more than half 79(50.6%) respondents assured that there was no timely request and delivery of medical equipment in the hospital**.** Around 51.3% of the respondents replayed that received medical equipment did not consider the hospital setting and not installed according to manufacturer instructions. The respondents were also asked whether the procurement was being processed based on the quantification plan, 84 (53.8%) replayed the hospital procure based on the quantification plan. On average the procurement level of medical equipment was about 53.47% (**table 4**).

Table 4: summery of medical equipment procurement practices of assessment of medical equipment management practices in Tulu bolo general hospital

Procurement practice		Yes	No
Medical equipment requested and delivered timely?	Frequency	77	79
	%	49.4	50.6
The source of your equipment your equipment is donation	Frequency	101	55
	%	64.7	35.3
The source of medical equipment hospital budget	Frequency	83	73
	%	53.2	46.8
The source of medical equipment other health facility	Frequency	73	83
	%	46.8	53.2

Does the hospital have good working relation with Suppliers?	Frequency	90	66
	%	57.7	42.3
Commissioned medical equipment considers the setting and installed according to the manufacturer instructions?	Frequency	76	80
	%	48.7	51.3
Procurement is being processed based on quantification plan	Frequency	84	72
	%	53.8	46.2
Procurement practices	%	53.47	

5.2. Utilization practice

The respondents were asked whether the service units report non- functional medical equipment immediately using work order and the majority 90 (58.3%) responded that they did not report immediately. The respondents also asked whether they got training on how to operate and use. More than half 79 (50.6%) responded they did not trained. Sixty five (41.7%) of respondents replayed they did not handover medical equipment used in their team. About 95 (60.9%) responded they undergo preventive maintenance, but only 92(59%) based on schedule and about 53.8% got maintenance in a required time. Most of the respondents 100 (64.1%) also replayed that there are non-function medical equipment in their units. On average medical equipment utilization practice was 56.57 (**table 5**).

Table 5: summery of medical equipment procurement practices of assessment of medical equipment management practices in Tulu bolo general hospital

Utilization practice		Yes	No
Do all service units report nonfunctional medical equipment immediately using work order form?	Frequency	65	91
	%	41.7	58.3
Have you taken training on how to operate the medical	Frequency	77	79

equipment you are using in your unit?	%	49.4	50.6
Do you have handover system within the personnel in your team?	Frequency	91	65
	%	58.3	41.7
Do the biomedical department provide preventive maintenance to the ME you are using?	Frequency	95	61
	%	60.9	39.1
Is there scheduled PM for the ME you are using?	Frequency	92	64
	%	59	41
Do you get the maintenance service in a reasonable period of time?	Frequency	84	72
	%	53.8	46.2
Means of your communication through filling work order format?	Frequency	102	54
	%	65.4	34.6
Is there any machine in your unit which is not functional?	Frequency	100	56
	%	64.1	35.9
Medical equipment utilization practices	56.57%		

5.3. Storage practice

The majority 110 (70.5%) of respondents answered there were non-functional medical equipment in the store. The respondents also asked about the SOP of storage management, 84 (53.8%) responded it exists. The majority 103 (66%) responded they have proper inventory of medical equipment. The respondents were also asked the presence of proper stock keeping by bin cark, stock card and model system, only 71(45.5%) replayed they had record keeping. The majority 102 (65.4%) responded they didn't disposed any non-functional medical equipment yet, and on average medical equipment storage practices were only 45.88% (**table 6**).

Table 6: summery of medical equipment procurement practices of assessment of medical equipment management practices in Tulu bolo general hospital

Storage management practice		Yes	No
Stored equipment are fully functional	Frequency	46	110
	%	29.5	70.5
Existing SOPs that are followed to ensure proper storage	Frequency	84	72
	%	53.8	46.2
All medical equipment available in the hospital are listed in inventory and appropriately documented	Frequency	103	53
	%	66	34
There is proper record keeping by Bin card , stock and model 19/22 for medical equipment and spare parts	Frequency	71	85
	%	45.5	54.5
Have you ever disposed equipment finished the service time	Frequency	54	102
	%	34.6	65.4
Medical equipment storage practices	45.88%		

Table 7: Medical equipment status in Tulu bolo general hospital for observation and profile at MEMU

NO.	Medical equipment	Unit	quantity	Categories			
				A	B	C	D
1.	Anesthesia machine	Each	6	2	4	2	2
2.	Analyzer Hematology	Each	3	2	1	0	1
3.	Adult weight scale with accessories	Each	13	6	7	4	3
4.	Autoclave	Each	07	4	3	1	2
5.	Bed-infant/neonate	Each	9	8	1		1
6.	Bone drill	Each	9	5	4	unknown	unknown
7.	Centrifuge-Hematocrit, Electrical	Each	7	4	3	2	1
8.	Chemistry machine	Each	2	1	1	1	
9.	Couch-examination; gynecological	Each	7	4	3	2	1

10	CPAP machine	Each	3	3	0	0	0
11	Drum - Sterilizer, Large, 27x16.5 cm	Each	11	6	5	4	1
12	ECG Machine	Each	1		1	1	0
13	Fetal monitor doplar	each	5	3	2	1	1
14	Infant radiant warmer	Each	3	3	0	0	0
15	Hot air sterilizer	Each	7	3	4	2	2
16	Laundry machine	Each	3	1	2	1	1
17	LED phototherapy light	Each	3	1	2	2	0
18	Light-Operating, Mobile	Each	3	2	1	1	0
19	Microscope - Binocular, LED	Each	4	1	3	2	1
20	Monitor – Patient	Each	10	7	3	2	1
21	Oxygen Concentrator	Each	14	10	4	4	0
22	Otoscopy machine	Each	14	9	5	unknown	unknown
23	Pulse Ox meter:	Each	12	8	4	2	2
24	Pop cautery machine	Each	1	1	0	0	0
25	stretcher	each	15	4	11	4	7
26	Refrigerator	each	9	4	5	2	3
27	Ultrasound-General Purpose, Color Doppler, Mobile	Each	4	4	0	0	0
28	Wheel chair	Each	9	6	3	1	2
29	Water distiller machine	Each	2	1	1	1	0
30	x-ray machine	Each	3	1	2	1	1
	total		199	114	85	43	33

Note: A-Functional, B- Not functional, C-Need maintenance, D-Need disposal

Total numbers of medical equipment selected were 199. From these only 114 were fully functional and 85 were non-functional (43 need maintenance and 33 need disposal.

Percentage of functionality= (functional medical equipment/total selected equipment) x100

= (114/199) x100

= 57.3%

The observation of medical equipment directly and from inventory list, interview from the coordinators, history profile of medical equipment at biomedical department the functionality of medical equipment and MEMC the result 57.3%.Out of 42.7% of non-functional medical equipment, 38.8% were which needs disposal(**table 8**).

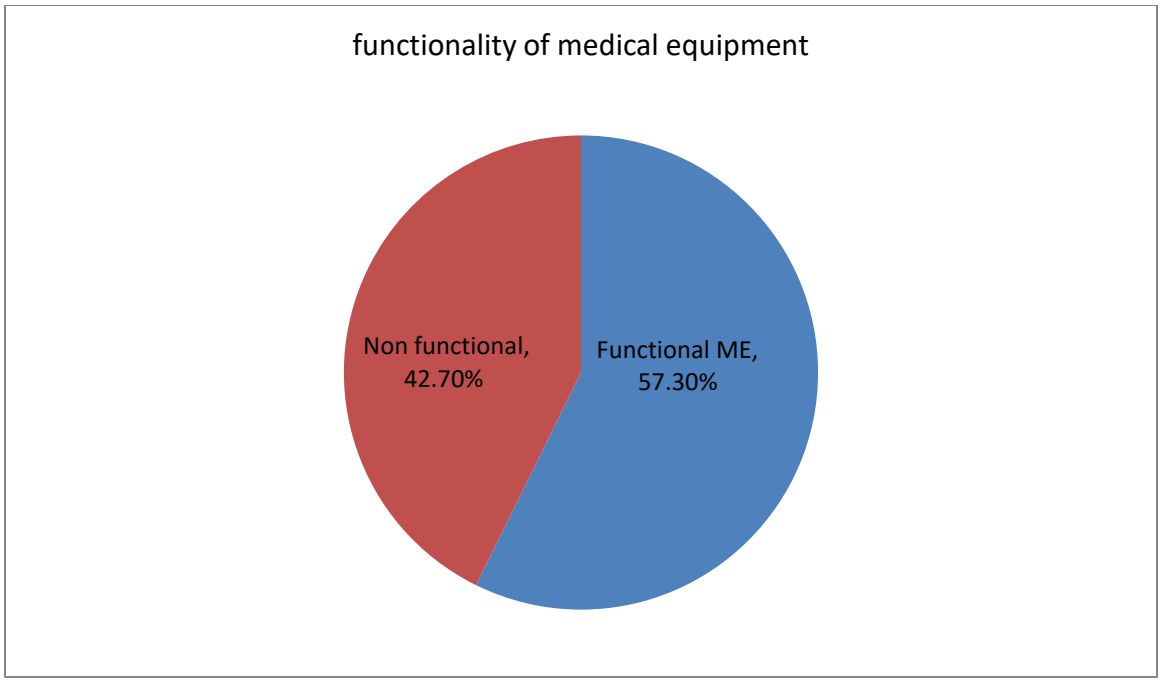

Figure 3: Functional status of medical equipment in TGH

Percentage of functionality of MEMC = (criteria fulfilled by hospital/total criteria to be fulfilled) x100

Criteria fulfilled from the check list-11

Total criteria on the check list-20

= (11/20) x100

=55%

Observation and document review findings

From visual observation there were no any bin card and stock card recorded by both store manager and pharmacy head. There were two oxygen cylinders found at store received from Kemete health center but didn't recorded on the model 19. Two mobile operation light were given to Bishoftu hospital has no model 19 and request letter. From Oxygen bill review at finance, one oxygen cylinder not returned to hospital from chora oxygen and other gases manufactory center. Damaged machines like x-ray, refrigerators, examination beds, laundry machines, suction machines etc. found indifferent sites. From review of incident report, three health workers injured when using medical equipment. Eleven operations cancelled in recent three years due to medical equipment (1 case due to x-ray machine,2 cases due to generator

maintenance and 2 cases due to stock out of anesthesia drugs,2 due to lack of catheter,4 cases due or light dysfunction (Elective surgery registration book, models, incident report Tulu bolo general hospital, 2022)

Almost all (92.3%) of the participants in qualitative study were almost male. About 84.6% had work experience of more than 5 years, minimum 3 years to 27 years of experiences and 92.3% (were degree and above holder. Thematic areas of the in-depth interview result include factors influencing management practices , appropriate medical equipment utilization and functionality, presence of sufficient human power to utilize, the involvement of appropriate professionals in the order, purchase and procure and utilize the medical devices, handling of safety issues (hazards due medical equipment use), service cancelation due to failure of medical device, presence of responsible person for the equipment, presence of policy/ guideline document for the equipment utilization, recommendations to solve the problem due to mal-function of medical equipment

A key informant from medical equipment store stated that:

> *…, medical equipment procurement practices were not based on schedule to buy medical equipment, but undergo the procurement based on the need and most of medical equipment received by donation and they did not have enough spare parts (*female druggist, 26,*) and here one KII added…, there is no involvement of hospital in decision making to receive the medical equipment (*male biomedical engineer, 27years*),…,*

One key informant also added:

> *…, the hospital has no adequate budget for medical equipment as that of pharmaceuticals and this was why medical equipment not availed in quality and quantity and purchase of medical equipment has much higher regulatory registration than medicines. Regulations like pre-procure agreement with the supplier that is EPSA (*male medical doctor, 39 years*).*

Similar idea was added from a key informant from finance*,…, EPSA was not interested to give us the stock out in reasonable time and if we request medical equipment through agreement, it may take long period of time even from 6months to one year duration added by (*male, 33years*).*

Medical equipment was the key element in health care system and needs care; majority of the respondents replayed that there were no proper hand overing system and one of the key informants mentioned*:*

*…, medical equipment users did not care for the medical equipment they used and even they did not hander the medical equipment and most of the service units didn't report the medical equipment and different non- functional medical equipment are seen during the inventory. If vital medical equipment medical equipment stops functioning, they bring it to the store and take the new one rather than consulting biomedical engineers through work order sheet (*male 27years, biomedical engineer*).*

*Similarly, this idea was supported by one physician from dental clinic… there is no sufficient training about medical equipment for store keepers, technicians and users. Sometimes they didn't know the name of the medical equipment stored there and arrangement is not attractive (*male medical doctor, 33years*).* A key informant interview of pharmacy head adds*…, biomedical engineers do not have enough training to do preventive maintenance for most and to fix when impaired especially not consider inspection and preventive maintenance (*Male, 35 years, pharmacist*).*

In addition, even though the procurement was the basic in measuring the quality of medical equipment, it didn't get sufficient attention, one key informant stated that:

> *…, the challenge in MEM starts at procurement, they didn't involve us in setting specifications due to this some medical equipment are not working from the begging, some impaired when they start to use due to inappropriate electric power, most equipment become out of use due to careless handling by professionals, and lack of preventive maintenance, overload above the capacity of the equipment (*male 36 years, physician*).*

Concerning medical equipment utilization, two key informants contradicted that:

> *…, we didn't' got the maintenance in a reasonable period of time and sometimes we rewrite the work order and report to the medical director. When we ask them, they respond us we are searching for spare parts and even they were busy more (*male, 3years,nurse*) and here one from biomedical unit complained that …, the service unit didn't report according to the work order format, but simply ask us verbally, and this felt us over burden(male 27years, biomedical engineer).*

As a key informant from laboratory,

> *…, Last year I was member of inventory team and we found some non-functional medical equipment in the store. Inventory system in our hospital was attractive and we count medical equipment found in store as well as in the service units and report to the CEO and finance management. In addition bin card was not recorded and only model 19 during receiving and model 22 for issuing were utilized. The stock card also not used to control the stock. Sometimes medical equipment left in the service unit without thatching the model simply verbal transfer especially during the transfer and change the unit (male 32 years)*

Again a key informant from laboratory states on safety issues *…, there were non-functional medical equipment distributed everywhere in the hospital and are risky in cleanliness and safety. For example two health workers were injured one during inventory and the other one at the service area by oxygen cylinder on her bare foot (male 32years, lab technologist).*

Similarly, one key informant from radiological team head added that:

> *…., before some year one digital x-ray machine was stopped working and biomedical engineers couldn't maintain it and consult the biomedical engineers at the regional level and also they didn't maintain it. The hospital felt problem and the imaging stops for around three months and RHB avail one new machine. Because of lack of space the previous one was improperly detached and the new one installed. While the medical equipment professionals came from abroad to maintain, the machine was already damaged and some spare parts like cable given to other health facility so at that time a four million machine become out of service(*Male 31years,radiology technologist).

A key informant from operation room stated *"Most of the received medical equipment were from donation not by hospital budget and not based on the need of the hospital. For example last year we encounter the problem from lack of radiant warmer while reputedly donated infant incubator with low quality which even full our store and added different medical equipment were not gave the intended services for example Electro cardio graph (ECG) machine returned to store due to*

the software language sated by Chinese even though the hospital has no other ECG machine (male, 32 years, emergency surgery).

Finally from the interview theme, a key informant recommended that: …, *the health care workers and administrative parts should bide to EHSTG guidelines to dispose medical equipment finished the service time and generate financial resources (male 35years, pharmacist) supported by KII physician…,(*male,37years).

A key informant from quality unit coordinator also recommended *... the health facility should update the workers especially on functionality of medical equipment as it is the first KPI the donors should involve the hospital in decision making to receive or not the medical equipment and accessories, reference manuals and should be included (KII$_{69}$, 36ages, Medical doctor, 2022) and this recommendation was supported by key informants leading human resource…,capacitated workers were very crucial and RHB should strictly follow and fill the gap as it was regional mandate,…(*male 46years,mamagment).

Advanced Data analysis

The correlation between Functionality of medical equipment with procurement, showed there exist positive medium correlation (r=.410 and p (.000) <0.05)). On the other hand, the correlation between functionality of medical equipment with utilization was also positive correlation (r= 0.293 and p=0.000). Again the correlation between functionality of medical equipment and storage practice was small and positive correlation (r=0.215 and p=0.005) <0.05)). Generally, all variables were correlated positively with functionality, even though their correlation strength varies. The independent variables have no any correlation with each other (**table 8**).

Table 8: the relationship between procurement, utilization, storage practices and functionality of medical equipment

		procurement practice	utilization practice	storage practice	functionality
procurement practice	Pearson Correlation	1	.332**	.345**	.410**
	Sig. (2-tailed)		.000	.000	.000
	N	156	156	156	156
utilization practice	Pearson Correlation	.332**	1	.233**	.293**
	Sig. (2-tailed)	.000		.003	.000
	N	156	156	156	156
storage practice	Pearson Correlation	.345**	.233**	1	.215**
	Sig. (2-tailed)	.000	.003		.007
	N	156	156	156	156
functionality	Pearson Correlation	.410**	.293**	.215**	1
	Sig. (2-tailed)	.000	.000	.007	
	N	156	156	156	156

** Correlation is significant at p value 0.01 levels (2- tailed)

Table 9: Functionality without and with explanatory variables (procurement, utilization and storage practices)

		Predicted		
		Functionality		Percentage
Observed		YES	NO	Correct
Functionality	YES	75	0	100.0
	NO	81	0	.0
Overall Percentage				51.9

		Predicted		
		Functionality		Percentage
Observed		YES	NO	Correct
Functionality	YES	47	28	62.2
	NO	18	63	77.8
Overall Percentage				70.5

The model that includes the explanatory variables (procurement, utilization and storage practice) is now correctly classifying the outcome for 70.5% of the cases compared to 51.9% in the null model (**table 9**).

The output in the Variables in the Equation table provides the regression coefficients (B), the Wald statistic (to test the statistical significance) and Odds Ratio (Exp (B)) for each variable category. The procurement overall effect (df=1, B1=1.470, OR =4.349 p=0.0, 95% CI between 2.045 and 9.241). The utilization overall effect (df=1, B2=0.79, OR =2.203 p=0.033, 95% CI between 1.075 and 4.618). The storage practice overall effect (df=1, B3=0.313, OR =1.367 p=0.423, 95% CI between 0.637 and 2.939) (**table 10**).

Table 10: MEM practices as predictors of functionality of medical equipment

		B	S.E.	Wald	df	P value	OR = Exp(B)	95% C.I.for OR	
								Lower	Upper
Step 1[a]	Procurementcat(1)	1.470	.385	14.610	1	.000	4.349	2.047	9.241
	Utilizationcat(1)	.790	.371	4.541	1	.033	2.203	1.065	4.556
	Storagecat(1)	.313	.390	.642	1	.423	1.367	.636	2.939
	Constant	-1.429	.370	14.913	1	.000	.240		

a. Variable(s) entered on step 1: Procurementcat, Utilizationcat, Storagecat

Generally, the effect of the three independent variables on the functionality of medical equipment expressed by logistic regression model as the following equation, the storage practices were not included in the equation as it is not significant.

$$FUN = \frac{e^{-1.429+1.470\ PRO+0.79\text{UTIL}}}{1+e^{-1.429+1.470\ PRO+0.79\text{UTIL}}}$$

FUN=functionality, PROC=procurement practices, UTIL= utilization practices,

Chapter six: Discussion

According to the finding the performances of procurement practices were only 53.47%. A study in Addis Ababa public hospitals were 50% comparable with this finding (50). The finding shows that the utilization practices were only 56.57%. This result was similar with the recent research finding in the eastern Wollega which was 57.8%(7).

From the study finding, the level of storage management practices was around 45.88% which in turn affect the functionality of medical equipment. The store rooms of medical equipment were separated from other supplies and furniture. But certain laboratory supplies, reagents and intra-venous fluids were stored mixed. And this result was similar with the finding in Government hospitals of Addis Ababa on laboratory commodities which only 45.45% of them had storage guidelines and comparable with 54.55% did separation of hazardous chemicals and supplies from other commodities(40).the reason for the difference with this findings were that there were no disposal of medical equipment in Tulu bolo general hospital and non-functional medical equipment hold huge space.

The finding indicates 42.7 % of medical equipment in Tulu bolo general hospital was not functional and not in use out of 199 inventory lists. This finding was comparable with the study conducted in Jimma zone, using observation and interview showed that 299 medical devices were available in the three hospitals and on average about 40.6% were non function (42). From the finding the reason for low functionality of medical equipment were lack of training, improper handovering, inefficient procurement practices, lack of reporting non-functional medical equipment with work order sheet, inadequate spare parts and budget. Non-functional medical equipment in Tulu bolo general hospital were slightly greater than that of the finding in Jimma zone and this may be due to the difference in level that is Jimma university specialized hospital was included in the study. The studies in Tanzania showed about 40% of medical equipment in the developing world were out of services. These facts have clear indication for health outcomes in these countries with the patients suffering from lack of accurate diagnostic or adequate treatment(53).

From the finding, functionality of those who well practices the procurement of medical equipment was 4.349 times greater compared to those not well practiced. Again functionality of a well-practiced utilization was 2.203 times greater than that of not well practiced. But the effect

of the storage shows statistically not significant (table 10). The finding was related to the study in public hospitals of Addis Ababa city administration which was at p value 0.00 (47) and the utilization practice result was similar with that conducted in JUSH at CI (1.124,4.228) and OR 2.180(43). The effect of medical equipment practices were not significant and this may be due to the study was conducted in a single health facility.

In contrast to the above finding, the study findings in China which indicated 77% of medical equipment under study showed an adequately managed and only 23% of the medical diagnostic equipment were underutilized(54).The difference in this finding may be due the economic level of the country that economically, China was one of the leading country while our country was developing country. The medical equipment management performance in public hospitals of Costa Rica and Ghana were 86.4% and 74.1% respectively(19). This difference could be due to the level of study hospitals and the training of the operating staff in the study hospitals.

When triangulating the qualitative response on lack of training, lack of policies and procedures, low testing inspection performance, physical space to install the procured item, absence of schedule record keeping by the hospitals were supported by the research finding in JUSH(43).

In south Sudan on pharmaceutical logistics reveals that many facilities 75% has a separate store assigned for but with inadequate space and many facilities do not adhere to the proper guidelines(55). There is no timely request and delivery, absence of schedule to procure, inadequate spare parts, lack of human resources, lack of efficient technology were some of crucial problems.

Again when triangulate the interview finding, improper use of SOPs, lack of disposal of medical equipment finished service time and absence of the use of technology like HCMIS software to manage stock. The low composite rate of disposal management is comprised of absence of policies and procedures, unable to conduct disposal regularly, absence of fixed asset committee and lack of clear direction on the identification of unusable medical equipment(50).

The results that obtained from observation and key informant especially on operation cancelations and incident report were evident when compared with the qualitative study in Canada(49). The study conducted in Benin on factors that affect medical device access and utilization in selected hospitals and health centers identified; unavailability of medical devices,

lack of spare parts of medical devices, equipment service manuals and lack of equipment for implementation activities(56).

Limitation of the study

The study was conducted only in Tulu bolo general hospital and didn't include suppliers like whole sales and EPSA which do have great potential to identify problems related medical equipment management practices of the study area. A longer time and enough resources would have helped to come up with more findings especially with other healthcare institutions in other regions of the country. The expected finding may be biased due to self-administered questionnaires. The study didn't include the brand or the origin of medical equipment that this may affect the quality and durability of medical equipment.

Chapter seven: Conclusions and recommendations

7.1. Conclusions

The study aimed to identify whether the procurement practice, utilization and storage practice can affect the functionality of medical equipment and determinant factors of medical equipment management cycle. From the finding the storage practices were the lowest practiced and procurement and utilization practices were comparably higher. All the three medical equipment management practices were not well practiced and medical equipment management cycle in Tulu bolo general hospital was not effectively managed this is why the majority of medical equipment were nonfunctional.

7.2. Recommendations

As we have seen in the result and conclusions of the study medical equipment were not functional which in turn contributes to poor healthcare service delivery and low patient satisfaction. Therefore, the following stake holders should bring the changes in recommended issues.

Medical equipment management committee (MEMC)

Should monitor medical equipment on inventory manually and electronically and update when there is transaction

Follow up end users to handover and report nonfunctional immediately

Senior management team and Governing board

The hospital administrative body and senior management team should undergo regular monitoring and evaluation on medical equipment management practices.

The GB and SMT of the hospital should add the capital medical equipment in the minutes while discussing about the hospital strategic performances and should mobilize the resource by developing the business plan to overcome the shortage of budget for medical equipment.

Hospitals shall work together with universities and partners on arranging trainings of medical equipment maintenance, utilization and handling before they are involved in using medical equipment.

FMHACA

The FMHACA has to accelerate approval of the national list and specifications of medical equipment and have to prepare national donation guideline on medical equipment or revise the drug donation guideline to address specific situations relevant to medical equipment. Hence, in order to avoid poor quality of medical equipment FMHACA has to introduce stringent regulatory requirements for the registration of medical equipment.

IPAS, ICAP and USAIDs

Donors should involve the hospital in decision making whether to receive or not medical equipment. The medical equipment should be availed with all necessary spare parts and accessories. The medical equipment donated should consider the hospital setting and manufacturer based installations.

Oromia regional health bureau (ORHB)

The RHB should capacitate the health professionals who use the medical equipment in the regular bases and should arrange the work shop Campion using the senior biomedical engineers to transfer the experiences and should avail adequate human resources especially biomedical engineers at hospitals.

Researchers

Further research should be conducted to account for other factors taking the same topic, but covering a different location other than south west Shoa Tulu bolo general hospital so as to determine whether there exist some variance in the findings by using other research design different from cross sectional. It is also possible to address factors like planning, monitoring and evaluation, and replacement system of medical equipment.

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Annex

Questionnaires

ASSESSMENT *"*MEDICAL EQUIPMENT MANAGMNET PRACTICE IN TULU BOLO GENERAL HOSPITAL, SOUTH WEST SHOA, CENTRAL ETHIOPIA*"*CONSENT FORM FOR THE STUDY PARTICIPANT

Good day. My name is _____. I am here to collect data in your facility that is needed for thesis titled *"*MEDICAL EQUIPMENT MANAGMNET PRACTICE IN TULU BOLO GENERAL HOSPITAL, SOUTH WEST SHOA, CENTRAL ETHIOPIA*"*. A Research to be Submitted to, Department of Health Management and Policy, Faculty of Public Health, Jimma University Institute of Health; in Partial Fulfillment for the Requirement for masters of health care and hospital administration by principal investigator **Sirnan Humnesa**. This survey is done in selected health facilities of south west Shoa.

Your participation is completely voluntary. All of the information you provide is strictly confidential. No one other than the research team will have access to your responses. Your personal identifiers such as your name will not be used. The principal investigator will not refer to individual respondents or individual facilities in the report, but rather will describe the overall picture of all facilities.

Do I have your permission? **Yes 1 No 2** If Yes, Continue

For comments/questions please contact **SIRNAN HUMNESA** (0913305216), principal investigator for the study.

I. Socio demographic questionnaires (For all respondents)

1. Sex? ____
    a. Female
    b. Male
2. How old are you? _____please write numerically
3. What is your profession? Write down_____
4. How many years of work experience did you have up to now?
    _____in numeric
5. What is your level of education?

a. Muster degree and above
b. Degree
c. Level (Diploma)
d. High school level
e. Other, specify_____

6. What is your marital status?
    a. Single
    b. Married
    c. Divorced
    d. Widowed
7. What is your position----------for those who are team leaders

II. Medical equipment management practice related questionnaires

1. Questionaries' that I will use in quantitate data collection

No.	Descriptions	Yes	No
	Assess the medical equipment **procurement** practice		
1.	Medical equipment requested and delivered timely?		
2.	The source of your equipment your equipment is donation		
3.	The source of medical equipment hospital budget		
4.	The source of medical equipment other health facility		
5.	Does the hospital has good working relation with Suppliers?		
6.	Does the procurement of ME consider setting of the hospital and installed according to the manufacturer instructions?		
7.	Procurement is being processed based on quantification plan		
i.	Assess the medical equipment **utilization** practice		
1.	All medical equipment in the hospital are calibrated and maintained as manufacturer's recommendations		

2.	Do all service units report nonfunctional medical equipment immediately using work order form?		
3.	Have you taken training on how to operate the medical equipment you are using in your unit?		
4.	Do you have handover system within the personnel in your team?		
5.	Do the biomedical department provide preventive maintenance to the ME you are using?		
6.	Is there scheduled PM for the ME you are using?		
7.	Do you get the maintenance service in a reasonable period of time?		
8.	Means of your communication through filling work order format?		
9.	Is there any machine in your unit which is not functional?		
ii.	Medical equipment **storage and disposal** practice		
1.	Stored equipment are fully functional		
2.	Existing SOPs that are followed to ensure proper storage		
3.	All medical equipment available in the hospital are listed in inventory and appropriately documented		
4.	There is proper record keeping(Bin card, stock card, model 19, model 22) for medical equipment and spare parts		
5.	Have you ever disposed nonfunctional medical equipment		

iii. Medical equipment management check list to ask team leaders/MEMC and observation

No.	Description	Yes	no
1	A Medical Equipment Management Unit has been established.		
2	Medical Equipment Management unit have workshop separate from the General Maintenance Workshop, Are there sufficient tools for conducting medical equipment maintenance Are there sufficient test equipment do you have millimeters do you have oscilloscopes do you have function generators do you have thermometer do you have Electrical safety analyzer do you have physiological simulators do you have defibrillator analyzer do you have radiation analyzer do you have ventilator analyzer do you have electrosurgical analyzer Are there appropriate safety extinguisher, eye google, boots etc.		
3	Medical Equipment Management unit with an operational plan,		
4	Medical Equipment Management unit with required staff and led by a Biomedical Engineer?		
5	A Medical Equipment Management committee has been established.		
6	Terms of reference for the Medical Equipment Committee are defined.		
7	An inventory management system to manage medical equipment has been established.		
8	An inventory management system to manage spare parts of medical Equipment has been established.		
9	An Equipment History File system has been established.		
10	There are policies and procedures for medical equipment acquisition.		
11	There are policies and procedures for medical equipment commissioning		
12	There are policies and procedures for medical equipment donations.		
13	There are policies and procedures for medical equipment disposal.		
14	There are policies and procedures for outsourcing of medical equipment servicing.		
15	A maintenance notification and work order system has been		

	established.		
16	Preventive maintenance of medical equipment is scheduled and conducted.		
17	Inspection and testing of medical equipment is scheduled and conducted.		
18	All new equipment undergoes acceptance testing		
19	Identify Equipment those need regular Calibration and made calibration as per the manufacturer recommendations		
20	Are all newly procured medical equipment under goes Procurement agreement management		

Received from Ethiopian Hospital Management Initiative, Medical Equipment Management, chapter 15 August, 2017 Version 1.0

JIMMA UNIVERSITY
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ቀጥር Ref.No HBMS76/14
ቀን Date December 02/2021

To: South West Shoa, Zone Health Office
Woliso

Subject: Support letter

A student of Masters of Science in Health Care and Hospital Administration (MSc – MHA) whose name is **Sirnan Humnesa** has got ethical approval from Jimma University Institutional Review Board on November 23,2021 with a reference Number of IHRPGn/71 for his thesis proposal entitled as **"Medical equipment Management practice in Tulu Bolo General Hospital** South West Shoa Zone, **Central Ethiopia."**

Therefore, we request your good office to support his/her research endeavour as the partial fulfilment of master's degree by **providing relevant data as well as any resource support** so as to help him collect adequate data and reach tangible result for both academic and administrative purpose.

With regards,

Shimeles Ololo Sinkie
(Asso. Professor)
Head, Department of Health
Policy & Management

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Ref.No: IHRPGm/71/
Date: 23/11/2021

To : Sirnan Humnesa

Subject: Ethical Approval of Research Protocol

The IRB of Institute of Health has reviewed your research project " **Medical Equipment Management Practice In Tulu Bolo Hospital In South West Shoa Zone, Central Ethiopia**"

Thus, this is to notify that this research protocol has presented to the IRB meets the ethical and

Scientific standards outlined in national and international guidelines. Hence, we are pleased to inform you that your research protocol is ethically cleared under the following strict conditions:

1. Any significant deviation from the methodological details indicated in the approved protocol must be communicated to the IRB before it has been implemented.
2. Approval shall be only for a period of twelve months. The principal investigator is required to submit an application for the renewal of the ethical approval.
3. The Committee must be notifi Determinants of delayed care seeking for TB suggestive Symptoms in Siltie Zone, Southern Ethiopia: A community based unmatched case-control study ed, in writing, of any alteration to the project including unforeseen events/circumstances that might affect the acceptability of the approved protocol.
4. The Principal researcher is required to immediately notify the committee in the event of any adverse effects on participants or of any unforeseen events that might affect continued ethical acceptability or amendment to the original consent form.
5. The inability of the Principal Researcher to continue in that role, or any other change in research personnel involved in the project, should be communicated.

IRB, Chairperson

Million Tesfaye, PhD
Tel: +251917063744
E-mail: ethicsjuirb@gmail.com

Biiroo Eegumsa Fayyaa Oromiyaa
Oromia Health Bureau
Saarbet (Calcalii) - Finfinnee

-የኦሮሚያ ጤና ጥበቃ ቢሮ
ሳርቤት(ጨልጨሊ) - ፊንፊኔ

Lakk/Ref.NO BEFO/HBTFH QTB/1-16/3031
Guyyaa/Date 12/04/2014

Hoospitaala Tuuluu Bolloo tiif

Tullu Bolloo

Dhimmi: Xalayya Deggersa Ilaala

Akkuma beekamu Biiroon Keenya Ogeyyii , dhabbilee akkasumas namoota qorannoo geggessuuf propozaala dhiyeffatan propoozaala isaanii madaaluun akkasumas iddo biratti ilaalchisani fudhatama argatan (approved) dhiyeffatan, propoozaala isaanii ilaaluudhaan waraqa deggersa ni kenna. Haaluma kanaan mata duree **"MEDICAL EQUIPMENT MANAGEMENT PRACTICE IN TULU BOLO HOSPITAL IN SOUTH WEST SHOA ZONE, CENTRAL ETHIOPIA''** jedhamu irratti barataa digirii lamaffaa kan ta'an **Obboo Sirnan Humnesa Kabeta** Godina keessan keessatti qorannoo geggessuuf propoozaala isaanii koree "**Health Research Ethical Review Commite**" Biiroo keenyatti dhiyeffatani jiru. Haaluma kanaan koreen "Health Research Ethical Review Committee" Biiroo keenya piropoozaal kana ilaaluun mirkanesse qorannoon kun akka hojii irra oolu murtesse jira.

Kanaafuu, hojji qorannoo kana irratti deggersa barbaachisaa ta`e akka gootaniif jechaa, **Obboo Sirnan Humnesa Kabetaa** tiis qorannoon kun qacceffamee eerga xumurame booda firii isaa koppii tokko BEFO tiif akka galii godhan galagalcha xalayaa kanaan isaan beeksifna.

Nagaa wajjin!

Mallattoo____________

Maqaa. **Obboo Sirnan Humnesa Kabeta**

Bilbila_ +251-913305216

G/G

Obboo Sirnan Humnesa Kabeta

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Check list of Medical equipment status in Tulu bolo hospital for observation and profile at MEMU

NO.	Medical equipment	Unit	quantity	Categories			
				A	B	C	D
1.	Anesthesia machine	Each	6	2	4	2	2
2.	Analyzer Hematology	Each	3	2	1	0	1
3.	Adult weight scale with accessories	Each	13	6	7	4	3
4.	Autoclave	Each	7	4	3	1	2
5.	Bed-infant/neonate	Each	9	8	1		1
6.	Bone drill	Each	9	5	4	unknown	unknown
7.	Centrifuge-Hematocrit, Electrical	Each	7	4	3	2	1
8.	Chemistry machine	Each	2	1	1	1	
9.	Couch-examination; gynecological	Each	7	4	3	2	1
10	CPAP machine	Each	3	3	0	0	0
11	Drum - Sterilizer, Large, 27x16.5 cm	Each	11	6	5	4	1
12	ECG Machine	Each	1	0	1	1	0
13	Fetal monitor doplar	each	5	3	2	1	1
14	Infant radiant warmer	Each	3	3	0	0	0
15	Hot air sterilizer	Each	7	3	4	2	2
16	Laundry machine	Each	3	1	2	1	1
17	LED phototherapy light	Each	3	1	2	2	0
18	Light-Operating, Mobile	Each	3	2	1	1	0
19	Microscope - Binocular, LED	Each	4	1	3	2	1
20	Monitor – Patient	Each	10	7	3	2	1
21	Oxygen Concentrator	Each	14	10	4	4	0
22	Otoscopy machine	Each	14	9	5	unknown	unknown
23	Pulse Ox meter:	Each	12	8	4	2	2
24	Pop cautery machine	Each	1	1	0	0	0
25	stretcher	each	15	4	11	4	7
26	Refrigerator	each	9	4	5	2	3
27	Ultrasound-General Purpose, Color Doppler, Mobile	Each	4	4	0	0	0
28	Wheel chair	Each	9	6	3	1	2
29	Water distiller machine	Each	2	1	1	1	0
30	x-ray machine	Each	3	1	2	1	1
	total		199	114	85	43	33

Note: A-Functional, B- Not functional, C-Need maintenance, D-Need disposal

Socio demography of respondents in interview

	Categories	Frequency	Percentage
Sex	Female	1	7.70%
	Male	12	92.30%
Age	20-25	0	0.00%
	26-30	2	15.38%
	31-35	7	53.84%
	36 and above	4	30.76%
profession	Nurses	1	7.70%
	Physician	4	30.76%
	Pharmacy profession	2	15.38%
	Laboratory profession	1	7.70%
	others	5	38.46%
Work experience	7month-5 years	2	15.46%
	6-10years	6	46.15%
	11-15 years	4	30.77%
	16 and above	1	7.33%
Marital status	Single	3	23.07%
	Married	9	69.23%
	Divorced	0	0%
	Widowed	1	7.70%
Educational level	Masters and above	2	15.38%
	Degree	10	76.92%
	Level/diploma	1	7.70%

Source: HRIS, 2022

i. **Guide for in depth interview**

1. How do you see the current process from procurement to disposal of medical equipment in your hospital?

A. Prioritizing of medical equipment?

B. Ordering and receiving medical equipment

2. Who will perform procurement and how would you judge the procurement system in your hospital?

3. How policy issues and procedures can influence the procurement practices in your hospital?

4. How do you judge the availability of medical equipment both in type and quantity in the hospital and elaborate with facilitators and barriers?

5. How would you judge the utilization practice of medical equipment in your hospital?

Probing (1): would focus mainly on user and technician training, maintenance, communication among team?

Probing (2): would you think personal behavior influence medical equipment usage and how regulatory body monitors the case?

6. How do you see the storage condition of medical equipment in your hospital giving emphasis to the strengths and limitations?

Kumalaa Baayisaa Fayyisaa

Turjumaana Sirnidha

Probing (1): With respect to: The size and location of the store, separation, inventory and use of technology

Probing (2): Decommissioning and disposal of medical equipment in your hospital?

Probing (3): How policy issues influence the disposal practices in your hospital?

Probing (4) :Have you ever disposed medical equipment yet and discuss the safety issues?

7. What would you recommend to overcome the challenging factors in management of medical equipment and add your opinion if you believe not to miss it?

Jumaana Simidha

Kumalaa Baayisaa Fayyisaa

Gaafannoo Afaanii gara Afaan Oromootti jijjiirame

1. Akkaataa bulchiinsa meeshaalee yaalaa hospitaala keessaanii karoora bittaa irraa hang dhabamsiisa meeshaalee yaalaa tajaajilaan ala ta'anii akkamitti ilaalta? Kallattii (1): kanneen armaan gadiirratti xiyyeefedhu:

A. Rakkoo furuuf meeshaalee barbaachisoof dursa kennuu

B. Akkaataa gaaffii fi dhiyeessii meeshaalee yaalaan wal qabatee

2. Bittaa ykn dhiyeessii meeshaalee yaalaa eenyutu raawwata, akkamiin ilaalta?

3. Akka hospitaala keessaniitti qajeelfamootni adda addaa dhiibbaa akkamii dhiyeessii irratti qabu?
4. Haalli dhiyeessii hospitaala keessanii baay'ina,gosaa fi qulqullinaan wal qabatee maal fakkata?
5. Haalli itti fayyadama meeshaalee yaalaa akkamitti qabamee jira?

Xiyyeeffannoo (1): leenjii ykn ga'uumsa itti fayyadamtootaa fi ogeessa suppaa irratti hundaa'uun?

Amalli dhuunfaa qabiinsa meeshaalee yaalaa irratti dhiibbaa in qabaa?yoo jiraate hospitaalichi akkamiin to'?

6. Haala tajaajila kuusaa meesaayaalaa hospitaala keessanii akkamiin ilaalta? Ciminootaa fi hanqinoota irratti hundd'uun kanneen naaf ibsi

Xiyyeeffannoo(1): Baldhinaa fi iddo argama kuusaa meeshaa yaalaa,adda ba'insa,lakkaa'umsaa fi itti fayyadama teeknoolojii

Xiyyeeffannoo(2): bakka buusuu fi dhabamsiisuu meeshaa yaalaa?

Kumalaa Baayisaa Fayyisaa

Turjumaana Sirnidha

Xiyyeeffannoo (3): dhiibbaa immaammataa fi qajeelfamni dhimma dhabamsiisa meeshaa yaalaa irratti qabu baldhinaan naaf heeri?

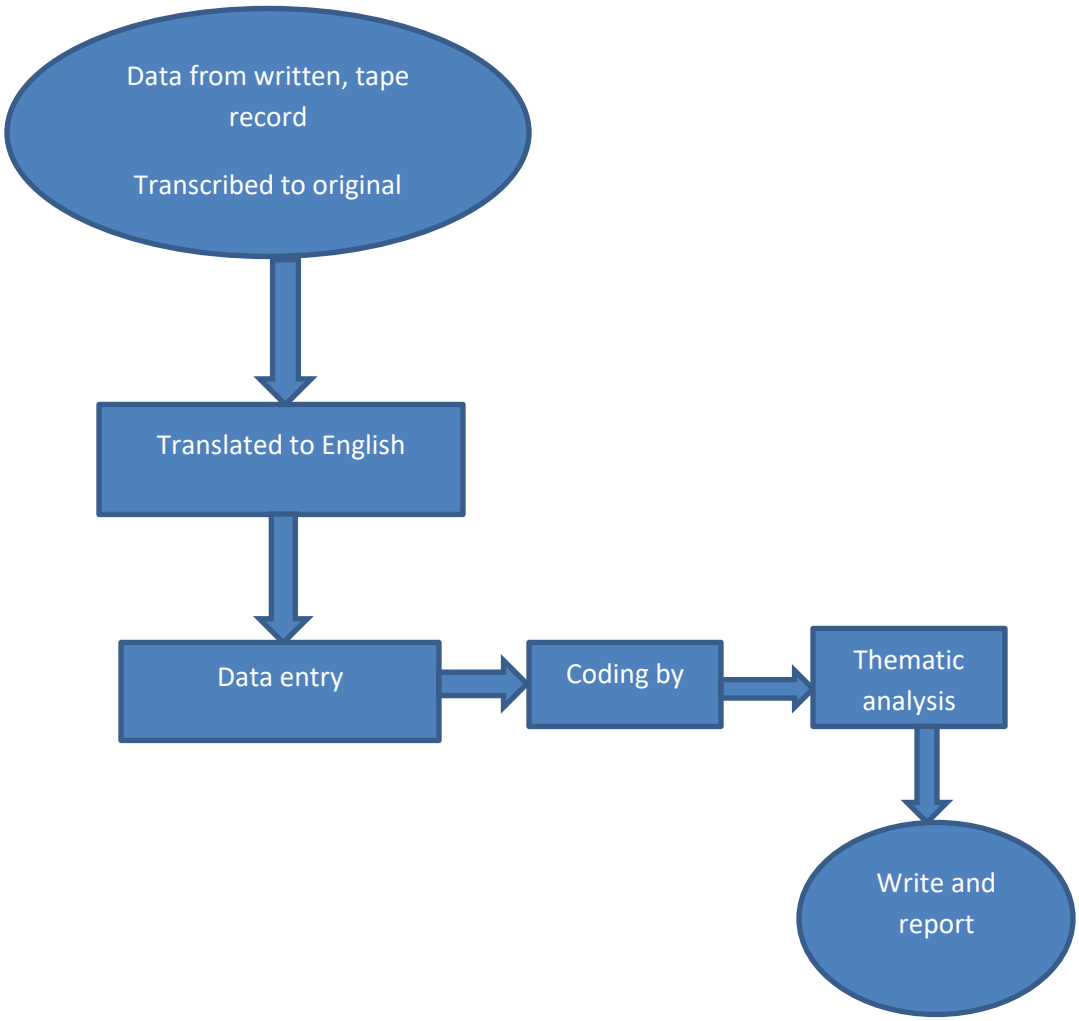
Xiyyeeffannoo(4) :kanaan dhura meeshaa yaalaa tajaajilaan ala ta'e dhabamsiiftanii beektuu?dhaabamsiisuu dhabuun nageenya irratti dhiibbaa akkamii qaba?

7. Haala bulchiinsa meeshaalee yaalaa irratti rakkoowwan dhiibbaa geessisuu dand'an furuuf maal gochhuu akka qabamuu fi wanti hafuu hin qabu jettee itti dabaltu yoo jiraate naaf ibsi?

Kumalaa Baayisaa Fayyisaa

Turjumaana Sirriidha

Data Processing Steps for medical equipment management practices, TGH, 2022



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