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REVIEW ARTICLE

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

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ABSTRACT

Background: Donation of different medical equipment to developing nations from different international and multinational organizations has been currently increasing. 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 2015, Data were analyzed using SPSS for windows version 16.0, Chi-Square test and binary logistic regression were used to determine the association between the different factors.

Result: A total sample of 180 donated medical equipment was included in the study. The result showed 81(45%) were in utilization 99(55%) were found out of service. Availability of a local expert was one of the factors predicting utilization (OR, 1.997 with CI of 95% 1.3, 4.2). availability of spare parts in local market were also found to predict utilization (OR 1.1212 with 95% CI of 1.2,2.2). Equipment condition and availability of accessories on arrival to the facility were also found to predict utilization of the equipment.

Conclusion: Majority of the equipment's obtained by donation are found out of service. Lack of skilled professionals in the institution, absence of spare parts in domestic market, condition of the equipment on arrival, absence of maintenance manual and accessory along machine are the predictors for utilization of donated medical equipment for intended purpose.

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INTRODUCTION

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 (WHO, 2015). The quality of medical equipment's 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 (Gatrad *et al*., 2007). Many developing countries are increasingly dependent on donor assistance to

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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 there is 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 (WHO, 2000). 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 might be too expensive. In addition to these, some of the received equipment as donation are not functional on arrival to the facilities of developing country (EU, 2012). Therefore, this study will be worthwhile to assess the root problems associated with donated medical equipment utilization. Besides, this research paper can contribute to the appropriate consideration of donated medical equipment and Service donation for maintenance and operating the equipment.

MATERIALS AND METHODS

Study setting and Period

The study was conducted from March 2015 to April 2015 at Jimma University Specialized Hospital. The hospital is found in Jimma town, located in Oromia Regional State, south west Ethiopia 350km from the capital city. The hospital is a university specialized hospital which serves as referral for over fifteen million people in south west Ethiopia and the neighboring country South Sudan. The Hospital was selected as a case because it is one of the largest public acquiring entities using the donated medical equipment. 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. Given its numerous services and larger capacity, there are many donated equipment in the different wards of the hospital.

Study Design

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

Sampling Technique and Sample Size

From a total of 350 donated medical equipment received from donors in the last five years, 183 equipment were selected randomly. 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. For qualitative part six respondents were selected purposively based on their position and responsibility to medical equipment.

Data collection

Data was collected using a pre tested check list designed for the study by a trained data collectors, the qualitative data was collected by an in-depth interview using a semi structured interview guide.

Data analysis

The collected data was cleaned and coded first and analyzed using SPSS Version 20. Descriptive analysis, chi square test and Binomial logistic regression were used to describe and explain the factors. The qualitative data was analyzed manually by thematic content analysis.

Ethical Consideration

An official support letter was obtained from the ethical review board of Jimma University College of Health Science to conduct the study in Jimma university specialized Hospital and permission letter from the Hospital was obtained before data collection. An informed consent were obtained from the respondents for the qualitative part after explaining the purpose of the study, any personal identifier were not used in the report of the study.

RESULTS

Description of the Characteristics of Donated Equipment

From the total 180 equipment, 81(45%) were used for diagnostic, 76(42.2%) were for treatment and 23(12.8%) were for monitoring patients and cold chain maintenance purposes (Table 1). There were no equipment which were irrelevant for diagnosis, treatment and Monitoring patients. Regarding the condition of the equipment up on arrival to the facility 111(61,7%) were new, 42(23.3%) were old (2nd hand) and one was refurbished, the condition of the remaining 26(14.4%) were unknown because of unavailability of documents. 109(60.6%) of the donated medical equipment have accessory along the equipment and 71(39.4%) were not accessory accompanied during receiving. 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, Heal TB, CDC, VILLIR, USAID and light for the world. Regarding distribution in years of donation More equipment donation were in2013 and it account about 48(26.7%), the list donation were 22(12.2%) in 2014. Concerning utility of the donated medical equipment, 81(45%) were in utilization and 99 (55%) were not in utilization. Regarding to the current condition of those donated medical equipment to JUSH, out of sampled equipment, 81(45%) working and in use (Figure 1). 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

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

Variable	Frequency	Percentage
Type of equipment		
Diagnostic	81	45
Treatment	76	42.2
Monitoring patients and maintain cold chain.	23	12.8
Utility of the equipment		
(Yes)	81	45
(No)	99	55
Equipment condition during donation		
New	111	61.7
Old	42	23.3
Refurbished	1	0.6
Others(no specification on equipment)	26	14.4
Availability of Spare parts in local market		
No	128	71.1
Yes	52	28.9
Availability of local expert for maintenance and operation of equipment		
Yes	56	31.1
No	124	68.9
Has accessory		
No	71	39.4
Yes	109	60.6

Table 2. Current condition of donated medical equipment JUSH, 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
Menschenformenschen	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

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

Variables	Utility of the equipment		Crude OR (95% CI)	Adjusted OR (95% CI)
Availability of local expert for maintains and operation of equipment	Yes	NO		
N o	63	61	1.000	1.000
Yes	18	38	2.180(1.124,4.228)*	1.997(1.252, 4.187)*
Spare parts				
No	63	65	1.000	1.000
Yes	18	34	2.831(1.939,3.571)*	1.212(1.449, 2.147)*
Accessory				
NO	48	23	1.000	1.000
Yes	33	76	4.806 (2.526,9.146)*	4.162(2.028,8.541)*
Equipment condition during donation				
New	35	76	1.000	1.000
Old	27	15	0.256(0.121,0.540)*	0.265(.118, 0.597)*
Refurbished	0	1	7.448(0.00, 9.448	2.299(0.00, 3.2989)
Others(unknown its condition)	19	7	0.170(0.065,0.441)*	0.238(0.084,0.668)*

Statistically significant at P<0.05 in the crude analysis *

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 (Table 2). The spare parts of 128(71.1%) of equipment's are not available in local market if it broken or need substitution, but 52 (28.9%) of the equipment spare parts are available in the local market according to the observer expert during data collection. Concerning with maintainability, out of sampled equipment 158(87.8%) are not maintained easily but 22(12.2%) of the equipment can be easily maintained. With respect to the availability of local expert to maintain the equipments, 124(68.9%) of donated medical equipment were not maintained by local experts, 56(31.1%) can be maintained by local expert. 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 CDC62.5% 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 villir100% in utilization, equipment

from heal TB 50% in utilization, and equipment from other source 42.1 in utilization.

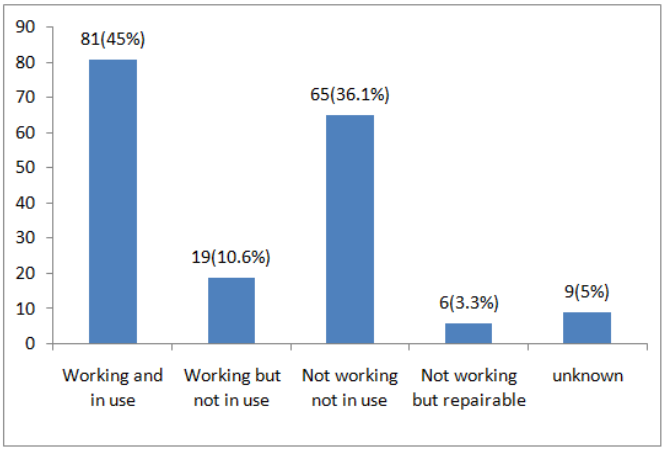

Figure 1. Functionality status of donated medical equipment in JUSH, Ethiopia March-April, 2015

Logistic Regression analysis of utilization of donated medical equipment

By applying binary logistic regression 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. However, the 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. Accordingly, 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 were 74% less likely utilized (AOR = 0.265 with 95% CI of 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 77% less likely utilized (OR, 0.23.with 95% CI of 0.084, 0.668) when compare to refurbished equipment during donation. The source of donation has association to the utilization of the equipment (Table 4). Similarly, User operation manual, maintains manual, list of spare parts, handling and storage has strong association to utility (Table 3).

DISCUSSION

The research was conducted with the aim of assessing the current condition of donated medical equipment in JUSH and identifying factors that influence utilization in detail. This research has identified that only 45% of the medical equipment's obtained through donation were in utilization in JUSH 55% of the equipment's were found out of service due to different reasons. Availability of maintenance professional, absence of spare parts in local market and the equipment condition on arrival to the facility were the significant factors for utilization of the equipment. This research has attempted to determine the level of utilization of the medical equipment acquired by donation and tried to explore the factors predicting their utilization. This study will serve the hospital to develop its own donation guideline and the federal ministry of health to revise its donation guideline. The study will also serve as a base line for future researches in the area in the country. This is a case study of a single hospital in south west Ethiopia, hence doesn't show the picture in the country or the region. 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 (Dzwonczy and Riha, 2012; Erinosho, 1991). The result of the study revealed that only 45% of the medical equipment's obtained by donation are functional and being utilized for their intended purpose. 55% of the equipment's are found out of service due to different reasons. This finding is similar with research conducted at the University of Gloucester –central England and Gambia where equipment acquired with donation was found out of service from 1%-70% (Gatrad et al., 2007; WHO, 2000; THET., 2012). The possible reason why large proportion donated equipment's in developing countries found out of service could be due to poor economic condition. 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 of this study, 61.7% were new, 23.3% were old, 0.6% were refurbished and the condition of 14.4% were unknown. Equipment's which was old at the time of donation to the organization were 74% less likely to be utilized than new equipment. This study somewhat different to study conducted in Haiti which reported that 88% of the donated medical equipment were old which served more than eight years and were 14% were less likely to be utilized (Dzwonczy and Riha, 2012). The possible reason could be donation receiving policy of Ethiopia might be a little bit stronger than Haitian and at time of receiving those donations were critical time for Haitian and it is believed that it was difficult to apply regulation at the time of catastrophe for Haitian. Availability of skilled professionals at local is one of the major factors that influenced the utilization of medical equipment's.

According to this study, equipment's for which local expert for maintaining, operation and installation were available was two times more likely to be utilized equipment than the others. The finding is consistent with the findings in Central England university of Gloucester, Haiti, WHO 2000 report, research conducted by THET global partnership. (Gatrad et al., 2007; WHO, 2000; THET, 2012) which reported 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 was also one of the influencing factors to utilization of donated medical equipment, according to the finding of this study equipment which has spare parts in the local market are more likely to be utilized when compare to those medical equipment's for which spare parts were not available in the domestic market. The finding also similar to research conducted by Healthcare technology laboratory, Duke University, USA (Robert Malkin and Allison Keane, 2015). Which reported that in resource limited countries getting spare part to the equipment were major reason of equipment's to become idle. Another influencing factor for utilization of the donated medical equipment was availability of accessory along the equipment. This study showed that equipment's for which accessory along equipment was available was four times more likely to be utilized than equipment's which has no accessory. The study inconsistent with research conducted at Duke University's USA and research conducted in Haiti by Dzwonczykaru which confirm this result (Robert Malkin and Allison Keane, 2015; Dzwonczy and Riha, 2012). This was also one the issue raised by key informants who shared this idea of problem with accessory to donated medical equipment. *'we are suffering with equipment which has no accessory accompanied during receiving from donors"*[9] User operation and maintenance manuals has strong association with donated medical equipment utilization. This research also found that lack of operation and/or maintenance manuals was one of the reasons of inability to utilize the equipment for their intended purpose. Other studies also confirmed the result, that about 50% of the donated medical equipment was without operation manual and as a result the equipment cannot be operational zed. Research conducted in U.S.A Duke University also confirm the result (Robert Malkin and Allison Keane, 2015; Lora Perry and Robert Malkin, 2011). This issue was also one the problems raised by the key informant's *"operation manual were the most common problem with most donated medical equipment in this institution".*

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 but larger proportion of them out of service because of different reasons. The main factors for equipment's being out of service 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 accompanying the equipment.

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