



**UTILIZATION OF DONATED MEDICAL EQUIPMENTS AND  
ASSOCIATED FACTORS IN JIMMA UNIVERSITY SPECIALIZED  
HOSPITAL, OROMIA, SOUTH WEST ETHIOPIA.**



BY

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Jimma Ethiopia

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## ABSTRACT

**Background:** Donation of different medical equipment to developing nations from developed countries has been currently increasing these days. Donation of medical equipment to developing countries account 80% of the total equipment in their facilities, more than 70% of the donated medical equipment found out of service in Sub-Saharan African countries. Hence, this study was conducted to assess the utility of donated medical equipment and associated factors in Jimma University specialized hospital as a base line research.

**Objectives:** To asses utility of the donated medical equipment found in Jimma University Specialized Hospital.

**Method:** An institution based descriptive cross-sectional study was carried out from March to April First 2015, an enumeration of all donated medical equipment was carried out then determined sample size by using single population formula. Next, the medical equipment was stratified according to their functions. The list was used as a framework for random sampling of the equipment. However, equipment, which has a high economic value, included in the study. Data were analyzed using SPSS for windows version 16.0, binary logistic and chi-square test were determined, result presented using figure and table

**Result:** A total sample of 180 donated medical equipment was included in the study. All of the equipment was relevant for hospital service. Regarding their purpose 81(45%) was of them used diagnostic. 76 (42.2 %) were for treatment and 23(12.8%) were for monitoring of the patient. Concerning the utility of donated medical equipment, 81(45%) were in utilization 99(55%) were not in utilization. Regarding availability of spare part in local market, 71.1% of equipment has no spare part in local market due to lack of agent of manufacturer in the country, which make available of spare parts. In line with maintainability with local expert 68.9% not maintained by local expert because of no trained professionals in the facility. Concern accessory 39.4 of the equipment has no accessory along equipment during equipment receiving from donors and 23% of donated medical equipment was old.

The availability of a local expert were almost two times more likely to be utilized than equipment not maintained by local expert (OR, 1.997 with CI of 95% 1.3, 4.2). Concerning availability of spare parts at a local markets more likely utilized than equipment which is not spare parts available at local market.(OR 1.1212 with 95% CI of 1.2,2.2). Regarding accessory, availability of accessory along machine four times more likely utilized than equipment which has no accessory during supply to the institution (OR,4.126 with 95% CI of 2.03,3.5).Receiving old equipment from donors 26% less likely utilized than new one (OR 0.265,with CI of 95% 0.1,0.6).

**Conclusion and recommendation:** Lack of skilled professionals in the institution, absence of spare parts in domestic market, old equipment receiving, no accompanied operation manual, maintains manual and accessory along machine are the predictors for utilization of donated medical equipment for intended purpose. Finally, the donors and receipts as well as any intermediaries have a responsibility to make donation complete and successful.

**Key words:** Donation, medical equipment, .JUSH.Utility, Relevance

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## **Abbreviations and Acronyms**

AC	Alternate Current
OR	Odd Ratio
CI	Confidence Interval
CBM	Christian Blind Mission
CDC	Communicable Disease Control
CE	Clinical Engineers
CHAI	Clinton Health Access Initiative
FMHACA	Food, Medicine, and Health care, Administration Control Authority
HTM	Human Training Management
ICU	Intensive Care Unit
MONSW	Ministry of Health and Social Welfare
MSH	Management Science for Health
NGO	Non-Governmental Organization
OPD	Out Patient Department
OR	Operation Room
THET	Tropical Health and Education Trust
UN	United Nation
UNDP	United Nation Development Program
UNICEF	United Nation Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization
PCR	Polymerization Chain Reaction

# **1. INTRODUCTION**

## **1.1. Background**

Medical equipment are medical devices requiring calibration, maintenance, repair, user training and decommissioning activities usually managed by clinical engineer's. They are used for the specific purpose of diagnosis and disease treatment or rehabilitation following disease or injury. They can be used either alone or in combination with any accessory consumable or other pieces of medical equipment. Medical equipment's exclude implantable, disposable or single use medical devices [1].

The quality of medical equipments directly affects the quality of healthcare services at different stages from Diagnosis to cure and post-cure. The resource challenge often force the developing world to depend on the medical equipment donated from the donor countries from the developed or emerging economies. Although, the donation of equipment significantly helps the developing countries in improving the healthcare services, Sometimes, the quality issues creep-in and adversely affect the spirit of the process. The quality assurance and maintenance of the standards are linked to the effectiveness of the donation process, which in public sector organizations, must confirm to the applicable regulatory framework [2].

Many developing countries are increasingly dependent on donor assistance to meet the equipment needs of their health care systems. However, because not all important parameters are taken into consideration, donations sometimes do not achieve their intended objectives, and could even constitute an added burden to the recipient health care system. Therefore a need to improve the process of equipment donation, to the mutual benefit of both donors and recipients. WHO guidelines address this issue, but are not an international regulation. Instead they are to be used to develop national or institutional guidelines; by governments and organizations dealing with health care equipment donations. Although they are intended for application everywhere, there is a deliberate emphasis on developing country health systems [3].

On the other hand, these donated medical equipments are partly used, some of them are new and others are refurbished while these equipment has no spare part in local market and even if the spare part available in domestic market it may be too expensive. In addition to these, some of the

received equipment as donation are not functioning when it arrived at health facilities of developing country [4].Therefore, this research thesis will be worthwhile to assess the root problems associated with donated medical equipment aspect of utility of equipment. Besides, this research paper can attribute the appropriate consideration of donated medical equipment and Service donation for maintains and operating the equipment.

## 1.2. Statement of the Problem

According to WHO report 80% of developing countries health facilities depend on donated medical equipment from developed countries and their partners in the world .In sub-Saharan African countries from these donated equipment 70% of them are out of service [5]. However in Ethiopia there is no research carried out about the status of these donated medical equipment. Despite this all-governmental health, facilities in Ethiopia are full of donated medical equipment. But their status is not known [5].

Those donated medical equipment were acquired from NGO, personal and foreign government donation .Most of the donation source were USA, Europe and China [6].Those equipment donated were new, old and refurbished. In some countries donation considered as dumping of old equipment from their country to developing nation as a result these equipment dumped to developing countries have no chemical and reagents for their operation likewise at the same time they have no spare parts in domestic markets or too expensive and the equipment also out dated. The equipment is sometimes broken on transportation or from the source and they are not maintained then when they are given for nations they occupies storage space, create environmental pollution at developing countries [7].

Some of the equipment is too old, they are not right in terms of service deliver for intended purpose because they need repeated maintains with low capacity performance. Again maintains of these equipment needs high professionals from developed countries and to get these professionals it too expensive. For example cost of installation of one dialysis machine is equal to purchasing cost of one dialysis machine [8].

Jimma University Specialized Hospital which serve about fifteen million population is one among the receivers of donated medical equipment from foreign country ,Nevertheless were receiving medical equipment cannot be a solution for its own sake . Therefore, the researcher would like to assess the medical equipment in terms of utility to the Hospital although factors that influence utilization of donated medical equipment.

## **2. OBJECTIVE OF THE STUDY**

### **2.1. General Objective**

The main aim of this study is to assess the utility of donated medical equipment and associated factors in Jimma University Specialized Hospital, South West Ethiopia.

### **2.2. Specific Objectives**

- ❖ To determine current condition of donated medical equipment at JUSH.
- ❖ To assess relevance of donated medical equipment at JUSH.
- ❖ To determine utilization of donated medical equipment at JUSH.
- ❖ To identify factors affecting Utilization of donated medical equipment at JUSH.

### 3. LITERATURE REVIEW

Most of developing country health sectors depend on foreign donation. According to WHO report more than 80% of developing country health facility depends on donated medical equipment from foreign source [5].

It was state in the same report that from donated equipment to these countries about 96% is out of service. But there is little documented evidence to support these statements. Inventory reports were analyzed from 1986 to 2010, from hospitals in sixteen countries across four continents. Which is determined by UN considered to be developing nation .non-medical Hospital equipment was excluded. This study examined 112,040 pieces of equipment. An average of 38.3% (42,925, range across countries: 0.83–47%) in developing countries was out of service. The three main causes were lack of training, health technology management, and infrastructure [5].

In this report most of the health structures in developing countries’’. Some have been more precise. For example, Frize and Cheng stated, also in this journal that up to 60% of medical equipment is out of service in developing countries [5].

The World Health Organization Guidelines for Healthcare Equipment Donations states that 70% of medical equipment in sub-Saharan Africa countries is out of service. The Director General of the World Health Organization stated at the Medical Device Meeting in the fall of 2010 that’ about 70% of the more complex medical devices do not function when they reach their destination.’’ Other papers state that up to 96% of medical equipment is out of service Most of the inventory reports included an introductory section. From total, compiled data for 112,040 pieces of medical equipment. Ninety-three percent of that equipment was from the developing world [6].

In developing countries, 38.3% (42,925 pieces) of the equipment was out of service. The percent of equipment out of service in individual countries varied from less than 1% (EX.Costa Rica) to 47%(Venezuela). They found that no documentation to support reporting more than 50% of medical equipment out of service. Sorting the inventories by equipment type does not reveal a strong pattern Nevertheless, some equipment was more likely to be out of service (X-ray and sterilizers) while some was less likely to be found out of service (anesthesia machines and operating room tables).Individual

types of equipment were out of service at a rate of 32% (anesthesia machines) to 47% (X-ray machines). Analyzing the introductions to the inventory data, they found that the state of the equipment was dependent on factors beyond the equipment itself in three major categories: infrastructure and resources, health technology management (HTM), and training. Infrastructure and resource deficiencies are system-wide deficiencies. Commonly cited causes for out of service equipment in this category included lack of spare parts, lack of disposable supplies and lack of required accessories in most of the health structures in developing countries. The World Health Organization Guidelines for Healthcare Equipment Donations states that 70% of medical equipment in sub-Saharan Africa is out of service. The Director General of the World Health Organization stated at the Medical Device Meeting in the fall of 2010 that about 70% of the more complex medical devices do not function when they reach their destination [9].

Human training management problems were also common. Regardless of fault, users sometimes failed to report equipment problems to technicians or administrators. Regular preventative maintenance schedules were rarely followed leading to early breakdown and escalation of problems. In most systems, administrators or donors were left making procurement decisions without technical advice. Adding to the systemic burden of non-functional equipment is the fact that many hospitals reported no system for disposal of irreparable or outdated devices [8].

Capacity building is frequently considered in the medical ranks, but it is also a problem with medical equipment. However, technicians are not the only ones who should understand their technology. Users, administrators, and donors need a base level of knowledge. In many systems, users were not trained in the proper use or handling of equipment, leading to avoidable breakdowns. When technicians were available to attempt repairs or maintenance, there was often a gap between their knowledge and the level of technology. Unfortunately, technicians with even minimal training were reported to be rare. More than half of the technicians, and even maintenance department heads in some regions, were not formally trained biomedical technicians [9].

Increased capacity must be coupled with increased repair infrastructure. One aspect of repair infrastructure is the service and operator manuals, with at least 50% of each type not found in the surveyed health systems. Compounding the knowledge problem is the fact that most of the equipment comes from outside of the country. Not all of the inventories listed the manufacturer. However, in a subset of 1,242 pieces from 10 hospitals in Indonesia, only 52 pieces (4.2%) of the medical equipment

were produced in-country. This is quite close to the 5% reported by Banta in the case of Brazil in the 1980s. . Imported equipment came mostly from China, Japan, the United States, and Europe [8].

If about 40% of donated medical equipment is out of service, they report that a commonly cited cause for equipment being considered out of service is the lack of spare parts and disposable accessories. However, in one of the very few prospective studies, Makin and Keane showed that 66% of out of service equipment (of about 3,000 pieces studied) could be returned to service using only locally available materials and less than \$50. This suggests that there may be a predisposition to designating a piece of equipment as being out-of-service. Or, this could indicate that the higher level of training of most of the volunteers in the Makin and Keane study allowed for more repairs. Their theory is being prospectively studied in Rwanda. Clearly one component that is discussed very little in the reviewed inventories is the proportion of inappropriate donations (8).

During the Bangkok Medical Device meeting mentioned above, the WHO Director General suggested that “only 10 to 30% of donated equipment ever becomes operational”. While the vast majority of donations are given with the genuine intent to strengthen the health system, probably a large percentage did not consider the technical infrastructure of the receiving hospital. Medical equipment is designed to operate where there is stable electricity and sophisticated amenities such as purified water or pressurized gas. Such infrastructure is rare. Drastic environmental changes also pose a challenge to operation and maintenance of modern, delicate equipment. Even American hospitals often rely on medical service contracts to keep their equipment running [10].

From the analysis, it is apparent that many organizations, even those donating new equipment, are doing so without donating a service contract. In many cases, a donation without a service contract very quickly leaves the hospital with an inoperative piece of equipment and a disposal problem. In other words, the donation leaves the hospital worse off [11].

The analysis may underestimate the number of pieces out of service. We have relied on hospital reported equipment status reports to create the analysis. However, hospitals may ignore some working equipment that never entered their inventory, broken equipment off inventory or they may lack the technical staff to conduct a thorough inventory. In any case, we suspect that many hospitals are underreporting their broken equipment. Unfortunately, we are aware of no independent, peer-reviewed study that tracks a particular shipment of donated equipment from original status to final disposition. There was no evidence to support the statement that most or



nearly all the equipment in resource poor settings is broken. While donations can cause problems and there are undoubtedly some hospitals where the situation is much worse, the analysis does suggest that donating equipment can improve the available healthcare options. On the other hand, investments in capacity building, health technology management and infrastructure could nearly double the amount of working medical equipment without the expense of collecting, testing, and shipping used medical devices.

Another study was conducted at Haiti on seven hospitals after 2010 earth quick disaster. There is loss of infrascutral due to disaster. Following this about 12% donated medical equipment given to those health facility for capacity building and 86% of those hospital medical equipment were got with donation before disaster and only 2% medical equipment's were newly purchased by health facilities. Out of Seven hospital 67% donated medical equipment were for one Hospital. This university medical center had sustained significant infrastructural damage and material loss from the earthquake. Regarding the condition of the equipment at the time of the assessment, only 28% was working and in use by the medical staff for patient care; another 28% was working and not in use; and 30% was not working, but repairable [10].

Equipment that was working, but was not in use, lacked either ancillary parts and/or supplies, (e.g., probes, patient cables, extension sets) or an appropriate location (e.g., no functioning or for the OR equipment). Only 14% of the equipment was not working and not repairable. This research team was able to establish the age of only 38% of the equipment with reasonable confidence. From this sample, the team estimated that 88% of the equipment was more than 5 years old. Of the total, 304 items (32%) either had an inventory tag from another hospital, were marked as having been owned by another hospital, or were known by the staff to have come from another hospital. This information suggested that at least this portion of the equipment had been used before its donation. Only 30% of the equipment donated after the earthquake (35/115 items) was working and in use. Fourteen percent of the equipment (16/115 items) donated after the earthquake was not working and not repairable. Among the entire inventory of the seven hospitals, only 10 user manuals and four service manuals were found. The Haitian CEs on the team indicated that they were responsible for servicing essentially all of the equipment at six of the seven hospitals assessed [12].

The CE team found only two pieces of equipment (an anesthesia machine and a laboratory refrigerator) that were marked as having been serviced by a local third party service provider. Only two hospitals had CE departments. The largest department, in terms of number of personnel, was located at The CE departments had only a few ordinary tools and testing equipment, as well as some common electrical, electronic, and mechanical spare parts. With no supply of equipment-specific spare parts, the Haitian CEs scavenged parts from inoperable equipment for repairs. It was evident that the CE departments functioned on a reactive, rather than proactive basis. Preventive maintenance was not part of the mode of operation. Of particular note, the CEs inventoried one new (in the box) laboratory incubator oven, donated after the earthquake that required a higher electrical voltage than the Haitian standard (240VAC versus 120VAC). In addition, the team recorded eight used dialysis machines, received after the earthquake that never worked according to the dialysis staff. These machines lacked consumables and operating manuals and were from 4–11 years old, on average older than the six dialysis machines that were in clinical service at the time of the assessment (mean 8 years old vs. 5 years old[12]).

Research conducted at Manor Hospital-UK reveal that In some countries there is a major dependence on donor aid, with nearly 80% of healthcare equipment funded by international donors or foreign governments. Unfortunately, it has been estimated that 50% of equipment in developing countries is not in use because of lack of maintenance or spare parts, because it is too sophisticated, or because local personnel do not know how to use it, representing a tragic waste of scarce resources [6].

The studies show that as much as 96% of medical equipment in developing countries is donated and about 40% of medical equipment in the developing world is out of services. These facts have clear repercussion for Health outcomes in these countries with the patients suffering from lack of accurate diagnostic or adequate treatment (6).

On the other hand research conducted in Tanzania National Hospital confirm that lack of supporting manual and training provision on how to use the sophisticated medical equipment one of the challenge associated with donated medical equipment and also poor communication between recipient and donors is one of the drawback faced by user in the Hospital.

On other way research were conducted at Tanzania support the importance of donation as such a way that the medical equipment donated usually used and second hand but technically suitable for the intended purpose.

There is also research conducted by Keane and Makin reveal that much of the laboratory and medical equipment in resource poor setting is out of service. They put reason of this equipment out service in developing country health facilities. Lack of spare parts to donated medical equipment and Lack of highly trained technicians. They found that from out of service medical equipment 72% were repaired without importing spare part and they indicate that trained professionals can help developing country by maintain of medical equipment [8]

By Malkin and Keane in 11 nations and sixty resource poor setting hospitals medical equipment in Africa Asia, Europe and central America 2849 pieces of equipment repair request of which 2529 were out of service, Each pieces of equipment was Analyzed and repair was attempted using only locally Available materials .A total of 1821 pieces of medical equipment was placed back in to service (8).

On the another paper which is conducted by(CHAI)Catholic church Dispose 600,000 tone of medical equipment to land fill or donated without appropriate steps. Sumaltinously on this paper donated medical equipment is also problematic. According to WHO report biomedical engineers estimate that between 70% to 90% medical equipment idle in the developing country. This is due to that in developing country almost always lack of the experts needed to maintain biomedical equipment and sometimes even the capacity to use it effectively more over equipment is often denoted without user on maintains manual. Note surprisingly it is usually older equipment that is donated unfortunately manufacturer often stop producing spare parts or complementary supplies [13].

Another research which is conducted in Papua New Guinean Hospital it estimate that up to 70% of equipment in sub-Saharan African gather dust in the some reason that at least half of all medical equipment in the developing world is unusable and the researcher add that donation is a well-established method for doors to dispose of old equipment's while on the recipients side donation have strong appeal as ready solution to gap in service. Unfortunately, they can be a poor substituent for the appropriate technology and genuinely sustainable development so badly needed in the developing world [14].

As one can see from the above literature there is a variation in there result toward the utility of donated medical equipment and the problem associated to the donation where prevalent. Even if the figure is different, the research will be conducted in jimma university Hospital to give clue on this equipment whether the problem is just as we see above or different.

### **3.1 Significance of the Study**

Most of the developing countries especially Sub-Saharan African countries depend on donated medical equipment. Ethiopia is one of the developing countries in the world, and one of the supported countries by developed nations for capacity building in health sectors for prevention, treatment and diagnosis of disease. Donation is one of technology acquiring strategies for diagnosis, treatment and prevention of disease, But as we can see from research conducted on those donated medical equipment about 70% it out service in developing country health facility. This is due to lack of spare parts, loss of operating manual, absence of professional and out dated equipment receiving (8).The cause of this unappropriated equipment donated to facility lead to poor health care service and the reason of these problems happen is that loose policy system, poor communication to donors and infrastructural problem to the receiver health facilities (8).

Due to this problem, the researches show what current condition of donated medical equipment and factors influence utilization of donated medical equipment in Jimma University Hospital. It believed that this paper help the organization before receiving any donated medical equipment to see the utility of the equipment to their organization.

This topic is selected due to observation of a lot of donated medical equipment being out of service. The findings of the study help to design mechanisms of checking the utility of donated medical equipment before receiving.

The result of this paper helps the government, health institutions and the nation because it gives clue to strengthen the policy toward donation.

### 3.2. Conceptual Framework

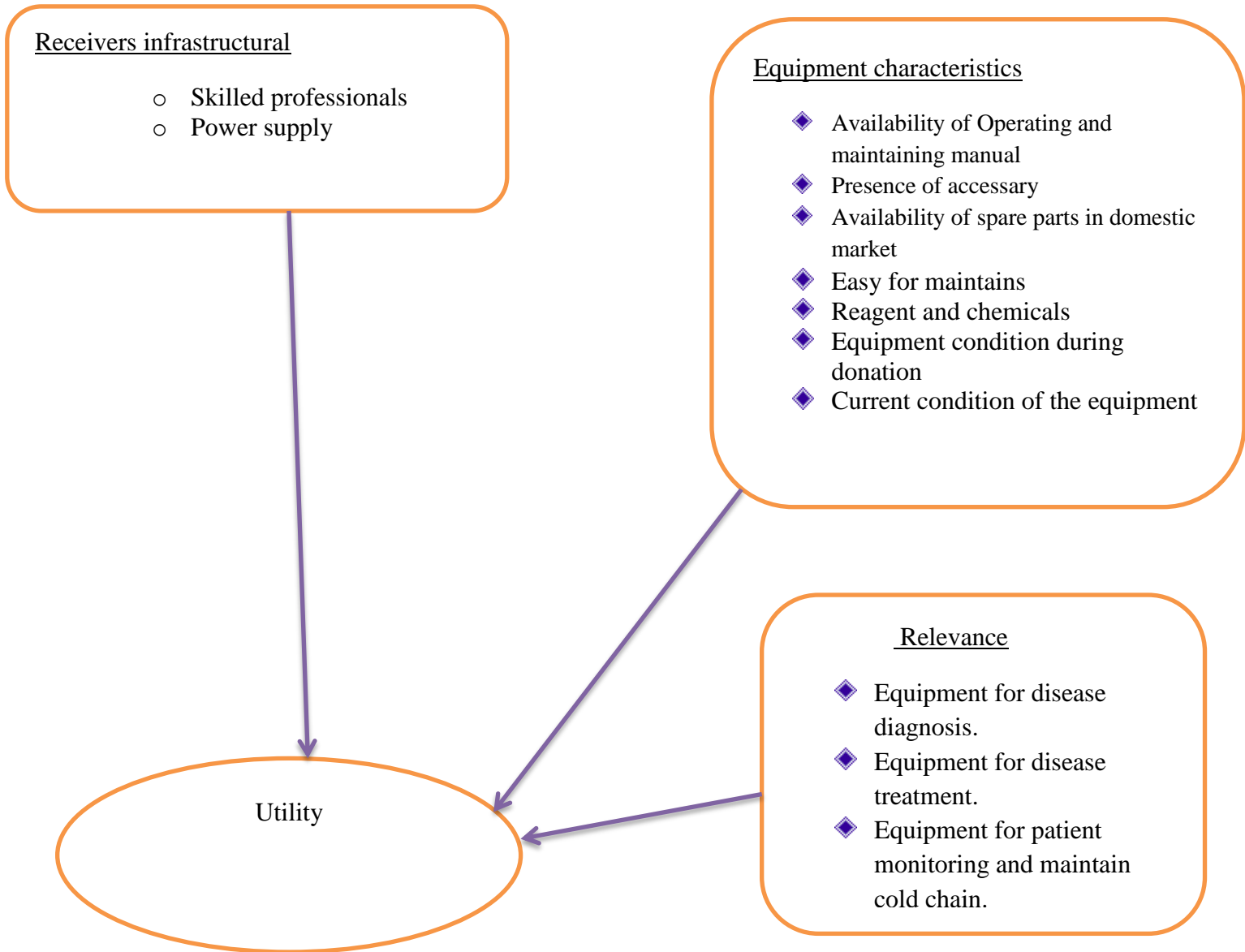


Figure 1: Conceptual framework for utility of donated medical equipment and possible factors n affect utility developed after literature review (2, 6, 8, and 12).

## **4. MATERIALS AND METHODS**

### **4.1. Study setting and Period**

The study was conducted from March 2015 to April 2015 first at jimma university Hospital, which is found in Jimma city, located in Oromia Regional State, south west Ethiopia 350km from the capital city. It serves as referral for fifteen million populations including neighbor country like south Sudan. The Hospital was selected as a case because it is one of the largest public acquiring entities using the donated medical equipment. Further, the accessibility and connivance in data collection added to the choice of the organization as a case. This Hospital is both referral and academic research Hospital with 600-bed facility, 450 outpatient capacity per day and 15000 inpatient serving capacity per year. Due to large service, capacities there are many of equipment donated to radiology, laboratory, pediatrics, OR, maternity, OPD, gynecology and ICU units. Most of the equipment is acquired as a donation (17).

### **4.2. Study Design**

An institutional based descriptive cross sectional study was carried out to describe the utility of donated medical equipment and associated factors in JUSH using quantitative, and triangulated with qualitative data.

### **4.3. Source Population**

All donated medical equipment's received by JUSH are considered source of population.

### **4.4. Study Population**

All donated medical equipment received from any donor for the last five years considered study population that fulfills inclusion criteria.

### **4.5. Sampling Technique and Sample Size**

#### **4.5.1. Sample Size Determination**

$$n_0 = \frac{P(1-P) Z_{\alpha/2}^2}{d^2} = 384, \quad d=0.05, P=0.5, Z_{\alpha/2} = 1.96,$$

Where  $P=0.5$  because the research not conducted before or no piloting study,  $d=0.05$  is the margin of error and  $P$ =population proportion of donated medical equipment.

$N = 351$ , since  $\frac{n_0}{N} > 5\%$ , the sample size was determined using  $n = \frac{n_0}{1 + \frac{n_0}{N}} = 183$ , Where the

formula is correction formula because  $n_0 = \frac{P(1-P) Z_{\alpha/2}^2}{d^2}$  it is almost nearer to total population

$\frac{n_h}{n} = \frac{N_h}{N}$      $n_h = \text{total number item}$      $N = \text{total population}$      $n = \text{number of}$      $N_h = \text{total number each Item}$

#### 4.5.2. Sampling Technique

To select equipment first a complete enumeration of all donated medical equipment in Jimma University Hospital was conducted later serve as a sampling frame for random selection by type. During enumeration equipment were identified by receiving voucher from warehouse. The sample size was allocated to each equipment category using proportional to size allocation technique. Then, from each category, equipment is selected using simple random sampling technique. According to the above technique, the equipment selected. See annex-1

For qualitative part in-depth interview for six respondents were selected purposively based on their status such as Hospital CEO, procurement department, biomedical engineering department, and other departments were involved.

#### 4.7. Eligibility Criteria

**Inclusion Criteria;** Those medical equipment donated to JUSH for the last five years were eligible to be checked for a given variables and only medical equipment which need techniques to operate, consumables, spare parts reagents, condition of medical equipment during receiving and special installation were considered .

**Exclusion Criteria:** That medical equipment has received before five years is excluded. This was identified by receiving voucher from the institution warehouse. This exclusion was done because most of the medical equipment's were received before five years are discarded and the hospital received more medical equipment's donation other than other time in the last five years Besides WHO requirements for donation of medical equipment which at least the equipment life expectancy must be five year prior of donation(19).



## **4.8 Data Collection Instrument**

Data were collected by checklist and in-depth interview which adapted from WHO and FMHACA donation guideline and from different literature (3,6). The checklist contains indicators for independent and dependent variables in detail and for qualitative part guideline were adapted from WHO guideline.

## **4.9. Data Collection Procedure and Measurements**

Data were collected by checklist and interview methods. Trained biomedical engineers conducted data collection; senior biomedical engineer supervised the data collection process. Before data collection the equipment were categorized according to its function then engineer conducted observation as well as interviewed check list administered to end user on some information concerning about equipment. Principal investigator conducted key informants in-depth interview. Informants were Hospital CEO, Biomedical Engineering Department Directorate, and Hospital Procurement Department Directorate, Ophthalmology Department head and ICU Department head were interviewed, each interview taken 55 minutes, Selection of these key informants depends on convenience purposive methods because they have direct relationship with donation process and communication with donors.

## **4.10. Data Quality Assurance**

To ensure quality of data one day training was given for data collectors and supervisor by the principal investigator on contents of the tool, relevant data collection principles and procedures before data collection. Supervisors and principal investigator conducted regular supervision during data collection. Consistency and completeness check by data collectors during and after data collection, moreover principal investigator checked every night on daily basis the consistency and completeness of the data and for qualitative data, data were using electronic record.

## **4.11. Study Variables**

### **4.11.1 Dependent Variables**

#### **➤ Utility of donated medical equipment**

### **4.11.2 Independent variables**

Independents variable for utility

- ✓ Type of donated medical equipment
- ✓ Availability of accessory to donated medical Equipment.
- ✓ Availability of spare parts in local market.
- ✓ Availability of operational Manual.
- ✓ Availability of maintains manual.
- ✓ Source of donation.
- ✓ Years of Donation.
- ✓ Equipment condition during donation.

## **4.12. Data Processing and Analysis**

Quantitative data were entered in to Epi data 3.1 and, cleaned analyzed using SPSS version 16.0 statistical software respectively. Errors related to inconsistency of data were checked and corrected during data cleaning. The univariate analysis such as percentages, frequency distributions and appropriate graphic presentations were used for describing data. Bivariate analysis of availability of local expert for maintenance, availability of spare parts, availability of accessory and equipment condition during donation. Then multivariate logistic regression model was used to isolated independent predictor variables. Variables, which included in model were those significantly related or supposed to be significantly associated to outcome in bivariate level. Qualitative data were analyzed thematically and support quantitative result.

Verbatim was transcribed to language in which the interview was considered then translated to English. The analysis starting by recording the text repeatedly to understand the concept of the data then followed by coding and regrouping of similar codes under one category finally themes were identified from codes.

#### **4.13. Ethical Consideration**

An official support letter was obtained from the ethical review board of Jimma University College of Health Science to conduct the study at Jimma university Hospital and permission letter from Jimma University Hospital was hold to conduct data collection consent were inform for which I am going to interviewed.

#### **4.14. Dissemination of the Result**

The finding of this study presented to Jimma University community, Jimma University Research Publication Office, preserved to Jimma University Library, copy to JUSH, to pharmacy department and considered to publication on international journal.

## 5. OPERATIONAL DEFINITION

**Utility:-** Those medical equipment donated to the Hospital is operationalized for its purpose of donation in terms of the purpose it is intended.

**Relevance:-** Those donated medical equipment help for the organization in terms of disease diagnosis, treatment, patient monitoring and maintain cold chain.

**Donation:-** Donation is a gift given by physical or legal person, typically for charitable purposes. A donation may take various forms, including cash offering, services, new or used Equipment including medical supplies, Medical Equipment, and vehicles. It also may consist of emergency, relief or humanitarian aid items, development aid support, and can relate to medical care needs as i.e. blood or organs for transplant. Charitable gifts of goods or services are also called gifts in kind.

**Medical equipment:-** means any instrument that may be used on the inner or outer part of the body for diagnosis or treatment of a disease in human. This includes various diagnostic, laboratory, surgery and dental medical instruments (1).

**Donor-** means a governmental or nongovernmental organization or individual who voluntarily donates medical equipment as a donation.

**Recipient-**means a governmental, non-governmental or private health institution that voluntarily receives medical equipment as a donation;

**Consumables** - Non-durable medical supplies that are usually disposable in nature; cannot withstand repeated use by more than one individual; are primarily and customarily used to serve a medical purpose; generally are not useful to a person in the absence of illness or injury; may be ordered and/or prescribed by a physician. Examples of medical supplies include, but are not limited to, gloves, oxygen, and syringes.

**Health Care Infrastructure:** Prior to beginning work in a country, Donors should have a clear understanding of the local healthcare infrastructure, including location and capacity of nearby health facilities, and other NGOs working in the area, and its receptivity to outside support.

**Spare parts:-**Replaceable component, sub assembly, and assembly identical to and interchangeable with the item it is intended to replace. Also called spare or service part

**Standard voltage:** A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts and international standard is 240v/50Hz

**Accessory parts:** -Having a secondary, supplementary or subordinate function by accompanying as a subordinate; aiding in a secondary way; being additional; being connected as an incident or subordinate to a principal; contributing or being contributory. Example probes, patient cable and extension set

**Chemicals:** -. Any basic substance that is used in or produced by a reaction involving change s to atoms or molecules

**Reagents:** -A reagent is a chemical substance that is used to create a reaction in combination with some other substance. For example, Small Particle Reagent (SPR), a suspension of molybdenum disulfide powder in a detergent solution, is used for fingerprint detection on wet, oily, or dirty surfaces, which may be unsuitable for other methods. The powder particles cling to the lipids in a fingerprint, thus rendering the fingerprint visible. Grey prints appear that can then be lifted from the surface with tape.

**Storage condition:** - An inventory storage condition that allows withdrawals from lots without disturbing other storage elements. This makes it easy to gain access to items in storage with minimal lead-time. In an open storage area, items are categorized and placed into separate bins with adequate spacing between for placement and removal.

**Safety:** - A state in which or a place where you are a safe, not in danger, or at risk.

**Operating Manual :** -a book that gives you practical instructions on how to do something or how to use something, such as a machine: operating system, maintenance, precaution, sterilization system, closed or open system, frequency of maintains etc.

**End user:** -A person who apply medical equipment to patient for disease diagnosis, treatment and rehabilitation.

**High Economical Value of Medical equipment:** -A medical equipment which is worth greater than 500USD (3).

## **6. RESULTS**

Medical equipment donation is one way of acquiring equipment only from developed country, individuals, and NGO to developing country. Those equipment help developing country for diagnosis of disease, for treatment of disease and for monitoring patient during diagnosis and treatment.

Medical equipment receiving as donation has some drawback according to literatures specified before. Due to this problem Jimma University Hospital selected as a case to conduct research, because a Hospital is teaching and referral Hospital in south-west Ethiopia and only Hospital, which has a lot of donors in the region, then cross-sectional study was used, check list were adapted from WHO donation guideline, all equipment donated to JUSH were enumerated, after identifying donation from purchased one by using donation documents like Bill of lading and Hospital receiving voucher and categorized according to its function, sample size determined, then equipment were randomly selected from each unit in the Hospital. Finally, checklist administered to end user and observational checklist conducted by expert.

### **6.1. Equipment type, Relevance and utility**

According to the study, result out of the total 351 donated medical equipment for the last five years to the Hospital 180 equipment has were sampled and assessed, but three items were missed for maintenance in foreign country. Regarding the finding 81 (45%) were for diagnostic, 76 (42.2%) were for treatment and 23 (12.8%) were for monitoring patients and cold chain maintenance (Table.1). There is no equipment, which is irrelevant for diagnosis, treatment and Monitoring patients.

Concerning utility of the donated medical equipment, 81 (45%) were in utilization and 99 (55%) were not in utilization whether for diagnostic, treatment or Monitoring the patient.

Table 1. Summary of important characteristics that measures utility of donated equipment JUSH, Ethiopia, March-April -2015

Variable	Frequency	Percentage
<b>Type of equipment</b>		
Diagnostic	81	45
Treatment	76	42.2
Monitoring patients and maintain cold chain.	23	12.8
<b>Utility of the equipment</b>		
(Yes)	81	45
(No)	99	55
<b>Equipment condition during donation</b>		
New	111	61.7
Old	42	23.3
Refurbished	1	.6
Others(no specification on equipment)	26	14.4
<b>Availability of Spare parts in local market</b>		
No	128	71.1
Yes	52	28.9
<b>Availability of local expert for maintains and operation of equipment</b>		
Yes	56	31.1
No	124	68.9
<b>Has accessory</b>		
No	71	39.4
Yes	109	60.6

## 6.2 Equipment character

### 6.2.1. Equipment condition during donation.

In line with the condition of donated medical equipment during donation to this organization out of sampled equipment 111 (61.7%) were new medical equipment 42 (23.3%) out of sampled equipment were old medical equipment, 26 (14.4%) of medical equipment were unknown its condition whether it is new, old or refurbished and 1(0.6%) were refurbished equipment.

### **6.2.2. Current condition of donated medical equipment**

Regarding to the current condition of those donated medical equipment to JUSH. Out of sampled equipment 81 (45%) working and in use, 65 (36.1%) of the equipment working but, not in use, 6 (3.3%) of the equipment not working, not in use, (the equipment were irreversible damaged from the beginning or after arrival) 16 (8.9%) the equipment not working, but repairable and 12 (6.7%) of the equipment was unknown its condition.

### **6.2.3. Availability of spare part in local market**

Concerning availability of spare part in local market, 128 (71.1%) sampled equipment spare parts in not available in local market if it broken or need substitution, but 52 (28.9%) the equipment spare parts available in the local market according to the observer expert during data collection.

### **6.2.4. Presence of accessory**

Regarding to accessory along the equipment during receiving 109 (60.6%) of the donated medical equipment has accessory along the equipment and 71 (39.4%) were not accessory accompanied during receiving.

### **6.2.5. Availability operating manual**

Out of 180 assessed donated equipment 78 (43.3%) has user operation manual during receiving and 102 (56.7%) no user operation manual.

### **6.2.6. Easily maintainability by Local expert**

Concern with maintainability, out of sampled equipment 158 (87.8%) are not maintained easily but 22 (12.2%) of the equipment can be easily maintained.

## **6.3. Receiver infrastructural**

**6.3.1 Availability of local expert.** Aspect of the availability of local expert to maintain the equipment 124 (68.9%) of donated medical equipment were not maintained by local experts, 56 (31.1%) can be maintained by local expert.

### **6.3.2. Operability by standard voltage**

Out of sampled equipment 148 (82.2%) were Operationalized by standard voltage but 32 (17.8%) not.



## **Qualitative information**

*After taking consent for interviewing to Hospital concerned body I explain uses of this research to their organization, the interview were conducted to key informants. According to the interview, result One of the informant said “the common source of donation were from Human Bridge international nongovernmental organization. Menschen for menschen, ICAP, Christian blind mission, former staff of the university and likes”<sup>1</sup>.*

*“Type of the equipment they donated was diagnostic, treatment and patient monitoring equipment was the commonest one but sometimes they donate medicine and supplies as well”<sup>2</sup>. “Almost all equipment’s were old and they have no spare parts in domestic market, no operational and maintains manual, some equipment were sophisticated and no professionals for installation”<sup>3</sup>.*

*“Hospital infrastructural was one of the bottlenecks for some equipment. Another were lack of consumable chemicals and reagent were one of the critical issue in the Hospital”<sup>4</sup>.*

*Another informants added “Spare part is one of the critical issue for donated medical equipment and difference in model of the equipment, and some manufacturing stop producing the equipment, some medical equipment were too old when it operate can easily broke”<sup>5</sup>.*

*“On other way some equipment is not operated in standard voltage, user not knows this problem then the equipment becomes easily damaged example oxygen concentrator. Some of the equipment which we acquire has no maintains, operation manual and without accessory”<sup>6</sup>.*

*Another key informant said “Lack of spare part in domestic market is the most critical issue in donated medical equipment, consume chemical and reagent also the other problem because most of donated equipment collect from different country they have no agent in domestic market then we suffer with the problem.”<sup>7</sup>*

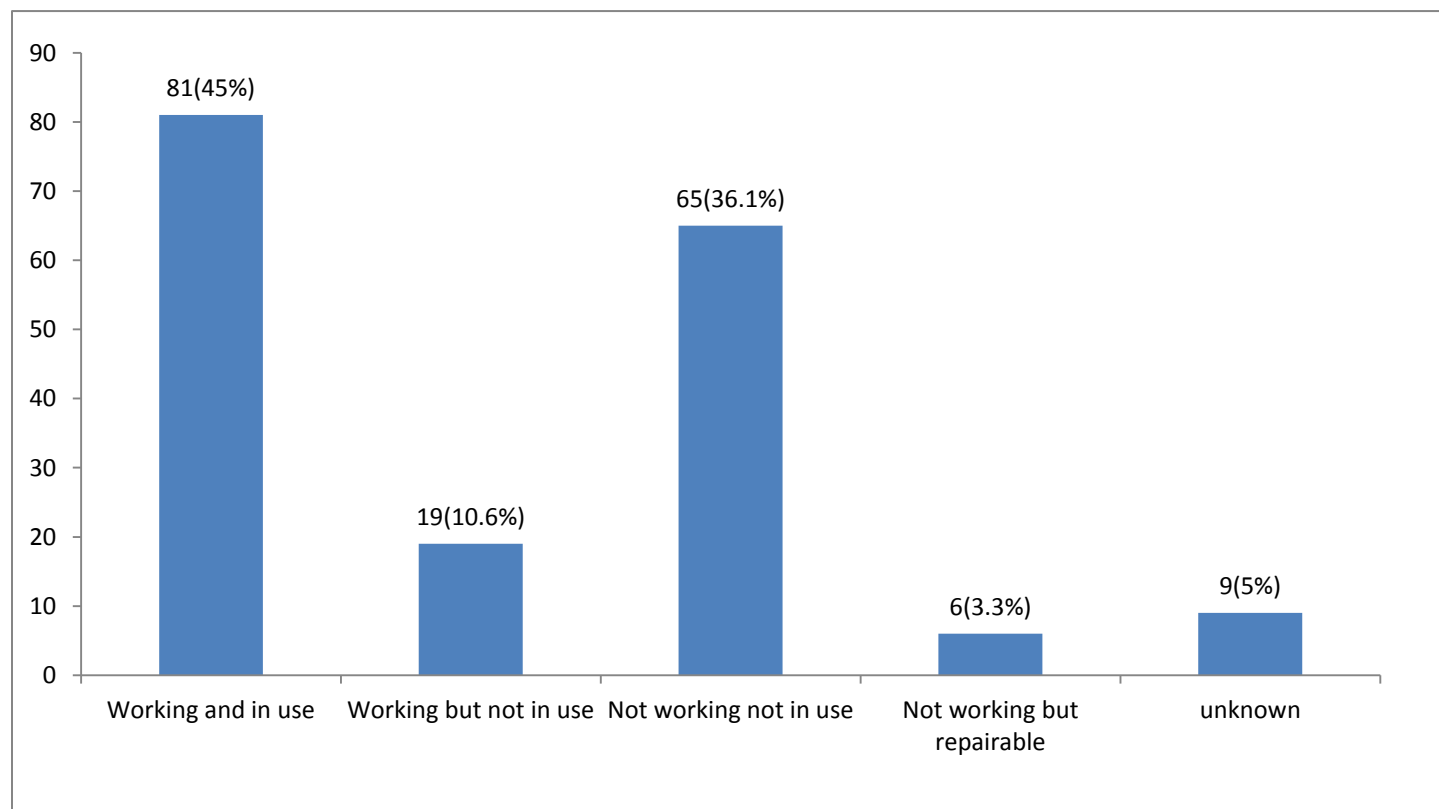
*, “Most of equipment donated to our unit were efficient but some equipment has no accessory with it”<sup>8</sup>.*

*In line with another key informants added “equipment acquired with donation has a great problem such as no accessory along equipment, too old equipment, when the equipment broken*

*we through it because nobody maintains it, when we ask biomedical engineering the equipment has no spare part”<sup>9</sup>.*

*Another informant said, “We don’t know the requirement of donated medical equipment to be received but we accept any type of donation”<sup>10</sup>.*

Figure 2: status of donated medical equipment in JUSH, Ethiopia March-April, 2015



Jimma University Specialized Hospital has a different source of donations. Nongovernmental organization and individuals are the commonest source of donations. According to this study 62 (34.4%) of the equipment from Human Bridge, 24 (13.3%) from Individuals like the former staff of the organization working in a foreign country, 23 (12.8%) from Christian blind mission, 21 (11.7%) from Menschen for menschen and about 50 (27.8%) from other source such as WHO, UNICEF, UNDP, HealTB, CDC, VILLIR, USAID and light for the world. Regarding distribution

in years of donation More equipment donation were in 2013 and it account about 48(26.7%), the list donation were 22(12.2%) in 2014.

Table 2.Current condition of donated medical equipment to Jimma University Specialized Hospital from different donors Ethiopia March -April -2015

Source of donation	Frequency of equipment	% of utilized equipment	% of non-utilized equipment	% of Working and in use	% of Working but not in use	% of Not working not in use	% of Not working but repairable	% of Unknown Its condition
Human bridge	62	27.4	72.6	27.4	14.5	33.9	8.1	16.1
Menschen for menschen	21	19	81	19	14.3	66.7	0	0
CBM	23	56.5	43.5	56.5	4.3	30.4	0	8.7
CDC	8	62.5	37.5	62.5	12.5	25	0	0
Individuals	24	45.8	54.2	45.8	12.5	25	0	0
Villir	7	100	0	100	0	0	0	0
USAID	4	25	75	25	0	75	0	0
UNDP	3	66.7	33.3	66.7	33.3	0	0	0
UNCEF	4	75	25	75	0	0	25	0
Light for World	3	66.7	33.3	66.7	0	33.3	0	0
Heal Tb	2	50	50	50	0	0	0	0
Others(WHO,MSH,)	19	42.1	57.9	42.1	5.3	36.8	0	15.8

Regarding the equipment utilization from each donors out of 62 item, 27.4% in utilization from Human Bridge, out of 21 item ,19% of equipment in utilization from menschen for menschen, out of 23, 56.5% of equipment in utilization from CBM, out of 24 item ,45.8% of equipment in utilization from individual, equipment from CDC 62.5% in utilization, equipment from USAID 25% in utilization ,equipment from UNDP 66.7% in utilization, Equipment from light for the world 66.7% in utilization, equipment from villir 100% in utilization, equipment from heal TB 50% in utilization, and equipment from other source 42.1 in utilization.

Besides 180 Sampled Donated medical equipment in JUSH, annex 1 36 (20%) were found in the pediatrics department,35 (19.4%) in ophthalmology department,21(11.7%) were in a Medical laboratory department,15(8.3%) were in Materinity,15(8.3%) were in Operation room,15(8.3%) were in Pharmacy store and 43 (23.8%) were distributed to ICU,X-ray department, Dental department, Surgical ward, medical ward and OPD.

Concerning consumption of chemicals and availability in the local market, 146 (81.1%), equipment does not need chemicals and reagent or available in local market, but 34 (18.9%) the equipment need chemical and reagent not available in the local market. Aspect of user operation manual 78 (43.3%) has operation manual during donated to the organization, 102 (56.7%) has no operation manual. Concern of Maintains manual 112 (62.2%) no maintains manual, 68 (37.8%) has maintains manual.

Regarding List of spare parts which will be replaceable or out of function after a time 136 (75.6%) of the equipment has no list, 44 (24.4%) were has list. In case of higher power consumption 168(93.3%) no need higher power, but 12 (6.7%) of the donated medical equipment need High power.

Concern of voltage about 148 (82.2%) use standard Voltage (240V), but 32 (17.8%) use under or over standard. Regarding special profession for operation and installation 111 (61.7%) can be operate and installed by local expert but 69(38.3%) were need higher profession for installation and operation.

Aspect of maintainability of equipment by local expert 158 (87.8%) not maintained by local expert 22 (12.2%) indicated maintainability by local expert. Concern training on medical equipment 158 (88.9%) the end user not trained on it but 20 (11.2%) of equipment the end user trained on it.174 (96.7%) of the equipment were open system,6 (3.3%)were closed system. Refer Annex : 2

#### **6.4. Bivariate and multivariate analysis for predicting utilization of donated medical equipment**

By applying binary logistic regression and chi-square for availability of spare part, the availability of local experts for maintaining and operation, availability of accessory along machine during receiving donated medical equipment, and equipment condition during donation with the utility of donated equipment were analyzed using logistic regression.

Concerning with a source of donation, user operation manual, maintenance manual, and handling and storage of the equipment with utility of donated medical equipment were analyzed by using the chi-square test. According to the result this study availability of local expert on utility of donated medical equipment were almost two times more likely to utilized the equipment(OR 1.997 with 95% CI of 1.252, 4.187) than no Local expert to maintain the specific equipment.

Availability of spare parts in the local market were more likely utilized when compare to those medical equipment spare parts not available in the domestic market (OR 1.212 with 95% CI of 1.449, 2.147) respectively table - 2.

Availability of accessory along equipment four times more likely utilized (OR 4.162, with 95% CI of 2.028, 8.541) when compare to those equipment donated without accessory.

Equipment condition, which were old during donation to the organization 26% less likely utilized (AOR 0.265 with 95% CI, 0.118, 0.597) when compare to equipment condition during donation to the organization were new.

Equipment condition which were unknown its condition during donation to the organization 23% less likely utilized (OR, 0.23.with 95% CI of 0.084, 0.668) when compare to refurbished equipment during donation.

Table 3. Logistic regression of various variables with utility of equipment. Ethiopia, March-April -2015

Variables	Utility of the equipment		Crude OR (95% CL)	Adjusted OR (95% CL)
	Yes	NO		
<b>Availability of local expert for maintains and operation of equipment</b>				
No	63	61	1.00	1.00
Yes	18	38	2.18(1.124,4.228)*	1.997(1.252, 4.187)**
<b>Spare parts</b>				
No	63	65	1.00	1.00
Yes	18	34	2.831(1.939,3.571)*	1.212(1.449, 2.147)**
<b>Accessory</b>				
NO	48	23	1.00	1.00
Yes	33	76	4.806 (2.526,9.146)*	4.162(2.028,8.541)**
<b>Equipment condition during donation</b>				
New	35	76	1.00	1.00
Old	27	15	0.256(0.121,0.540)*	0.265(.118, 0.597)**
Refurbished	0	1	7.448(0.00, 9.448)	2.2989(0.00, 3.2989)
Others(unknown its condition)	19	7	0.170(0.065,0.441)*	.238(0.084,0.668)**

Statistically significant at P<0.05 in the crude analysis \*

Statistically significant at P<0.05 after adjusting odd ratio\*\*

When we see table-4 below the source of donation has association to the utilization of those equipment (p-value = 0.047) at 0.05 level of significance. User operation manual has significant association to utilization of equipment (p value = 0.00). Similarly, maintains manual, list of spare parts, handling and storage has strong association to utility at 0.05 significance level.

Table 4. Association of utility of equipment's with various variables using chi-square test JUSH, Ethiopia March-April -2015

Independent variable	Utility of donated medical equipment		Total	p-Value
	Yes	No		
User operation manual				
Yes	21	60	81	0.00
No	57	42	99	
Maintenance manual				
Yes	19	62	81	0.00
No	50	49	99	
List of spare part				
Yes	71	10	81	0.00
No	65	34	99	
Label of Handling and Storage				
Yes	35	46	81	0.029
No	40	59	99	
Current condition of medical equipment				
Yes	16	65	81	0.00
No	74	25	99	
Source of donation				
Yes	21	60	81	0.047
No	45	54	99	

## 7. DISCUSSION

Economic changes, financial problems, and a growing burden of disease have contributed to an increasing dependence on donor assistance in the area of health care for many developing economies. This assistance usually includes physical equipment and spare parts, and in some countries, nearly international donors or foreign governments fund 80 percent of health care equipment. The introduction, utilization and maintenance of health care equipment require substantial financial, organizational and human resources. Often, this is either not recognized, or not enough attention is paid to it. In the Sub-Saharan Africa region, for example, a large proportion (up to 70 per cent) of equipment lies idle due to mismanagement of the technology acquisition process, lack of user training and lack of effective technical support (6,18).

The main reason why this research was conducted is to identify the current condition of donated medical equipment to JUSH whether the equipment under use or not and factors that influence utilization in detail. On the other way the result of this research, help the organization as a clue to follow donation guideline, to improve Hospital infrastructural, and developing Human resource for maintenance and installation of the equipment.

This study has attempted to identify the extent and factors influence with utilization of donated medical equipment. The study finding revealed that out of the total donated medical equipment 45% of the equipment used for medical diagnosis. 42.2% of them used for medical treating and rest 12.8% of the equipment were used for monitoring patients and maintaining cold chain. The studies found that in Haiti all equipment's donated to Haitian were used for clinical purpose and it was relevant to the Haitian Hospital (6).

Utilization of donated medical equipment's in JUSH show that 55% of the equipment not in utilization and 45 % of the equipment were in use for purposes they were donated. This finding is similar with research conducted at the University of Gloucester –central England and Gambia were equipment with donation out of service from 1%-70% (2,3,5).the possible reason were in developed country donated equipment out service were less than1% and in developing country equipment out of service extended to 70% is that developing country has poor economic



condition lead them to receive inappropriate equipment and their policy were loosen but in developed country they regulation is strong .

Equipment condition during donation was one of the influencing factors for utilization of donated medical equipment because donors donate medical equipment in three conditions such as new equipment, old equipment and refurbished equipment. According to the finding in this study,61.7% were new,23.3% were old,14.4% were unknown its condition and 0.6% were refurbished. Equipment conditions, which was found old during donation to the organization 26% less likely utilized than new donated medical equipment. This study somewhat different to study conducted at Haiti and 88% of the donated medical equipment were old and more than eight years served and only about 14% were less likely in utilization(6). The possible reason can be donation receiving police in Ethiopia a little bit stronger than Haitian and at time of receiving those donation were critical time for haitian and I believe that it difficulty to apply regulation at the time of catastrophe for Haitian.

Equipment condition, which was unknown, its condition during donation to the organization 23% less likely utilized as compared to refurbished equipment's. This indicates that the probability of fulfilling the WHO standard more in refurbished equipment than equipment its condition unknown. The possible reason for equipment their conditions unknown were due to professionals in this country. The qualitative result confirms that equipment, which is found in some hospital unit, is not unknown due to professional's poor knowledge on equipment.

Availability of skilled professionals at local is one of the major factors that influence the utilization of medical equipment's. According to this study, availability of local expert for maintaining, operation and installation for those donated medical equipment was two times more likely to utilized equipment than no expert at local. The finding is consistent with the findings in Central England university of Gloucester,Haiti,WHO 2000 report, research conducted by THET global partnership.(2,3,7) similarly found that trained profession were the main problem in developing country to maintain and install medical equipment.

Concerning the availability of spare part to the donated medical equipment, it also one of the influencing factors to utilization of donated medical equipment, But according to the finding of this study equipment which has spare parts in the local market more likely utilized when compare to those medical equipment spare parts not available in the domestic market. The finding also similar to research conducted by Healthcare technology laboratory, Duke University, USA (2, 8, 12, 14, 15).in resource poor country to get spare part to the equipment were major problem to be equipment become idle.

Another influencing factor for utilization of the donated medical equipment was availability of accessory along the equipment. His study show that availability of accessory along equipment four times more likely utilized than equipment, which has no accessory. This indicates that those donated medical equipment to JUSH without accessory were about 39.4% from different donors. As a result, the equipment was not in utilization if that equipment has accessory accompanied it has a probability to use the equipment. The study inconsistent with research conducted at Duke University's USA and research conducted in Haiti by Dzwonczykaru confirm this result (12, 15). In the same time key informants, share this idea on problem with accessory to donated medical equipment. *'we are suffer with equipment which has no accessory accompanied during receiving from donors'*<sup>9</sup>

User operation manual has strong association with donated medical equipment utilization at the same time on this research lack of operation manual lead this equipment in ability to utilize the equipment for what purpose they are donated. There is, which study confirms the result that about 50% of the donated medical equipment was without operation manual, As a result the equipment cannot be operationalized. Research conducted at U.S.A Duke University confirm the result (6,12).*Similarly qualitative result confirm that operation manual were the most common problem with most donated medical equipment in this institution.*

Concerning the maintaining manual, it has strong association to utilization of the equipment in the Hospital because without this manual the equipment cannot maintained with its minor problem, than the equipment become out of use. The research conducted at Haiti on donated medical equipment confirms the result (6).

Aspect of source of donation utility of donated medical equipment has strong association with its donors to the institute receive donation. The result indicates that old medical equipment has less utilization when compare to new equipment and more utilized with new equipment. The researchers conducted by catholic health association of the United States reveal that most of old donated medical equipment were not utilized in developing country. The research put the reason why old equipment not to be in used were ,equipment were out dated, has no accessory from the origin, donation of broken equipment and they consider donation as dumping of the out date medical equipment(16)

There is also another factor that disabled utilization of donated medical equipment is handling and storage of the equipment. If this equipment not handled well by user is can easily broke and become out of use then to maintain the equipment there is knowledge gap between local expert and technology then the equipment not utilized .Research conducted at Nigeria in Ogun state University confirm that poor handling and storage by badly trained staff lead the equipment out of use and research conducted by Duke University (USA) in sixteen country across four content on donated medical equipment confirm that lack of trained professionals were common problem in this country (12,18).

## **8. CONCLUSION AND RECOMMENDATION**

### **8.1. Conclusion**

The study aimed to identify the factors that affect utilization of donated medical equipment and their relevance to the hospital under focus. According to the finding, all equipment donated to the hospital was relevant.

In line with utility of the equipment, 55% of donated equipment to the Hospital was currently not in Utilization but only 45% of the equipment in utilization. Common associated factors for equipment not in utilization were equipment condition during receiving, lack of spare parts at local market, absence of accessory along machine during receiving, lack of well-trained professionals in the organization, maintenance and operation manual not accompany to equipment were problem in sight associated to donated medical equipment.

## 8.2 Recommendation

Based on the results of the study the following recommendations forwarded

Ethiopia have a clearly worded donation policy and procedures .Therefore any donation must fulfill FMHACA requirement and donation recipients organization also confirm whether donated equipment screened by FMHACA or not. Jimma University specialized Hospital Head management and biomedical engineering department must have to have communication to the donors before the equipment arrived to country.

Hospital head management, biomedical engineer and head procurement department of the Hospital must check the following condition.

- ◆ Availability of spare parts to local market.
- ◆ Availability of professionals who operate, maintains and installation of the equipment
- ◆ Equipment condition weather old, refurbished or new for old equipment check for life span performance and availability of spare parts.
- ◆ JUSH must train there professionals and equipped with tools to maintain this out of service equipment.
- ◆ Receiver must confirm operation manual, maintenance manual and accessory accompanied equipment. If no immediate contact to donors.
- ◆ Receiver must confirm source of donation to easily contact to know about equipment.
- ◆ Negotiation with donors on maintains installation and operating the equipment.

Donors must be confirm receiver infrastructural condition

- ◆ The donors and recipients must confirm that appropriateness of equipment, maintainability and professionals in the recipient's organization.
- ◆ Before any request for donors, organization must confirm type of equipment going to ask and must observe availability of local profession, infrastructural, and technological condition of the environment.
- ◆ Donation- receiver must confirm Local agents for spare parts availability.
- ◆ For those sophisticated equipment end user must trained by help of donors.

For researcher

Further study should be conducted at national level on donated medical equipment.

## **9. Limitation of the Study**

This study only concern with jimma university Specialized Hospital. The result of the study is not generalization for national wide, the current study doesn't show the national or regional status of donated medical equipment since it is conducted in a single hospital but can be used as a base line to conduct further research throughout country.

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### Annex: 1. Selected donated medical equipment from each Hospital unit

Serial No	Equipment type	proportionality	No of sampled	Remark
1	Suction machine	183*33/351	17	from each ward two suction machine
2	Medical lab microscope	22*183/351	11	laboratory department , pharmacy
3	Manual chemistry analyzer	1*183/351	1	From lab department
4	PCR Machine	2*183/351	1	From lab department
5	Heat block	2*183/351	1	From lab department
6	Safety Cabinet	183*3/351	2	From lab department
7	Centrifuge	10*183/351	5	From lab department
8	Incubator+ incubator	lab 10*183/351	4	ICU ,lab and pediatric
9	Oxygen concentrator	22*183/351	11	From each department on concentrator
10	Defibrillators	4*183/351	2	Two ward
11	Servo ventilator	8*183/351	4	One ward. ICU
12	Patient Monitor	6*183/351	3	ICU
13	Anesthesia Machine	11*183/351	6	Three
14	Couter Machine	6*183/351	3	One ,OR
15	Fluoroscopy	1*183/351	1	OR
16	Autoclave	20*183/351	10	From each ward
17	Ultra sound	7*183/351	4	Four ward
18	ECG machine	5*183/351	3	Two ward

<b>Serial No</b>	<b>Equipment type</b>	<b>proportionality</b>	<b>No of sampled</b>	<b>Remark</b>
21	Boiler	2*183/351	1	One
22	Endoscopy	1*183/351	1	One
23	Colonoscopy	1*183/351	1	One
24	Spirometer	1*183/351	1	One
25	Echocardiography	1*183/351	1	One
26	Refrigerator	20*183/351	10	From each ward
27	Surgical microscope	2*183/351	1	One
28	Febirilator	1*183/351	1	One
29	Heat Radiator	8*183/351	4	Two
30	Pulse oximeter	22*183/351	11	Two
31	Phototherapy	4*183/351	2	One
32	per fusser	2*183/351	1	One
33	Respirator machine	9*183/351	5	One
34	Nebulizer	9*183/351	5	One
35	Weight scale	12*183/351	6	From all
36	Slant lamp microscope	11*183/351	6	One
37	Tonometer	9*183/351	5	One
38	Auto meter refractor	2*183/351	1	One
39	Visual acuity projector	2*183/351	1	One
40	Diode Laser	2*183/351	1	One
41	DCR set	1*183/351	1	One
42	DORC	1*183/351	1	One
43	FDT	1*183/351	1	One
44	Fundus Camera	1*183/351	1	One
45	IndirectOphthalmoscope	1*183/351	1	One

<b>Serial No</b>	<b>Equipment type</b>	<b>proportionality</b>	<b>No of sampled</b>	<b>Remark</b>
46	Kerometer	1*183/351	1	One
47	Lenso meter	1*183/351	1	One
48	YAG Laser	1*183/351	1	One
49	Operating microscope	6*183/351	3	One
50	Ophthalmoscopy	1*183/351	1	One
51	Phaco machine	6*183/351	3	One
52	Retinoscopy	1*183/351	1	One
53	Slant compressor	1*183/351	1	One
54	Bilirubin Machine	1*183/351	1	One
55	A1C Analyzer	1*183/351	1	One
56	CT Dipolar machine	5*183/351	3	One
57	Wheel chair	10*183/351	5	From all
58	Dialysis Machine	1*183/351	1	One
Total			190	

**Annex -2. Descriptive Summary of donated equipment at JUSH, Ethiopia, March-April -2015**

Variable	Frequency	Percentage
<b>Source of donation</b>		
Human bridge	62	34.4
Individual	24	13.3
Christian blind mission	23	12.8
Menschen for menschen	21	11.7
Others	19	10.6
CDC	8	4.4
VILLIR	7	3.9
UNCEF	4	2.2
USAID	4	2.2
Light for the world	3	1.7
UNDP	3	1.7
Heal TB	2	1.1
<b>Consumables chemical and reagent</b>		
No	146	81.1
Yes	34	18.9
<b>User operational manual</b>		
Yes	78	43.3
No	102	56.7
<b>Maintains manual</b>		
No	112	62.2
Yes	68	37.8
<b>List of spare parts</b>		
No	136	75.6
Yes	44	24.4

Variable	Frequency	Percentage
<b>Accessory along equipment</b>		
Yes	109	60.6
No	71	39.4
<b>High power consumption</b>		
No	168	93.3
Yes	12	6.7
<b>Utilization of standard</b>		
Voltage		
Yes	148	82.2
No	32	17.8
<b>Label of estimated life span of equipment</b>		
No	151	83.9
Yes	29	16.1
<b>Open system of the equipment</b>		
Yes	174	96.7
No	6	3.3
<b>Equipment reagent need special refrigerator</b>		
No	177	98.3
Yes	3	1.7
<b>Equipment need special profession to operate and maintains</b>		
No	111	61.7
Yes	69	38.3

Variable	Frequency	Percentage
<b>End user training on equipment</b>		
No	160	88.9
Yes	20	11.1
<b>Labeled any safety precaution on equipment</b>		
No	110	61.1
Yes	70	38.9
<b>Frequency of maintains</b>		
No	158	87.8
Yes	22	12.2
<b>Comfort ability(accuracy) of the equipment</b>		
Yes	128	71.1
No	52	28.9
<b>Equipment name labeled</b>		
Yes	24	13.3
No	156	86.7
<b>Has the equipment handling and storage</b>		
Yes	94	52.2
No	86	47.8
<b>Manufacturer Name</b>		
Yes	99	55
No	81	45

### **Annex:3 Distribution of donated medical equipment in JUSH March-April 2015**

Variable	Frequency	Percentage
<b>Equipment distribution in the Hospital department</b>		
Pediatrics	36	20
Ophthalmology	35	19.4
Medical Laboratory	21	11.7
Maternity	15	8.3
Operation room	15	8.3
Pharmacy Store	15	8.3
Intensive care Unit	9	5
X-ray Department	8	4.4
Dental Department	8	4.4
Medical ward	7	3.9
MCH,OPD and GYNE	6	3.3
Surgical ward	5	2.8
<b>Source of donation of medical equipment</b>		
Human bridge	62	34.4
Individual	24	13.3
Christian blind mission	23	12.8
Menschen for menschen	21	11.7
Others	19	10.6
CDC	8	4.4
VILLIR	7	3.9
UNCEF	4	2.2
USAID	4	2.2
Light for the world	3	1.7
UNDP	3	1.7
Heal TB	2	1.1

Variable	Frequency	Percentage
<b>Year of donation</b>		
2010	42	23.3
2011	24	13.3
2012	44	24.4
2013	48	26.7
2014	22	12.2
<b>Consumables chemical and reagent</b>		
No	146	81.1
Yes	34	18.9
<b>User operational manual</b>		
Yes	78	43.3
No	102	56.7
<b>Maintains manual</b>		
No	112	62.2
Yes	68	37.8
<b>List of spare parts</b>		
No	136	75.6
Yes	44	24.4
<b>Accessory along equipment</b>		
Yes	109	60.6
No	71	39.4
<b>High power consumption</b>		
No	168	93.3
Yes	12	6.7



Variable	Frequency	Percentage
<b>Utilization of standard</b>		
Voltage		
Yes	148	82.2
No	32	17.8
<b>Label of estimated life span of equipment</b>		
No	151	83.9
Yes	29	16.1
<b>Open system of the equipment</b>		
Yes	174	96.7
No	6	3.3
<b>Equipment reagent need special refrigerator</b>		
No	177	98.3
Yes	3	1.7
<b>Equipment need special profession to operate and maintains</b>		
No	111	61.7
Yes	69	38.3
<b>End user training on equipment</b>		
No	160	88.9
Yes	20	11.1
<b>Labeled any safety precaution on equipment</b>		
No	110	61.1
Yes	70	38.9.

Variable	Frequency	Percentage
<b>Frequency of maintains</b>		
No	158	87.8
Yes	22	12.2
<b>Comfort ability(accuracy) of the equipment</b>		
Yes	128	71.1
No	52	28.9
<b>Equipment name labeled</b>		
Yes	24	13.3
No	156	86.7
<b>Has the equipment handling and storage</b>		
Yes	94	52.2
No	86	47.8
<b>Manufacturer Name</b>		
Yes	99	55
No	81	45

## **Annex-4 :Interview guided semi-structured questioners**

My name is-----, and I am data collector on donated medical equipment for MSC student in pharmaceutical supply chain management at jimma university. The study will be on the relevance and utility of donated medical equipment in this Hospital. The purpose of this study is to confirm that the appropriateness and usefulness of donated medical equipment to this Hospital, which was donated, from personal organization and foreign country. These study primaries help your organization to now the status of this equipment in your organization.

### **Questioners (checklist) for equipment users**

General information on donated medical equipment.

1. Equipment name \_\_\_\_\_
2. Years of donation-----
  3. Source of Donation.
    - Country (specify).....
    - NGO (specify).....
    - Individuals.....
  4. Manufacturer of this equipment.  
.....
  5. Unit in the Hospital.....
6. Equipment condition during donation
  - A) New
  - B) Old
  - C) Refurbished
  - D) Others-----

Check list for equipment users

Serial no	Questions or criteria	Yes (1)	No (0)
1	Is this equipment need consumables chemical and reagents?		
2	Is chemical and reagent available in local market		
3	Has this Equipment consumables reagents and spare parts during given to your organization?		
4	Has spare parts available in local market for this equipment		
5	Has this equipment user operation manual when it supplied to your unit?		
6	Has this equipment reparable and maintenances manual along machine?		
7	Is there list of spare parts, which is replaceable along with equipment?		
8	Is all accessory included when it supplied to your unit?		
9	IS there any power supplied associated problem with this equipment such as high power consumption?		
10	Is this equipment utilize standard voltage (240V/50Hz		
11	Is there any estimated life span of the equipment on machine such as model no, manufacturer date, new or reconditioned?		
12	Is the machine open system or closed system?		
13	Do the reagent need special refrigerators?		
14	Are their professionals for maintaining in the facilities?		
15	Is the donated medical equipment supplied to your unit easily maintained by local expertise?		
16	Does it need special professions to operating the equipment like software engineers?		
17	Have you any training on this equipment?		
18	Is this equipment labeled any safety precaution to you?		

19	Is this equipment need daily, weekly or monthly maintenances?		
20	Is this equipment comfortable for patients, validity, specificity and sensitivity of test result?		
21	Is there any specification for which patient this equipment will apply?		
22	Is the equipment name labeled on it?		
23	Is there any specification on handling and storage of this equipment?		
24	Is there any description how the equipment sterilized??		

Observational check List

1. Medical equipment name-----

2) Source of Donation.

Country (specify).....

NGO (specify).....

Individuals.....

3) Serial number and manufacturer of this equipment.

.....

.....

4) Location of Manufacturer.....

5). Current condition of this donated medical equipment.

A) Working in use

B) Working but not in use

C) Not working not in use

D) Not working but repairable

6) Is this equipment appropriate for organization? In terms of

Space occupying-----

Patient comfort ability-----

Environmentally friend-----

Capacity to do intended purpose-----

Others-----

7) Performance of the equipment when compare to similar equipment which is purchased by Hospital. -----

8) Capacity of performance according to it .s standard unit

-----

-----

9) Depending on its nature and type, the label of donated medical equipment shall at least include

- A. the name of the medical equipment ----- A)Yes B) No
- B. model number or serial number ----- A)Yes B)No
- C. manufacturing date ----- A)Yes B)No
- D. life span or expectancy----- A)Yes B)NO
- E. name and address of the manufacturer ----- A)Yes B)No
- F. handling and storage requirement Label ----- A)Yes B)NO
- G. technical direction for use ----- A) Yes B) No

H. an indication, if applicable, that the medical equipment is intended to be used only for clinical or performance investigations before being supplied

A) Yes B) No

I. for a sterile medical equipment, the word “Sterile” and where appropriate, description of methods of re-sterilization Indicated

A) Yes B) No

J. Is the device is a refurbished, an indication of the device as refurbished device

A) Yes B) No

K. if the device is intended for presentation or demonstration purposes only, it must be labeled as “for presentation or demonstration purposes only, not for use on human.

A) YES B) No

L. if the device emits radiation for medical purpose, details of its nature, type and appropriate, the intensity and distribution of this radiation.

A) Yes B) No

M. if the device is to be installed with or connected to other medical device or equipment, or with dedicated software, in order to operate as required for its intended use, sufficient details of its characteristics to identify the correct device or equipment to use in order to obtain a safe combination

A) Yes B) No

N. if the device is an in vitro diagnostic medical device it must be labeled as “ in vitro diagnostic

A) Yes B)No

O. The intended purpose of the medical equipment, the intended user of the medical equipment, and the kind of patient on whom the medical equipment is intended to be used.

A) Yes B) No



## Annex 5- Key informant interview Guideline

Serial No	Open ended question	Ways of probes
1	How your organization get medical equipment	If purchased what is source of money? Was donation requested by your organization? If yes how often? When? Why? Whom did your organization request? Type of equipment?
2	Have you ever across any communication on donated medical equipment supplied to your organization before equipment arrival?	
3	How do you install and maintain donated medical equipment in your facility?	Are there professionals in your organization for installation and maintaining equipment? If yes is there necessary tool to maintain the equipment? If no why? Who install the equipment? How do you deal with them? Purpose of Having professionals in the organization and lack of having them in the facility?
4	Are there training for user on handling of donated medical equipment? Please would you tell me how this equipment handled in your organization?	Was training given to professions on how to use ? If yes when? By whom? Number of attendant? If no why? What was the difficulty?
5	Donated medical equipment to your organization has warranty. Tell me about donated equipment	What was the status of this equipment when you receive? Is there installation document?
6	Was donation based on your organization need?	If no why? Are all donated equipment help full to your facility? How/ if no why? Are there technologically appropriate?(in terms of capacity, specify and sensitivity ?to test sample? Easy to use
7	Are these donated medical equipment registered on the national medical equipment list?	If no why?
8	Is there any donation from the local non-government organization or individual from the domestic product?	If yes from whom or which organization Type of equipment Are these equipment are technological appropriates Are there clinical appropriates?

**ASSURANCE OF PRINICIPAL INVESTGATOR**

I. The undersigned declare that this thesis paper is my original work and agree to accept responsibility for the scientific ethical and technical conduct of the research project and provision of required progress reports as per terms and conditions of college of public health science in effect at the time of grant is forward s the result of this application.

Name of student Genale Wabe Biftu

Date----- Signature-----

**APPROVAL OF THE ADVISORS**

Name of the first Advisor Mr. Gizachewu Tilahun (MSC)

Date----- Signature-----

Name of the second Advisor Professor Tefera Balachew (MD, Msc, PhD)

Date----- Signature-----