ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF PUBLIC HEALTH

MEDICAL EQUIPMENT MANAGEMENT IN AYDER REFERRAL HOSPITAL, MEKELLE, ETHIOPIA.

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A CAPSTONE PROJECT SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE MASTERS OF HOSPITAL AND HEALTH CARE ADMINISTRATION.

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ADDIS ABABA, ETHIOPIA

Declaration

I, the undersigned, declare that this capstone project is my original work and has not been presented for a degree in this or other University and all sources of materials have been fully acknowledged.

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Date of submission:_____

This capstone project work has been submitted for examination with our approval as University advisors.

	Advisor's name	Signature	Date
A.	_____	_____	_____
B.	_____	_____	_____

Acknowledgement

Above all, I would like to thank my God for his kind help for me.

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ABBREVIATIONS

CEO	Chief executive officer
EHRIG	Ethiopian hospitals reform implementation guideline
EMOC	Emergency obstetric care
ENT	Ear, neck and throat
GPS	General practitioners
HM	Hospital management
ICU	Intensive care unit
I-TECH	International training and education center for HIV
MD	Medical director
MEC	Medical equipment committee
MEU	Medical equipment unit
OR	Operation room
SOP	Standard operating procedure
TB/ART	Tuberculosis/antiretroviral treatment
PLC	Private limited company

LIST OF TABLES AND ANNEXES

Operational definitions

- **Medical equipment:** Medical equipment is defined as any instrument, apparatus, machine, or other material or similar article that is used for diagnosis, investigating, prevention, monitoring and treatment of patients.
- **Higher level medical equipment:** Higher level medical equipment is an equipment which is routinely used in the day-to-day patient care activities and which is expensive.
- **Medical equipment management:** Medical equipment is the planning, organizing, monitoring and evaluation of activities pertaining medical equipment.

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Abstract

Problem statement: In Ayder referral hospital, there is no well-organized system for the management of medical equipment.

Objective: The overall objective of the project is to improve medical equipment management by increasing the percentage of EHRIG standards pertaining to medical equipment management met and by increasing medical equipment repaired by the end of April, 2012.

Result: The percentage of functional medical equipment showed an improvement from 72(72.7%) to 82(83.8%). Compliance with EHRIG standards for medical equipment management (operational standards met) increased from 3 to 5 out of 9(33.3% to 55.6%).

Conclusion: Sustainable provision of trainings on medical equipment operation and handling can result in a significant improvement in medical equipment functionality. Moreover, establishing medical equipment maintenance work agreements has a great impact in the management of medical equipment and also adherence to the Ethiopian hospitals reform implementation guideline can bring about improved management of medical equipment in health facilities.

Recommendation: Full implementation of the Ethiopian hospitals reform implementation guideline strategies should be made and it is better to establish medical equipment maintenance work agreements with experienced companies.

1. INTRODUCTION

1.1. The health facility

Ayder hospital is located in Mekelle, the capital city of Tigray region. It was established in 2007 and is administered by Mekelle University. The mission of Ayder referral hospital is

- To be the center of excellence in clinical teaching, tertiary health care services and clinical research in the country.
- To provide patient-centered quality health care services
- To satisfy the health care needs of the society

Ayder offers the following services

Outpatient services

- Gynecology and Obstetrics unit
- Psychiatric unit
- ENT unit
- Internal medicine unit
- Surgical unit
- Cardiac unit
- Minor operations unit
- Diabetic unit
- Blood bank services
- Physiotherapy unit
- Dental services unit
- Emergency unit
- Pediatric and child health unit
- TB/ART unit
- Laboratory and Pathology services
- X-ray, & Doppler ultrasound and Endoscopy
- 24-hours retail pharmacy service

In patient services

- Adult and neonatal ICU services
- Free laboring mothers services
- Dermatology services
- Internal medicine, Gynecology, Obstetric, Pediatric& Surgical wards.

Ayder referral hospital is considered to be the only referral hospital in northern Ethiopia and provides medical services to as many as 5 million people.

Moreover, it is among the most highly staffed hospitals in Ethiopia.

The hospital is staffed by 24 specialists, around 67 general GPs (39 are on study), 255 nurses, 28 laboratory technicians and technologists, 24 druggists and pharmacists, 6 X-ray technicians, 15 midwife, 11 anesthesia, 191 other technical staffs.

The hospital does not have a governing board or Chief Executive Officer (CEO). Hospital operations are run by the medical director who is accountable to the Dean of the College of Health Sciences.

1.2. Problem and Objective

Problem statement: There is no well organized system for medical equipment control and asset management system in Ayder referral hospital**.**

Biomedical equipment is used for various preventive, diagnostic, therapeutic, supportive and control procedures for day-to-day patient care activities. Functioning biomedical equipment is vital for producing accurate and reliable test results, and for effective treatment. It helps health care facilities to provide quality health services and meet health service standards.

In the last one year, a dramatic improvement has taken place in Ayder referral hospital, particularly in the laboratory department. However, there are problems that still need special attention. The existence of poor medical equipment management, for example, is one of the biggest problems of the hospital as EHRIG assessment is made and the compliance is found to be low(33%). In Ayder referral hospital, there is no organized equipment control and asset management there is no proper documentation of medical equipment management activities. Most importantly, there is ineffective medical equipment maintenance system and the process of medical equipment maintenance is long. As a result, most maintenance work orders are left incomplete which in turn brings about low quality health care services.

This project will have its own contribution in improving the management of medical equipment in the hospital which in turn brings about a significant improvement in the health care service delivered by the hospital.

Objective

General objective: To improve the management of medical equipment in Ayder referral hospital

Specific objectives

1. To increase the percent of functional medical equipment from 70% to 90 % by increasing equipment repair by the end of April, 2012.
2. To increase the percentage of EHRIG standards to pertaining medical equipment management met from 33% to 66% by the end of April, 2012.

1.3. Root cause analysis

Using the fishbone tool, many causes were identified as contributors to the existence of long and ineffective medical equipment maintenance process and flow chart tool was carried out to see the process of medical equipment maintenance.

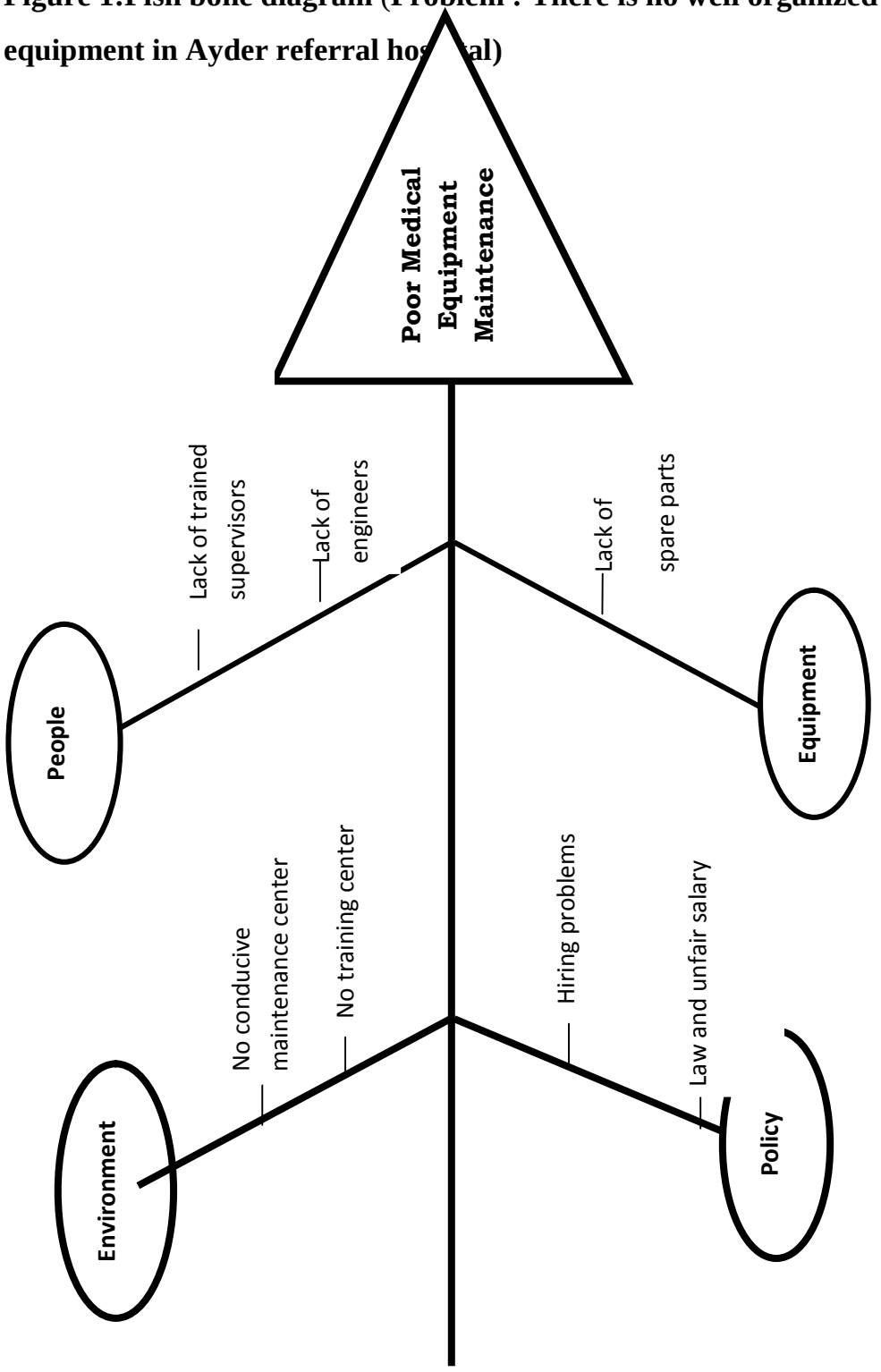
Methods used to identify the root causes include:

- Assessment of compliance with Ethiopian hospitals reform implementation guideline (EHRIG operational standards were used).
- Discussion with facility head, maintenance technicians and selected staffs especially unit heads on medical equipment management activities.
- Assessment of the notification and maintenance work order system.

Main problems identified as evidenced by results of the baseline data include the following

- There are no well-trained maintenance engineers. Medical equipment management responsibility is in the hands of a technician who doesn't not have biomedical equipment maintenance background. He is recruited by the hospital as lift maintenance engineer.
- There is no adequate scheduled preventive and curative maintenance training given to the existing technician. He has received training on general medical equipment maintenance at two different occasions.
- There is no computerized or paper-based regular medical equipment and spare parts inventory system.
- There is no scheduled inspection and testing of medical equipment.
- There is no properly prepared and documented history file for most medical equipment.

Figure 1:Fish bone diagram (Problem : There is no well organized system for medical equipment in Ayder referral hos[illegible]al)



1.4. Literature review

Medical equipment is an article, instrument, apparatus or machine that is used in the prevention, diagnosis or treatment of illness or disease, or for detecting, measuring, restoring, correcting or modifying the structure or function of the body for some health purpose. Typically, the purpose of a medical device is not achieved by pharmacological, immunological or metabolic means [1].

Biomedical equipment is an integral part of the physical infrastructure of health facilities and is an important part of modern health services**.** Medical devices are considered to be crucial for the services offered in prevention, diagnosis, treatment and rehabilitation of illness and disease [2-4].

Every day more than 50, 000 different kinds of medical devices are estimated to be used in health care facilities and elsewhere all over the world.[5] and it is estimated that most developing countries seldom have 50% of equipment in usable condition, and in some countries, 80% of equipment is inoperable[6]. This finding is bigger than the finding obtained in this capstone project which is 23%.

WHO reports state that in most countries, there is lack of adequate repair and maintenance facilities, infrastructure, professionally trained staff and logistics support resulting in wastage of limited resources and/or in their ineffective use [7].The same is true in Ayder hospital where there is lack of trained professionals in medical equipment maintenance and ineffective maintenance process. Properly working equipment is just as important as the readiness of staff, physical facility and supplies in providing timely emergency obstetric care (EmOC) [8].

Although many international projects provide equipment to improve the functioning of primary health centers and hospitals, not much attention is directed to the management of the equipment. A World Bank study showed that in a state in India, only 2—5% of district hospital budget was earmarked for machinery and equipment. Similar budget (3% to 6% of the hospital budget) is allocated for medical equipment management & maintenance in Ayder hospital. Rural secondary hospitals (at sub-district level) had no maintenance budget at all [9], unlike our organization.

Many studies have shown that technological changes in health care, especially medical devices are among the key drivers of growth in health expenditure growth [10]. In Europe, 6.2% of the total health expenditure goes on procurement and maintenance of medical devices, while both the United States of America and Japan spend some 5.1% of total health expenditure on medical devices [11].

Conservative estimates and findings of this capstone project indicate that an inadmissibly high wastage of national health care assets persists due to lack of proper management and maintenance of medical equipment. The most common factors contributing to the wastage are purchase of sophisticated equipment, which is underutilized or never used due to lack of operating and maintenance staff and medical expertise to support and use it ,a little limitation of the useful life time of the equipment due to inexperience of operators and lack of maintenance and repair ,additional purchase of accessories, extras, specialized spare parts and testing equipment and building modifications, initially unforeseen due to lack of expertise in choosing appropriate systems in the first place ,lack of standardization resulting in increased spare parts costs and extra work load on the limited number of competent staff. The problem is further compounded by inadequate feedback on proper design of equipment for ease of maintenance and work , Excessive

down time of equipment, i.e., time they remain inoperative, due to lack of spare parts and inexperience in repair and absence of maintenance (25-50% of equipment) [12-16].

As an important input to the health care system, medical devices should be properly managed and utilized in order to produce an efficient health intervention. Nevertheless, lack of appropriate selection and acquisition of knowledge; optimal skills base; maintenance and repair budget; adequate support infrastructure; and adequate managerial skills, result in the waste of already scanty resources in some countries, which in turn leads to a decrease in the quality of health care services [17-20].

2. METHODOLOGY

2.1. Setting

The capstone project was conducted at a five year old urban referral hospital in northern Ethiopia. The 480 bed hospital serves a catchment area of approximately 5 million people and is administered by Mekelle University. The laboratory, radiology, physiotherapy, pathology and operation room were the major areas of study.

2.2. Study design:

Pre and post intervention study was conducted to assess the status of medical equipment in the different units of the hospital.

2.3. Study population

All units of the hospital were included in the study and the respective heads were interviewed.

2.4. Study sample

Heads of the fourteen units were studied.

2.5. Data collection procedure.

A questionnaire with closed-ended questions (yes/no) question was adopted from the Ethiopian hospital reform implementation guidelines (EHRIG) to collect information on the current status of the equipment was used. In addition to the EHRIG questionnaire, data collection tool was created to gather detailed information on each piece of equipment at Ayder referral hospital.

2.6. Data analysis procedure

Data was analyzed using Excel sheets. Moreover, tables and MacNemar's chi-square test were used to determine whether statistical difference exists between pre and post intervention results.

2.7. Ethical consideration

Ethical clearance from public health, research ethics committee and faculty institutional review board was obtained. Moreover, permission was obtained from Mekelle University College of health sciences, Ayder referral hospital.

2.8. Result dissemination

The results of the projected were disseminated to Mekelle University College of health sciences, I-TECH Ethiopia and research publishing agencies.

2.9. Data quality management

Properly designed questionnaire was adopted from the Ethiopian hospitals reform implementation guideline and proper training on objectives and process of the data collection was given to the data collectors and supervisors. In addition to this, closer supervision was made during the data collection process. Questionnaires were checked for completeness by the data collection supervisor and the primary investigator.

3. INTERVENTION

3.1. Selected strategies

- **Establishing medical equipment maintenance work agreements/maintenance campaign.**

Health care facilities need to use several service maintenance service sources in order to keep their biomedical equipment in safer and proper condition. When complicated equipment break down occurs, call for the service engineers of the different vendors is made. Therefore, Ayder hospital has planned to establish maintenance work agreements. The work agreement will consider

- ✓ The specialization (qualification of the) of the service provider
- ✓ The type of biomedical equipment to be covered
- ✓ The services provided under the contract agreement
- ✓ The duration of the service contract
- ✓ The terms and conditions that must be met under the agreement
- ✓ The cost of the agreement

- **Provision of long and short term trainings**

To attain the optimal performance of medical equipment, proper use of the equipment is essential. The proper use of medical equipment can be maintained through the provision of trainings. All equipment users will be trained how to operate the equipment when new medical equipment is purchased and introduced in to the health care service. The training, due to time constraint, will be given to laboratory staff only. Moreover, majority of the equipment are found in the laboratory. The onsite training will be provided by the service engineers of the supplier.

- **Establishing supervision for clear notification and work order system for the repair of medical equipment**

  Establishing effective and sustainable medical equipment maintenance supervision can play a significant role in the reduction of the number of medical equipment that are nonfunctional. The medical equipment management coordinator will facilitate this activity and more awareness activities on timely reporting of medical equipment repair, impact of medical equipment on health service delivery, etc will be done.

- **Implementing EHRIG strategies pertaining medical equipment management**

  Some of the EHRIG strategies which are helpful for medical equipment management and can bring about some improvements are

  - Establishing medical equipment and medical equipment spare part inventory
  - Developing preventive and corrective maintenance plans
  - Establishing a clear notification and work order system for the repair of medical equipment.
  - Establishing medical equipment maintenance work agreements.
  - Provision of training on equipment operating and preventive maintenance.
  - Establishing a schedule for inspection and testing of each piece of equipment.

3.2. Implementation accomplishments

As part of this project, the following are accomplished.

1. **Training**: Short onsite training on how to use, operate and perform laboratory medical equipment preventive maintenance were given to all laboratory staffs. The 3-days training was given to four laboratory staff members by service engineers from Mesroy PLC and the four trained staff members in turn trained the remaining staff members. Generally, the four medical laboratory technologists who got the training from service engineers of Mesroi PLC have shared it to 28 staff members.
2. **Maintenance agreement made between Marien Hospital, German and Ayder, hospital**, **Ethiopia**: A group of medical equipment engineers (6 in number) headed by Mr. Theo, a senior expert in hospital administration, had performed some maintenance activities on broken autoclaves, X-ray machines and other medical equipment for two weeks in Ayder referral hospital. This campaign was valuable, although it was not effective in reducing the number of nonfunctional medical equipment.
3. **Two of the nine standards pertaining medical equipment were implemented**

Before the intervention, there was no clear procedure for the reporting of medical equipment repair. Some report to the medical director, some to the facility head and some directly to the technicians. This had a negative impact on the management of medical equipment. But after the intervention, a clear direction of medical equipment maintenance work order is established. Maintenance request is made directly to the facility management head then to the technicians. Previously there was no medical equipment inspection and testing. But after the intervention was conducted, a schedule for the inspection and testing of medical equipment every two weeks is established.

4. RESULTS

A total of 99 essential pieces of medical equipment were included in this capstone project both in the pre and post intervention. The number of medical equipment included by department is shown in table 1.

Table 1: Number of medical equipment in the pre-post intervention

Department	Pre-intervention/Post-intervention	
	No	%
Laboratory	34	36.66
Dental clinic	10	9.90
Radiology	07	6.93
Pathology	06	5.95
Physiotherapy	10	9.90
Emergency	03	2.97
Outpatient department	03	2.97
Medical ward	02	1.98
Recovery	03	2.97
Pediatric ward	02	1.98
Surgical ward	02	2.97
ICU	02	1.98
Gynecology & Obstetrics	04	3.96
Operation unit	11	11.88
Total	99	100%

The analysis of data from the baseline regarding the number of functional medical equipment showed a change from 72 (72.7%) to 83(83.8%) and also showed that most of the Ethiopian hospitals reform implementation guideline standards pertaining medical equipment management were not met (3 [33%] of 9 standards; Table 4) and the; Table 2.

Table 2: Proportion of functional medical equipment in the pre and post intervention

Department	Pre-intervention		Post-intervention	
	Total	Functional No	Total	Functional No
Laboratory	34	22	34	29
Dental clinic	10	04	10	07
Radiology	07	04	07	06
Pathology	06	06	06	06
Physiotherapy	10	08	10	09
Emergency	03	03	03	03
Outpatient department	03	02	03	03
Medical ward	02	02	02	02
Recovery	03	02	03	01
Pediatric ward	02	02	02	0
Surgical ward	02	02	02	02
ICU	02	02	02	02
Gynecology & Obstetrics	04	03	04	02
Operation unit	11	10	11	11
Total	99	72	99	83

Table 4 : Pre and post compliance of Ayder Hospital medical equipment management unit with EHRIG Operational standards		
Standard	Pre	Post
The hospital has a medical equipment committee	Un met	Un met
The hospital has a paper-based or computer-based medical equipment inventory	Un met	Un met
The hospital has a paper-based or computer-based spare part inventory	Un met	Un met
An equipment history file is maintained for all medical equipment	Un met	Un met
The hospital has policies and procedures in place for acquisition of new medical equipment	Met	Met
All new medical equipment undergoes acceptance testing prior to its initial use	Met	Met
All medical equipment users are properly trained on the operation and maintenance of medical equipments	Met	Met
There is a schedule for inspection , testing and preventive maintenance for each piece of equipment	Un met	Met
There is a notification and work order system for the repair of medical equipment	Un met	Met
Total score	**33.3%**	**55.6%**

5. DISCUSSION

In this capstone project, I found that a survey of the number of functional and nonfunctional medical equipment following medical equipment maintenance and training strategies brought about some improvements in the functionality of medical equipment.

Establishing medical equipment maintenance service contracts, although it took longer time and was limited to the laboratory unit, providing training on medical equipment operation & preventive maintenance and the two-weeks campaign to fix broken equipment by Marien Hospital (German) engineers, resulted in some change in increasing the percentage of functional medical equipment from pre-intervention score of 72.7% to post-intervention score of 83.8%. This finding, like previous assumptions, suggests that significant and tangible improvements in the maintenance of medical equipment can be achieved through the establishment of maintenance service contracts and while establishing maintenance contract agreements, it is good to focus on the specialization (qualification) of the service provider. Moreover, concerted effort between equipment users and maintenance administrators is required to have healthy equipment.

The finding regarding the changes in the number of functional medical equipment in the other units of the hospital reflects no significant improvements. The agreement made with Marien hospital was very important. However, due to limited time resource and inadequate knowledge and skill of the medical equipment maintenance engineers, the desired outcome was not achieved. Therefore, seeking the right biomedical engineer is required to bring about successful changes in the maintenance and management of medical equipment.

Generally, the change in the number of functional medical equipment in Ayder hospital ranged from 72.7% in the pre-intervention to 83.8% in the post-intervention (calculated X^2M value [3.03]

is less than the critical value). This implies that although there was an improvement trend, there was no significant association between the intervention and the improvements.

Compliance with Ethiopian hospitals reform implementation guideline standards for medical equipment increased from 33% to 55.6%. In the pre-intervention period, only three of the nine (33.3%) standards were met. But, after strategies that are equivalent with those that are listed in the Ethiopian hospitals reform implementation guideline were made, I found that five of the nine operational standards were met (an increase from 33.3% to 55.6%). This finding suggests that there was an improvement trend as a result of the intervention even though the change was as such satisfactory because only two of the standards were met. This could partially be due to the interventional period which was short (four months) and partially due to lack of staff committeemen. Generally, the intervention has brought about a change in the compliance of Ayder hospital's medical equipment management unit with EHRIG.

The figure obtained here, as compared to the achievement of other hospitals, is slightly lower.

6. CONCLUSION AND RECOMMENDATION

Conclusion: The findings of this capstone project suggest a number of implications.

- Sustainable provision of trainings on medical equipment operation and handling can result in a significant improvement in medical equipment functionality.
- Establishing medical equipment maintenance work agreements has a great impact in the management of medical equipment.
- Adherence to the Ethiopian hospitals reform implementation guideline can bring about improved management of medical equipment in health facilities.

Recommendations

- Full implementation of the Ethiopian hospitals reform implementation guideline strategies should be made.
- It is better to establish medical equipment maintenance work agreements with experienced companies.

7. APPENDICES

Annex -A: Evaluation and monitoring indicators

The following indicators can be monitored on regular basis to assess the outcome of the implementation plan.

S.No	Indicator	Formula	Frequency of monitoring
1	Percentage of functional biomedical equipment	Total number of medical equipment that is functional/Total number of medical equipment	Quarterly
2	Compliance with Ethiopian hospital reform implementation guideline	Number of EHRIG standards met/Total number of EHRIG standards*100	Quarterly

Annex - B: Questionnaire for medical equipment data collection

Addis Ababa University

College of health sciences

School of Public health

Medical equipment data collection form

1. Medical equipment name:_____
2. Serial number:_____
3. **Current state:**
    - Operable & in service
    - Operable & out of service
    - Needs maintenance
    - Not repairable
    - Needs to be discarded Yes_____ No_____
4. Stand by spare parts available Yes_____ No_____
5. Manuals available?

- Users Manual Yes_____
  No_____
- Service manual Yes_____
  No_____

6. Equipment Users:
    - Doctors
    - Nurses
    - Laboratory
    - Others (specify)

7. Current location of equipment
    - Pharmacy Nursing
    - Laboratory
    - Physiotherapy
    - Radiology
    - OR
    - Others (specify)
8. Contact person and telephone number:_____
9. Other notes

Annex-C: Checklist of standards for medical equipment management

EHRIG Standards for medical equipment management			
S.No	Standard	Unmet	Met
1	The hospital has a medical equipment committee composed of doctors, nurses, technicians, pharmacists and administrative personnel that oversees the medical equipment management program.		
2	The hospital has a paper-based or computer-based inventory management system that tracks all equipment included in the equipment management program.		
3	The hospital has a paper-based or computer-based spare parts inventory management system. The system is used for ensuring that there is an adequate supply of spare parts on hand.		
4	An equipment history file is maintained for medical equipment containing all key documents for the equipment.		
5	The hospital has policies and procedures in place for acquisition of new medical equipment, commissioning, decommissioning and disposal of equipment, the receipt of donation, and outsourcing technical service.		
6	All new equipment undergoes acceptance testing prior to its initial use to ensure the equipment is in good operating condition. Equipment is installed and commissioned in accordance with the manufacturer's specifications.		
7	All equipment users are appropriately trained on the operation and maintenance of medical equipment with standard operating procedure readily available to the users.		
8	There is a schedule for inspection, testing and preventive maintenance for each piece of equipment as guided by the manufacturer's recommendations and schedule is appropriately implemented		
9	The hospital has a notification and work order system for the repair of medical equipment		

Annex D : Table showing comprehensive list of medical equipment

S.No	Name of medical equipment	Equipment Status		P value
		Pre (N=99)	Post (N=99)	
1	Micros 60 OS Haematology analyzer	F	F	
2	HumaCount 60 ^{TS}-Haematology analyzer	NF	F	
3	Horiba Medical-Haematology analyzer	NF	F	
4	HumaSed 100^{mix}ESR reader	F	F	
5	HumaPure Deionizer	NF	NF	
6	HumaScope microscope	NF	F	
7	Refrigerator	NF	NF	
8	Stundar PZO microscope	NF	F	
9	HumaSed 40 ESR reader	F	F	
10	Combilyzer^{B} human urine analyzer	F	F	
11	HumaCount 30 ^{TS}Heamatology analyzer	F	F	
12	HumaScope classic Microscope	F	NF	
13	HumaScope classic Microscope	F	F	
14	HumaScope classic Microscope	F	F	
15	Mini Vidas Cancer marker analyzer	F	F	
16	Humalyte Plus Electrolyte analyzer	NF	F	
17	Humalyte Plus^{5} Electrolyte analyzer	F	F	
18	Humalyte Plus^{3} Electrolyte analyzer	F	F	
19	Sigma general bench centrifuge	F	F	
20	Sigma general bench centrifuge	F	F	
21	Sigma general bench centrifuge	F	F	
22	Class II safety cabinet	NF	NF	
23	Remi Microhaematology centrifuge	NF	F	
24	General bench centrifuge	NF	F	
25	Remi centrifuge	F	F	
26	HumaStar 300 chemistry machsine	F	F	
27	Horiba Penta 200 chemistry machine	NF	F	
28	HumaStar 180 chemistry machine	NF	F	
29	FACS Count CD4 analyzer	F	F	
30	HumaLyzer 300 chemistry machine	F	F	
31	HumaScope microscope	F	NF	
32	Linear ESR reader	F	F	
33	Penta 60 C+ Chemistry machine	F	F	
34	HumaClot Duo Plus	F	F	
35	Dental filling material	F	F	
36	Dental extraction equipment	F	F	
37	Hand pieces	NF	NF	
38	Dental ultrasonic scaler	NF	NF	
39	Steam sterilizer	NF	F	

40	Dry sterilizer	NF	F	
41	Dental X-ray	F	NF	
42	Dental filling equipment	F	F	
43	Compressor	NF	F	
44	Dental chair	NF	F	
45	Ultrasound machine	F	F	
46	Mobile radiographic X-ray machine	NF	F	
47	Echo cardiography X-ray machine	F	F	
48	Manual x-ray film drier	NF	F	
49	X-ray film processor-automatic dark room processing machine	F	F	
50	X-ray machine	F	F	
51	Thales digital x-ray machine	NF	NF	
52	ECG machine	F	F	
53	Endoscopy machine	F	F	
54	Electrical oxygen	NF	F	

55	Ultrasound monitoring	NF	F	
56	Patient monitoring unit	F	NF	
57	Electrical suction	F	NF	
58	Olympus Microscope	F	F	
59	Water bath	F	F	
60	Rotary microtome	F	F	
61	Embedding machine	F	F	
62	General bench centrifuge	F	F	
63	Tissue processing machine	F	F	
64	ECG machine	F	F	
65	Pulsoxymeter	F	F	
66	Lower extremity hodrotherapy(Small)	F	F	
67	Exercise therapy equipment	F	F	
68	Walking frame	F	F	
69	Shoulder wheel	F	NF	
70	Treamill	NF	F	
71	Upper extremity hydrotherapy(large)	F	F	
72	Full body hydrotherapy	NF	F	
73	Ewac hydrotherapy	F	F	
74	Lower extremity hydrotherapy(large)	F	F	
75	Parallel bar	F	F	
76	Steam inhalation machine	F	NF	
77	Pulsoxometer	F	NF	
78	Ultrasound machine	F	F	
79	ECG machine	F	F	
80	Autoclave	F	F	

81	Cardiac monitor	F	F	
82	ECG monitor	F	F	
83	Electrical suction machine	F	F	
84	Autoclave-3	F	F	
85	Electrical vacuum extractor	F	NF	
86	Electrical dopler	NF	F	
87	Autoclave	F	NF	
88	Ultrasound machine	F	F	

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