

Medical Equipment Management and Failure Factors in Ethiopian Teaching Hospitals: A Survey-Based Study of Systemic Challenges and Operational Gaps, Research Data Collection Tools

Section A. Introduction

This research, titled *“Medical Equipment Management and Failure Factors in Ethiopian Teaching Hospitals: A Survey-Based Study of Systemic Challenges and Operational Gaps,”* focuses on investigating issues related to medical devices with the goal of enhancing clinical services in Ethiopian hospitals. Both practical experience and theoretical evidence suggest that periodic and unpredictable failures of medical equipment, along with persistent challenges in their management systems, remain unresolved problems within the Ethiopian healthcare sector. These issues pose significant barriers to the effective delivery of medical services. The study is supported by the Korea Foundation for International Healthcare (KOFIH) under the KGA Regional Activity Project 2024 and is being conducted by a research team from Jimma University. Data has been collected from seven selected university hospitals. These institutions were chosen based on several factors, including the availability of comprehensive data on various medical devices (which can reflect broader trends), the presence of experienced professionals capable of providing accurate information, and the strong research background of the host institution.

Section B. Research objective

This research has been designed to clearly investigate:

- ❖ The common factors contributing to malfunctions of medical equipment in Ethiopian hospitals
- ❖ The study also aims to investigate the challenges associated with medical equipment management and utilization system in Ethiopian hospital settings.

Through this study, the research team intends to produce “valuable findings that can benefit as input for national policy makers in the national medical equipment utilization systems, ultimately reducing failure and malfunction rates in the country”.

Section C. Informed Consent

Dear Respondents: This questionnaire has been prepared to support a survey-based research project titled *“Medical Equipment Management and Failure Factors in Ethiopian Teaching Hospitals: A Survey-Based Study of Systemic Challenges and Operational Gaps.”* The study focuses on selected university hospitals, using appropriate sampling techniques. The questionnaire is divided into seven sections, each designed to gather specific and relevant information aligned with the research objectives. All questions have been carefully formulated to ensure the collection of comprehensive and accurate data.

Dear Data Collectors: Please follow the instructions provided for each section and ensure you approach the designated respondents. Your role is essential in obtaining detailed and reliable information. An end-to-end encrypted online data entry platform has been developed to facilitate the data collection process. Data collectors should use both the online platform and manual entry system. All manually collected data must be signed and submitted to the research team and must align with online entry. These signed forms will be used to verify and crosscheck the information entered through the online platform. We kindly ask all respondents to answer each question as accurately and completely as possible. Your cooperation and thoughtful input are greatly appreciated. Please be assured that all collected data will be kept strictly confidential and will be used solely for research purposes.

Thank you for your valuable participation and support.

Sincerely,
The Research Team

Research Questionnaires

Do you agree to respond for all questions? ☐ Yes ☐ No

I. General questions

(Expected respondent: hospital administrators, CEO, clinical director or other administrative personnel)

1. Name of hospital-----Location (region)-----City-----
2. Year of establishment (in GC)-----contact address (official phone No)-----
3. Catchment area (for how many people the hospital provides medical service?) approximately for -----
----- (million population)
4. Hospital bed capacity (total no of beds) -----
5. Total number of health professionals in the hospital
☐ Medical doctors----- ☐ Nurse Professionals----- ☐ Medical Lab technologist-----
☐ Others-----
6. Who is responsible to manage medical devices in your hospital?
☐ Pharmacy department ☐ Biomedical Engineering department ☐ Equipment Users
☐ Hospital administrators' ☐ other
7. Is there a frequent breakdown of medical equipment in your hospital?
☐ Yes ☐ No ☐ not known
8. Do you think, medical equipment breakdown and periodic malfunction is bottleneck for provision of sufficient clinical service?
☐ Yes ☐ No ☐ not known
9. In your opinion, what are the possible main causes of medical equipment breakdown in your hospital?
Select all that apply

☐ Skill gap of biomedical personnel's	☐ Irresponsible handling by users'
☐ Shortage of budget for maintenance	☐ Shortage of preventive maintenance and inspection
☐ Lack of user Training	☐ Other
☐ Procurement of low quality Equipment	
10. Do you think there is sufficient budget for medical equipment maintenance, spare part and annual service fee in your hospital?
☐ Yes ☐ No ☐ Not known

II. Medical device acquisition and procurement process

(Expected Respondent; procurement office head or pharmacy head)

1. Do you (your office) have any role in medical equipment procurement process?
☐ Yes ☐ No ☐ not known
2. Who is primarily responsible for medical *equipment planning* in your hospital? Select all that apply

☐ Hospital higher officials'	☐ Procurement office
☐ Users'	☐ Not known
☐ Biomedical Engineers	
☐ Pharmacist	

3. Who is primarily responsible to handle *medical equipment procurement* in your hospital?
Select all that apply
- | | |
|---|--|
| ☐ Hospital leaders' | ☐ Biomedical Engineers |
| ☐ Pharmacist | ☐ Procurement committee |
| ☐ Procurement office | ☐ Other |
4. What are the main source of medical equipment acquisition (sources that your hospital get medical equipment)? *Select all that apply*
- ☐ Procurement by government budget
☐ Procurement by partner organization
☐ Donation from different organization
☐ Others
5. Do Biomedical Engineers prepare medical Equipment specification during procurement in your hospital?
- ☐ Yes ☐ No ☐ not known
6. For question 5, if your answer is yes, do you use the prepared specification for medical equipment selection during procurement?
- ☐ Yes, fully ☐ Yes, but partially ☐ No ☐ not known
7. During medical equipment procurement for your hospital, what are the main criteria used to select proper equipment from supplier's catalog? *Select all that apply*
- | | |
|--|--|
| ☐ User's preference | ☐ Application area |
| ☐ Equipment cost | ☐ Suppliers' competency |
| ☐ Equipment specification | ☐ Not known |
| ☐ Equipment brand and quality | |
8. Do you include equipment-running cost in procurement budget, i.e. for spare parts, periodic inspections and maintenance service cost?
- ☐ Yes ☐ No ☐ not known
9. During medical equipment procurement, does your hospital agreement document includes both technical and application training package as mandatory requirement and implement properly?
- ☐ Yes ☐ No ☐ not known

III. Medical Equipment Installation and commissioning process

(Respondent: Biomedical Engineering head or any senior BME staff)

1. Who is responsible for arranging site preparation for equipment installation in your hospital? Select all that apply
- | | |
|---|---|
| ☐ Local supplier | ☐ The hospital facility office |
| ☐ Local Bio medical Eng. | ☐ Not known |
| ☐ Equipment manufacturer | |
2. Who is responsible to do installation for new medical equipment purchased by hospital?
- | | |
|--|--|
| ☐ Local supplier | ☐ Any authorized body by hospital |
| ☐ Hospital Biomedical Engineers | ☐ Not known |
| ☐ Equipment manufacturer | |
3. Who is primarily responsible to do installation for medical equipment purchased by Ethiopian Pharmaceuticals Supply Service (EPSS)? *Select all that apply*

- ☐ Local agent
 ☐ Biomedical from EPSS
☐ Hospital Bio medicals
 ☐ No clear regulation about it
☐ Equipment manufacturer
4. Does your hospital receive official agreement, specification and warranty documents from EPSS for the equipment purchased by them?
- ☐ Yes
 ☐ No
 ☐ not known
5. What types of problem do you face related to installation, commissioning and training about equipment purchased by EPSS for your hospital? *Select all that apply*
- ☐ Unknown Local supplier
☐ Absence of agreement document
☐ No timely installation
☐ Burden of installation on local Bio medicals without pre training
☐ Other
6. Who is responsible to do installation for medical equipment donated by other organization for your hospital?
- ☐ Local agent
 ☐ Donor organization
☐ Hospital Biomedical Engineers
 ☐ No clear regulation for this matter
7. Does the supplier provide service and user manual after Equipment installation for your hospital?
- ☐ Yes
 ☐ No
 ☐ not known
8. Do the hospital biomedical engineers fully participate during new equipment installation in your hospital?
- ☐ Yes fully
 ☐ Yes but partially
 ☐ No participation at all
9. Do you get all technical document containing password, manual, accessories part number, contact address from supplier at the end of installation?
- ☐ Yes fully
 ☐ Yes, but partially
 ☐ Not all
 ☐ not known
10. What are the most common challenges during equipment installation in your hospital? *Select all that apply*
- ☐ Obstacle to prepare required site
☐ Delay from equipment supplier,
☐ Absence of equipment document and guide
☐ Less cooperation from hospital facility
☐ UPS, power supply, water and network problem
☐ Financial related challenges between hospital and supplier
11. Who is responsible to follow service warranty of high tech devices (X ray, CT scan, MRI, Oxygen plant...) in your hospital? *Select all that apply*
- ☐ Biomedical office
 ☐ Hospital higher officials'
☐ Procurement office
 ☐ Not known
☐ Pharmacy department
12. Is there perfect service agreement implementation from supplier side after installation of equipment including high-tech devices? ☐ Yes ☐ No ☐ not known

IV. Medical Equipment maintenance conditions, related challenges & constraints

(Respondent: Biomedical Engineering head or senior BME staff)

1. How many Biomedical Engineers and Technicians do you have in your hospital? -----
2. In average, how many medical devices are there in your hospital? Please use your inventory file if there is, ☐ Total number of medical equipment-----
3. From question 2, how many of them are fully functional and non-functional?
 - ☐ Total number of functional equipment-----
 - ☐ Total number of non-functional equipment-----
4. In your opinion, what are the most challenging problems do you face during any equipment maintenance? *Select all that apply*
 - ☐ Lack of skill based training
 - ☐ Absence of spare part
 - ☐ Absence of calibration & testing tools
 - ☐ Other
 - ☐ Absence of maintenance budget
 - ☐ Absence of cooperation from supplier
5. Does your hospital have medical equipment maintenance tools in a sufficient quantity?
 - ☐ Yes, there is sufficient quantity
 - ☐ yes, but not sufficient
 - ☐ No
 - ☐ not known
6. Which types of “*Medical equipment performance inspection and calibration tools*” do you have? *Select all that you have from the following table.*

Table I: selected equipment analyzers

No	Types of Medical equipment performance inspection tools (analyzers)	Availability			All Biomedical Eng./ Technicians/ can use it.	
		Yes	No	No information	Yes	No
1	Electrical safety analyzer					
2	Oscilloscope for circuit analysis					
3	Function generator					
4	Patient monitoring analyzer					
5	Electro surgical unit analyzer					
6	ECG simulator					
7	Defibrillator analyzer					
8	Gas flow analyzer					
9	Oxygen analyzer					
10	Infusion pump analyzer					
11	Neonatal Incubator analyzer					
12	Light meter					
13	Phototherapy meter					
14	Radiation inspector(dosimeter)					

Table II: Overall maintenance related questions.

Fill it based on indicated ***key** and Put √ below the appropriate answer box

***Key:** 1 = Strongly dis agree, 2 = Dis agree, 3 = Neutral, 4 = Agree, 5 = Strongly agree

No	Parameters	Response				
		1	2	3	4	5

1	Your hospital has medical equipment maintenance budget (for spare part procurement and annual service cost)					
2	The hospital has well trained and skilled Biomedical Engineers/Technicians					
3	Your hospital has maintenance agreement with supplier for high tech equipment (Oxygen plant, CT, MRI, X- ray etc.)					
4	All high tech devices have spare part in your stock					
5	There is periodic inspection and preventive maintenance for most high tech devices by local suppliers					
6	Your hospital has periodic preventive maintenance schedule and appropriately implemented by Biomedical personnel					
7	Most corrective maintenance of equipment (including hardware and software) can be handle by local Bio medicals					
8	There is documentation for all corrective and preventive maintenance					
9	For corrective maintenance, most spare parts are accessible from local market					
10	The hospital can purchase spare part when required without complication & delay					
11	The hospital can facilitate Outsource maintenance service when required					
12	The hospital has backup generator					
13	Most medical devices have UPS to protect electric power fluctuation					
14	Absence of maintenance budget is bottleneck for equipment maintenance					
15	Absence of spare part in local market is challenging for maintenance task					
16	Absence of medical device information such as manual, supplier's address, password, software etc. are challenging for effective medical device maintenance					
17	Technical skill gap on advanced equipment for Bio medicals is bottleneck for maintenance and calibration task					
18	There is periodic inspection and preventive maintenance schedule in your hospital by local Biomedical staffs					
19	There is period calibration and inspection of medical devices in your hospital					
20	The overall institutional concern for medical equipment maintenance issue is lower than other clinical services					

- V. Capacity Building Training for Medical Equipment** (*Respondent: Biomedical Engineering head, nursing and laboratory head*). For user training issue, either nursing or medical laboratory head can respond, for Biomedical related training, Biomedical head can respond)

Table III. Fill the following questions (yes/no/neutral). Put this √ below the answer box

No	Parameters	Response		
		Yes	No	Neutral
1	All Biomedical Engineers and Technicians got sufficient technical training			
2	Medical equipment suppliers provides training for hospital Biomedical Engineers after completing equipment installation			
3	The hospital has strong attention to train Biomedical Engineers			
4	Users get application training by equipment suppliers after installation			
5	Users have sufficient knowledge to use various equipment in hospital			
6	Users get refresher training to update their skill on medical equipment			
7	Hospital Biomedical engineers get training on equipment supplied by EPSA			
8	There is technical training program on donated equipment			
9	There is skill transfer among clinical staffs when they shift to other ward			

2. For question 1, if your answer is yes, what types of inventory do you have?
☐ Manual based (Excel & spread sheet) ☐ Web based ☐ desktop application ☐ other
3. If your answer is no for question 1, what is the challenge you face not to have inventory?
☐ Skill gap to develop inventory ☐ absence of cooperation from hospital side ☐ less cooperation from users' ☐ other
4. Do you have system of new equipment registration and removal of obsolete equipment from inventory? ☐ Yes ☐ No ☐ not known
5. Does your hospital use the “*Medical Equipment Information Management System Software*” (MEMIS)? ☐ Yes fully ☐ Yes but partially ☐ not at all
6. If your answer for question 5 is no, what is the problem?
☐ Skill gap ☐ Shortage of resource (computer) ☐ local Network problem ☐ System server problem ☐ Lack of staff commitment
7. Do you have Spare part and accessories inventory system?
☐ Yes ☐ No ☐ not known
8. Do you have paper based work order system during maintenance task?
☐ Yes ☐ No ☐ not known
9. Do you have a system for maintaining a medical equipment history file in your hospital?
☐ Yes ☐ No ☐ not known
10. Do you have organized maintenance documentation system?
☐ Yes ☐ No ☐ not known
11. Does your hospital keep records of all medical device files and have a data archiving system for documentation?
☐ Yes ☐ No ☐ not known

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Disclosure statement

I confirmed that all the above data is true and correct to the best of my knowledge.

Name of data collectors 1-----Affiliation -----

Contact address: phone No-----email-----

Date-----signature-----

Name of data collectors 2-----Affiliation -----

Contact address: phone No-----email-----

Date-----signature-----

The End!

*Thank you for your kind cooperation
The research team!*