ENGINEERING WORLD HEALTH MAKERERE UNIVERSITY CHAPTER

AND

MAKERERE UNIVERSITY BIOMEDICAL ENGINEERING STUDENTS' ASSOCIATION

REPORT FOR

INDOOR OUTREACH

AT

MAKERERE UNIVERSITY HEALTH FACILITIES

ACKNOWLEDGEMENT

The indoor outreach would not have been possible without the selfless contribution of Dr Robert T Ssekitoleko, patron of both the EWH Mak Chapter and MUBESA, who mentored and guided us from the planning process to the activity's execution.

We are grateful to Dr. Byamugisha Josaphat, Director of the University Hospital, and the Head of Department of the Dental School for their assistance in achieving this success. They welcomed us to their facilities, which was a fantastic opportunity for us as students. Although the indoor outreach was not held at the University Hospital, Mr Byamugisha Josaphat approved the distribution of a box of gloves to us for the Dental School Hospital outreach. We appreciate all the help.

We thank Mr Mugaga Julius, the Design Hub's manager, for his hospitality and willingness to share knowledge about outreach organization. When servicing the equipment, the outreach also required the use of a toolkit. We also thank Mr Mugaga Julius for entrusting us with his toolkit for use during the outreach.

We would like to express our gratitude to all of the health professionals who were contacted during the outreach. We would like to thank Eng Jesca Lugeremi from Makerere University Dental School Hospital for her input in the pilot study throughout the day of execution, as well as the University Hospital's health workers for their flexibility during the pilot study.

We would like to express our heartfelt gratitude to all members of the organizing committee for their tireless efforts to ensure the success of the outreach. There was a lot that went into the process, but the organizing committee members gave up a lot of their time and other resources to ensure that the outreach was successful.

Above all, we thank the almighty God for wisdom and providence. We especially thank him for his good health and calm mind despite the challenges of organizing the outreach.

ORGANISING COMMITTEE MEMBERS

No	Name	Position
1	Jjuuko George William	President EWH
2	Ogoola Ronald	President MUBESA
3	Mwampashe Natasha	Vice President EWH
4	Asiimwe Ambrose	Chairman Organizing committee
5	Lutaaya Edward	Vice Chairman Organizing committee
6	Tugume Mark	Finance
7	Atamba Edgar	Secretary
8	Mukwaya Pius	Secretary
9	Mugaba Jessy John	Welfare
10	Wamani Derrick Eric	Welfare
11	Kadodo Vanessa	Publicity
12	Ssendikwanawa Nicholas	Publicity

ABSTRACT

Indoor outreach is a new activity that was created in 2022 by Engineering World Health Makerere University Chapter (EWH Mak Chapter), a student-led association. The outreach was intended to cover some of the facilities that provide Makerere University Health Services (MakHS) at Makerere University main campus. The goal of the outreach was to reduce the rate of medical equipment failure in Makerere University health facilities by repairing and maintaining them. A number of steps were taken to achieve this main goal, including establishing a bond between the student body and the University's health facilities, conducting a pilot study, compiling the pilot study report, raising funds, and conducting the outreach on the day of execution. The outreach exposed the students to a dental hospital environment, which was unfamiliar to the majority of the students who attended the outreach. Students learned how to operate dental chairs as well as how to maintain them on a regular basis. Although BME is yet to celebrate its tenth anniversary at Makerere University, this was the first time Makerere University Biomedical Engineering students served the dental school in any capacity. The outreach at the Dental School Hospital was a success, but it was unfortunate that it did not take place at the University Hospital, as the organizing committee had planned. This was primarily due to the COVID-19 pandemic's uncertainties, such as shortening the semester.

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LIST OF ACRONYMS

EWH:	Engineering World Health
Mak:	Makerere University
HS:	Health Services
MUBESA:	Makerere University Biomedical Engineering Students' Association
BBIO:	Bachelor of Science in Biomedical Engineering
BME:	Biomedical Engineering
Dr:	Doctor
Eng:	Engineer
BME HOP:	Biomedical Engineering Hospital Outreach Program

CHAPTER ONE: INTRODUCTION

1.1 Background

Indoor outreach is a new activity that was created in 2022 by Engineering World Health Makerere University Chapter (EWH Mak Chapter), a student-led association. The name **INDOOR** was inspired by the fact that the outreach would be organized at the health facilities which are inside Makerere University. The outreach was intended to cover some of the facilities that provide Makerere University Health Services (MakHS). On the main campus, there are two hospitals: Makerere University Hospital and the Dental School Hospital. The Makerere University Hospital has been in operation for over 40 years and provides health services to both students and members of the community.

Engineering World Health (EWH) is a non-profit organization based in the United States, but Makerere University is the only university in Uganda with a chapter. EWH has more than 30 active chapters in various universities around the world. EWH Mak Chapter promotes the profession and activities of EWH through research, discussion of EWH fields, and dissemination of knowledge gained as a result. The first ever indoor outreach was organized in conjunction with the Makerere University Biomedical Engineering Students' Association (MUBESA). MUBESA is a registered students' association at Makerere University that brings together all students and alumni pursuing or who have previously pursued a Bachelor of Science in Biomedical Engineering (BBIO).

It was unfortunate that the indoor outreach was only completed at the Makerere University Dental school hospital. This was mainly caused by the uncertainties due to the COVID-19 pandemic such as shortening the semester. The uncertainties made it difficult to balance the students' nonacademic programs with the University's timetable, as well as secure enough funding for both activities, making it impossible to be at both facilities. We were, however, amused by the success of the outreach at the Dental School.

1.2 Objectives

1.2.1 General objective

To reduce the rate of medical equipment failure in Makerere University health facilities through repair and maintenance.

1.2.2 Specific objectives

i. To record the faulty medical equipment at the University Hospital and Dental school
ii. To show the relevance of Biomedical Engineering at Makerere University
iii. To expose students to various medical equipment in Makerere University health facilities
iv. To build the spirit of innovation in Biomedical Engineering students

CHAPTER TWO: DESCRIPTION OF THE ACTIVITIES CONDUCTED

Outreaches involve two or more communities, which helps the communities involved function well because the work affects different segments of the population (University, 2021). The student body, the dental school hospital, and the Makerere University Hospital were the communities involved in the Indoor outreach.

The steps required to organize a successful outreach cannot be completed in a single day. There are several processes that were followed in order for the outreach to be successful. The key process in having a successful outreach was establishing a bond between the parties (communities) who will benefit from the outreach's outcomes. This bond was formed through letters introducing the students to the Director of the University Hospital and the Head of Department of the Dental School Hospital. The letters were written through the patron of both associations, Dr. Robert T Ssekitoleko. This was due to his oversight of both the Makerere University health facilities and the Biomedical Engineering student body.

Following the establishment of the bond, the other steps required for a successful outreach were carried out. These included conducting the pilot study, compiling the pilot study report, sourcing for funds, and conducting the outreach.

2.1 Pilot study

After being approved by the facility heads to conduct the outreach at the hospitals, this was carried out at both the University Hospital and the Dental School Hospital.

2.1.1 Pilot study at the University Hospital

The pilot study at the University Hospital was carried out in the month of April 2022, by a team of two people, Lutaaya Edward and Jjuuko George William. This activity lasted three days, and the team used the EWH MAK Chapter medical equipment operation status evaluation forms to record the equipment name, model number, serial number, and operating status.

The study was conducted in the departments of Treatment, Immunization, Ultrasound, Imaging, Laboratory, Eye Clinic, and Art Clinic. A Combined total of 35 pieces of equipment were evaluated at the facility, and comments were made based on the needs that were discovered. 21 of the 35 pieces of equipment were in good working order, but 17 needed to be serviced. 5 of the 35 pieces of equipment were not in use but repairable. They were missing some accessories, necessitating the need for spare parts. The rest of the equipment were operational, but they needed to be repaired.

2.1.2 Pilot study at the Dental School Hospital

The pilot study at the Dental school hospital was conducted by Jjuuko George William, and it was for one day. Eng. Jesca Lugeremi is the Engineer in charge of the Biomedical Engineering department at the Dental School Hospital. The Dental School Hospital was primarily furnished with dental chairs; however, the majority of the dental chairs were new, while the rest were old.

The Dental School Hospital is always busy, and the Biomedical Engineer follows a strict schedule for servicing the hospital's medical equipment. All of the equipment had been serviced by the technician one month before the pilot study. Therefore, none of the equipment was found faulty during the pilot study. However, various components in the chair may fail much sooner than expected if not cleaned on a regular basis. Furthermore, it may expose patients and staff to illness. As a result, the only need identified at the Dental School Hospital was the cleaning of the Dental chairs.

2.2 Pilot study report

After identifying, examining, and determining the needs at the specific facilities, the pilot study report was written. The pilot study report was written in a format that included the Equipment's name, model name/number, serial number, operating status, and remarks. The report was then given to Dr. Josaphat Byamugisha, Director of the University Hospital, in preparation for the outreach.

2.3 Conducting the outreach

The outreach was only held at the Dental School Hospital on July 20, 2022. Some equipment at the University Hospital required spare parts that the associations were unable to obtain. The associations were also planning another outreach event, the Biomedical Engineering Hospital Program (BME HOP), which is held every year. The BME HOP was held in the Toro sub-region, and the hospitals visited included Fort Portal Regional Referral Hospital, Rukunyu General Hospital, and Kyenjojo General Hospital. The organizing committee for both activities was the same, and obtaining spare parts and other necessities for both events proved difficult. The Dental School outreach required only gloves, buckets, water, and other consumables.

The outreach at the Dental School began at 11:00 a.m., under the supervision of Eng Jesca, the facility's Biomedical Engineer. The Hospital engineer was unfamiliar with the students' body, but it was introduced by Jjuuko George William, who was in regular contact with the Engineer. The outreach was attended by 35 students, led by Jjuuko George William and Ogoola Ronald, the two presidents of both associations. The students who attended the outreach were from various years, and all four years of study were represented. Because it was a school day, the students did not arrive at the hospital at the same time due to differences in lecture schedules.

2.3.1 Description of the activity

The activity began with Eng Jesca welcoming students to the dental school. She informed them that, as a Dental School Hospital, dental chairs were the most common piece of equipment at the facility. Following introductions, Eng Jesca took the students to the facility's Biomedical Engineering workshop, and then to the hospital's treatment areas. The Biomedical Engineering workshop houses the Biomedical Engineer's office as well as her engineering tools and other engineering-related necessities at the facility. The treatment areas were areas in the facility where dental teams were found.

Some of the treatment units visited were open, while others were closed. Closed units are private, whereas open units are public. Students appreciated the temperature and air conditioning in the treatment areas, thanks to Eng Jesca's guidance. The temperature in treatment areas should be between 68 and 76 degrees Fahrenheit, depending on the comfort of the dental team and the patients. Eng Jesca demonstrated the operation of a dental chair and named its basic components using one of the dental chairs.

Figure 1: Eng Jesca teaching students the operation of a dental chair

2.3.2 How a dental chair is operated

A Dental Chair is a specially designed medical device that is used to support a patient's body during a dental procedure. The dental chairs were electrically powered, with water lines, micro-motors, compressed air, and the ability to retract as needed by the dentist during a procedure. The equipment had seats where the dentists could sit while working on the patients. The chairs were made up of many different parts, each of which served a specific purpose. The major components of the dental chair are listed below, along with the functions they serve.

Operator lights: Dental operator lights provide the necessary illumination for performing dental procedures comfortably. It is kept at a distance of 30-50 inches from the patient's mouth. It has controls that allow dentists to adjust the intensity as needed.

Air-Water Syringe: While treating patients, this device can dispense compressed air, water, or a combination of the two. It is also used to clean the tooth's surface during a procedure.

Spittoon bowl: During a procedure, patients spit into this container. It is connected to a water pipe that pushes the contents of the bowl towards the drain, flushing them and keeping the bowl clean.

Foot control motor: This motor is used to deliver power to the dental equipment and is controlled by a pedal.

Disposable glass holder: Disposable cups and glasses are stored in holders. During a dental procedure, patients use these cups to drink water and gargle. After that, they spit them out in the spittoon bowl.

X-ray viewer: The X-ray viewer is used to view radiographs. Dentists use these images for examination and analysis (MEDIKABAZAAR, 2021).

Figure 3: Students learning how a dental chair operates

Figure 2: Students teaching each other

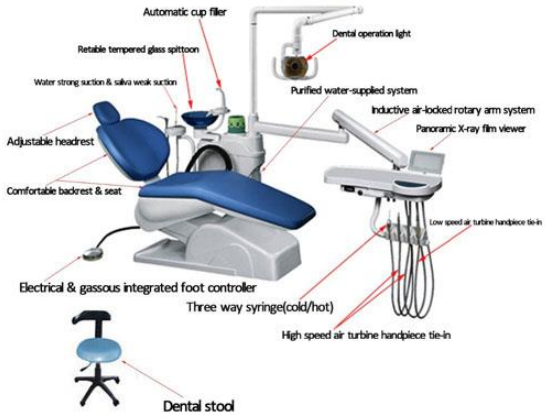

Figure 4: Parts of a dental chair

2.3.3 Maintenance work on the Dental chairs

Cleaning and disinfecting the treatment center should only be done with approved agents. The dental chairs that were maintained were cluster to clear type chairs with wet suction line systems and baskets. Spittoon filters were also available on the spittoon bowls of the dental chairs. The baskets of the suction line systems and the spittoon filters were cleaned and disinfected on the dental chairs.

Spittoon filters are used to filter waste from the spittoon of a dental chair. The baskets are housed in dental suction systems, which draw a large amount of air and saliva from patients during dental cleanings and oral surgeries. As a result, these components are highly susceptible to contamination by blood or saliva. The mesh of the baskets can also become clogged, causing problems with suction volume reduction. Thus, cleaning and disinfecting these components was required.

The baskets and spittoon filters were cleaned and then disinfected. Cleaning was done with soapy water and a brush. The soapy water solution was a mixture of water and Omo. Eng Jesca, on the other hand, advised us not to soak spittoon filters in soapy water for too long. After cleaning, the components were immersed in Jick to disinfect them. The components were then reinserted into the dental chairs.

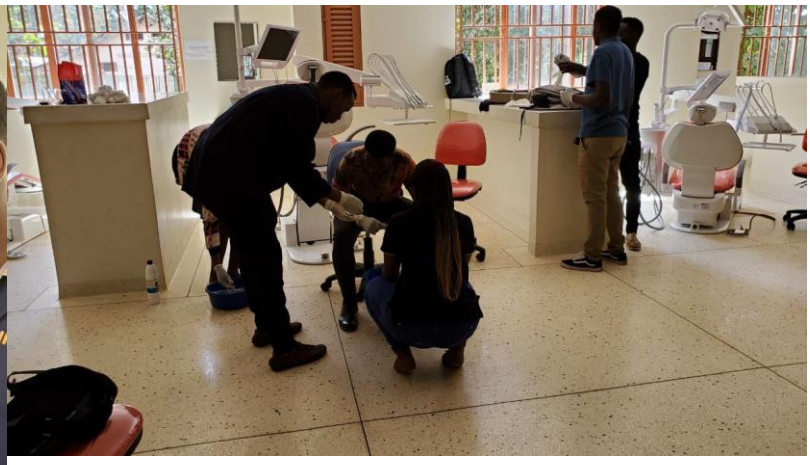

Figure 5: Students cleaning filters and suction line baskets

Figure 6: Students during maintenance

2.3.4 Other activities performed

Although the primary activity was to maintain the dental chairs based on the results of the pilot study, students at the facility also performed some other tasks. Because the dental school hospital is a large health and medical facility, some other pieces of equipment were prepared for the Engineering team on the day of the outreach. However, because the team had not adequately prepared for these items, their repair was unsuccessful.

On the day of the outreach, a Hydraulic dental press was brought. The dental team brought the Hydraulic dental press to the Engineering team because it had failed to work. The hydraulic press was opened with an Allen key and inspected by the engineering team. It was later discovered that the hydraulic dental press's failure to function was caused by a lack of hydraulic oil in the system. However, because the team had not brought hydraulic oil, the hydraulic press was left nonfunctional.

There was also a faulty dental chair that required a spare part. The dental chair had been moved from Mulago National Referral Hospital to Makerere University Dental School Hospital previously. The dental chair had a faulty air gauge that needed to be replaced. Unfortunately, after removing the faulty air gauge, it was discovered to be a different model than the spare that had been brought. The Engineering team was therefore unable to repair the faulty dental chair because the new air gauge was not compatible with it.

Figure 7: Students removing the Air gauge of the dental chair

CHAPTER THREE: OUTCOMES OF THE OUTREACH

3.1 Gains from the indoor outreach

3.1.1 Student Body

Most of the students who attended the outreach were unfamiliar with the environment of a dental hospital. Makerere University Biomedical Engineering students are typically placed in hospitals, medical companies, and research centers, among other facilities, during field attachment. Few of them are given the opportunity to work in dental hospitals or facilities that have dental hospitals during the attachment period. Some students who are attached to facilities that have dental hospitals usually complete their attachment period without visiting them. The indoor outreach provided students with an excellent opportunity to learn about the standard environment of dental hospitals as well as the roles of Biomedical Engineers in dental hospitals. Students also benefited from learning how to operate dental chairs, how to perform routine maintenance, and which key parts should be maintained on a regular basis.

By the time of the outreach, the first-year Biomedical Engineering students had never interacted with any complex medical equipment. The outreach provided them with a feeling of a health facility, as well as basic Engineering skills such as troubleshooting. During the outreach, some soldering guns lacked top plugs, requiring the engineering team to connect them. This was an amazing experience for the year ones who had never seen anything like this before.

3.1.2 Dental school

The day of the outreach marked the first time Makerere University Biomedical Engineering students served the dental school in any capacity. BME was introduced at Makerere University in 2011, but the university's health facilities had never benefited from the students' services since then. Biomedical Engineering students at Makerere University typically give back to the community through an annual outreach program known as the BME-HOP. This activity, however, is organized in hospitals outside of the University. As a result of the outreach, the Dental School was able to benefit from the services provided by BME students.

During the outreach, the students completed all of the tasks that were assigned to them. The students collaborated with Eng Jesca to complete all of the tasks. The labor force on the outreach was sufficient to complete the maintenance of the dental chairs. As a result, the outreach relieved Eng Jesca's task of maintaining the dental chairs through the services provided by students.

3.2 Challenges

The team failed to organize the indoor outreach at both the University Hospital and the Dental School Hospital as planned. The University Hospital pilot study took place in April, while students began their final exams in May. Students had to focus on their exams, and association activities were put on hold. The associations were also preparing for the BME-HOP in the new semester, among other activities, but the semester was also cut short due to the pandemic's effects. It was overwhelming for the associations because both the University Hospital outreach and the BME-HOP required funding, which was not obtained. It was better to organize one successful event than two unsuccessful ones. As a result of the limited resources, the indoor outreach was postponed. As a result, the indoor outreach was limited to the Dental School Hospital because it required fewer resources than the University Hospital.

Some dental school equipment were left inoperable. These included the Hydraulic dental press, the dental chair that was relocated from Mulago National Referral Hospital to the Makerere University Dental School Hospital, and some foot switches from the old dental chairs. The hydraulic dental press required hydraulic oil, which the team lacked. The dental chair required an air gauge, but the spare part that was brought was not compatible with the equipment. The foot switches also needed to be repaired by soldering in new micro switches. Unfortunately, even after using WD-40 to open them, their screws were too old and worn out.

It was difficult to select a suitable day for the outreach at the dental school hospital. During the date discussion with Eng Jesca, she stated that any date was fine with her as long as it was a Friday. The suggestion was made because the Hospital is usually less crowded on Fridays, leaving enough space and time to carry out the outreach activities. However, this was unfavorable to students because, for the most part, they had Friday lectures according to their respective timetables. Choosing other days of the week was also difficult due to differences in free periods on the timetables. After considering this, the student leaders proposed scheduling the outreach on one of the semester's Saturdays. This was attempted twice but failed because Eng Jesca was always busy on weekends. When it became clear that finding a weekday that worked for all years was impossible, student leaders resorted to thinking about a day when all years had no afternoon lectures. This meant that some students would arrive at the hospital earlier, while others would arrive later after their lectures. Thus, the 20th of July 2022 was chosen and it was Wednesday.

Students were supposed to assemble an old dental chair in the workshop for practice on the day of the outreach, as planned by the organizing committee and Eng Jesca. However, due to time constraints, this activity was not carried out.

3.3 Recommendations

The next indoor outreach organizing committee should fully involve the University health facilities in the planning process. The organizing committee did not fully engage the director of the University Hospital regarding the needs of the outreach after the pilot study. Despite the team's many constraints, one of which was limited time during the semester, the Director of the University Hospital was less engaged. The organizing committee came to all of the conclusions. If the hospital administration had been fully engaged, perhaps another solution other than eliminating the outreach at the University Hospital would have been devised.

The organizing committee for the next indoor outreach is encouraged to conduct additional assessments of the medical equipment at the health facilities or to inquire from the engineers of the facilities about additional activities to be performed on the day other than what was observed during the pilot study. This will assist the team in adequately preparing for the day, including equipment that were not previously considered, in order to work on all of the faulty equipment at the facilities.

Eng Jesca has a routine for maintaining medical equipment at the Dental School Hospital. The next indoor outreach committee is advised to check her schedule and likely organize the outreach on the day she is doing maintenance. However, depending on the semester timetable, the two parties can reach an agreement on the schedule adjustments. This will assist in resolving the issue of selecting a date for the outreach.

APPENDICES

Figure 8: Students learning about the suction line of a dental chair

engineeringworldhealth

INDOOR OUTREACH PROGRAM at MAK UNIVERSITY HOSPITAL

EQUIPMENT ASSESMENT FORM

BY

ENGINEERING WORLD HEALTH MAKERERE UNIVERSITY CHAPTER

(EWH Mak Chapter)

AND

MAKERERE UNIVERSITY BIOMEDICAL ENGINEERING STUDENTS'

ASSOCIATION (MUBESA)

No	EQUIPMENT NAME	MODEL NAME/No	SERIAL NUMBER	OPERATING STATUS	REMARKS
			TREATMENT		
1	System Unit	2UZ41AV	CZC3379TT	A	Servicing
2	UPS	L600	241808570519-002	A	Servicing
3	Weighing scale				Servicing
4	Digital Blood Pressure monitor	2013359-003	AAX05040072SA	E	Power cable needs fuse (13A) Faulty cuff
5	Digital Blood Pressure monitor	2013359-003	AAX045301505A	A	Servicing
6	Sphygmomanometer	E-10		A	Servicing

Figure 10: University hospital pilot study report

			IMMUNIZATION		
12	Refrigerator	GCF5508-120L	W133365080914000 81	A	Servicing
13	Refrigerator	MK304	20156562349	A	Servicing
14	Wheel chair			C	No foot Peddle
15	Digital BP monitor	2013359-003	AAX0442002254	A	
			ULTRASOUND ROOM		
16	System unit	F2D6459G4V	CZC6459G4V	C	Servicing
17	System unit	2UZ41AV	CZC83379TK	C	Servicing
18	System unit	2UZ41AV	CZC83379V2	C	Servicing
19	Digital BP monitor	2013359-003	AAX050300615A	E	Needs cuff
20	System unit	2UZ41AV	CZC83379TY	A	Servicing
			EYE CLINIC (OPTOMETRY)		
21	Focimeter			C	Loose Eye piece
22	Zeiss nutorefractor	2006-367	K80FA4D	A	Servicing
23	Keratoscope	162202	504AR	E	Needs software update (Keratron)
			ART		
24	Weighing scale	M308800	16313-0004798	C	Calibration
25	System unit	DIIS	07WR56-FCC00-08P-AFGB-A09	A	Servicing
			IMAGING		
26	Ultrasound machine (Printer)	1043848	0106017	A	
27	Ultrasound machine	11235411	504040	A	
28	Printer	G3Q34A	VNC3T94140	A	
29	System unit	2UZ41AV	CZC83379TN	A	
			LABORATORY		
30	System unit	2UZ41AV	CZC83379TW	A	
31	Printer	G3Q58A	VNC5K02520	A	
32	Centrifuge	E8	14521	A	Servicing
33	Dry bath	DSD-200		A	Servicing
34	Microscope	CX22RF51	2M82880	A	Servicing
35	Freezer	GL-C412RLCN	009PRGN052607	A	

Figure 9: University hospital pilot study report

References

MEDIKABAZAAR. (2021, September 29). *Role and components of a Dental chair*. Retrieved from https://www.medikabazaar.com/blog/dental/role-and-components-of-a-dental-chair/

University, T. (2021, August 27). *The Importance of Community Outreach*. Retrieved from https://www.tuw.edu/school-news/importance-of-community-outreach/

MAKERERE UNIVERSITY BIOMEDICAL ENGINEERING STUDENTS' ASSOCIATION AND ENGINEERING WORLD HEALTH (EWH) MAKERERE UNIVERSITY CHAPTER.

A REPORT ON THE 5TH BIOMEDICAL ENGINEERING HOSPITAL OUTREACH PROGRAM (BME-HOP) IN TOORO SUB-REGION ORGANIZED BY MAKERERE UNIVERSITY BIOMEDICAL ENGINEERING STUDENTS' ASSOCIATION (MUBESA) AND ENGINEERING WORLD HEALTH (EWH) MAKERERE UNIVERSITY CHAPTER FROM 5TH JULY TO 9TH JULY,2022.

COMPILED BY:

ASIIMWE AMBROSE
MINISTER REASERCH AND INNOVATION MUBESA (2021-2022)
(CHAIRPERSON 5TH BME-HOP)

PRESENTED BY:

OGOOLA RONALD
PRESIDENT MUBESA (2021-2022)

DATE OF RELEASE: 28TH SEPTEMBER, 2O22.

DEDICATION

This book is first all dedicated to students' body of Biomedical engineering at Makerere University college of health sciences for their outstanding support. These were the first sponsors of this program, otherwise it would not be possible to be a successful activity.

Also, this book is dedicated to Biomedical engineering department as well as college of Health at Makerere University for their encouragement even when resources were not available. Without your encouragement and support, it would be challenging to decide whether to carry on the BME-HOP activity or not.

ACKNOWLEDGMENT

we extend our deepest gratitude to Biomedical engineering students for their selfless service and self-financial support towards the 5th BME-HOP to Tooro sub-region, the students were the core funders (student funded) of this program as well as the Biomedical Engineering students' leaders for organizing well this activity to ensure that it becomes a successful one.

We would also like to acknowledge the contributions of Dr. Robert Ssekitoleko, Head Biomedical Engineering department at Makerere University college of Health Science and all other staffs that gave support and knowledge towards the 5th BME-HOP programs and also dedicating their precious time to give advice to the success of this activity. Thank you for always being willing to give advice and knowledge about this activity whenever we needed it the most.

We also thank and acknowledge Eng. Tadeo Byabagambi, Principal Biomedical Engineer, Ministry of Health for warm welcome, recommendation and contribution towards BME-HOP program to Tooro sub-region. This gave the organizers confidence to continue with the activity especially to government facilities. Similarly, it also showed that Biomedical Engineering service provides a key role in improving healthcare services delivery Nationally and Internationally.

Special thanks to Eng. Ogen-Mungu Ronald (Now at UCI) for honoring and considering Mak Biomedical Engineering students' request while still at Fort-portal RRH to carryout 5th BME-HOP activities in Tooro Sub-region, this was the start for organizing a successful event as students.

Sincere appreciations to Mr. Twesigye Reuben and Mr. Nyemera Richard both from Fort-portal Regional Referral Hospital for dedicating their precious time in orienting the students team, providing knowledge and support during the 5th BME-HOP, these two experts were at the center of every activity to be done in all targeted health facilities in Tooro sub-region, we shall forever thank you.

Similarly, special thanks to all administrators from different target health facilities especially Dr. Alex Adaku, Director of Fort-portal RRH, Dr. Mwesige Ivan (Rukunyu HC IV), and Dr. Kalyegira

Staten from Kyenjonjo General Hospital for their warm welcome and recommending Biomedical Engineering students give their service program in their respective facilities with in Tooro Sub-region, it was really a pleasure. And also thank Mr. Rauben for leading a team that went to Kyegegwa General Hospital. We must say, thank you so much forever.

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1.0 Biomedical engineering in Uganda at Makerere University

1.1 Introduction

Biomedical engineering is a discipline that advances knowledge in engineering, biology and medicine, and improves human health through cross-disciplinary activities that integrate the engineering sciences with the biomedical sciences and clinical practice. It includes:

The acquisition of new knowledge and understanding of living systems through the innovative and substantive application of experimental and analytical techniques based on the engineering sciences.

The program further includes development of new devices, algorithms, processes and systems that advance biology and medicine and improve medical practice and health care delivery. The term "biomedical engineering research" is thus defined in a broad sense: It includes not only the relevant applications of engineering to medicine but also to the basic life sciences.

1.2 Background to the programme.

The rapid growth of healthcare systems and the indispensable increasing role of technology in diagnostic, therapeutic, and associated research activities have culminated into increasing demand for skilled biomedical engineers both in Uganda and globally. Bachelor of Science in. Biomedical Engineering (BSc. BME) programme is aimed at advancing the technology needed to enhance healthcare.

The Programme combines traditional engineering expertise with an understanding of biological processes.

The Biomedical Engineers are expected to work with physicians, therapists, and other technicians in the design, construction, implementation, and maintenance of sophisticated healthcare equipment and lifesaving devices. The Biomedical Engineering Programme equips scholars to use cutting-edge engineering principles to analyze and facilitate the biological and medical technology innovations needed to solve healthcare problems and ultimately, improve the healthcare system.

In Uganda as a nation that is increasingly importing complex pieces of equipment to support health and health related research. Most of these pieces of equipment arrive without the accompanying care, maintenance and support. In some cases, the equipment specifications are not suited to the local environment, which affects durability and use of this equipment. The graduates of this

program use their knowledge to reduce the costs of maintenance, wastage, loss of work hours from equipment downtime and other resources due to the current lack of this cadre of trainees on the market. In addition, these graduates are in position to advice on sourcing, procurement and preventive maintenance correctly specified for our environment thus making further savings to the country.

Given the uniqueness of the environment and people in Africa, there was a need to design biomedical equipment that is suited to both. The graduates of this program will participate in research, innovation and design of new devices suited to and in response for the local need of healthcare in low resource settings.

It wasn't long when Makerere University decided to offer biomedical engineering in the country at Bachelor level. With this, the government of Uganda also came out to support students offer biomedical engineering at this institute through the Ugandan Government Scholarships.

The University offers biomedical engineering for a period of four years and this program is being taught between two colleges i.e. College of Engineering Art Design and Technology and also the College of Health Sciences which houses the program under its school of biomedical sciences, department of physiology.

In 2012, Makerere University opened up a degree program for Bachelor of Science in Biomedical Engineering which aims at equipping students with skills to manage medical equipment, and design and develop solutions to the health challenges. Later, Makerere University Biomedical Engineering Students under the umbrella association "Makerere University Biomedical Engineering Students' Association (MUBESA)" joined the rest of the world of biomedical engineers and signed up for a student chapter in the Engineering World Health (EWH) Makerere chapter and IEEE Uganda subsection to improve health care delivery through Biomedical engineering in Uganda. Biomedical Engineering Hospital Outreach Program (BME HOP) is one of the activities performed in this collaboration two students' associations mentioned in the same paragraph.

1.3 Background of Mubesa

Makerere University Biomedical Engineering Students' Association (MUBESA) is a registered students' association at Makerere University that brings together all students and alumni that are pursuing and have pursued a Bachelor of Science in Biomedical Engineering (BBI).

The association aims at being the platform through which students can practically put what is taught in class into reality through hospital outreach, design competitions, and project write ups to mention but a few. Engineering world health is a non-profitable organization that engages the skills and passions of students and professionals from around the globe to improve health care delivery in low income countries.

Engineering world health has a student chapter at Makerere University whose main objective is to educate and empower young engineers, scientists, and medical professionals from MAKERERE UNIVERSITY to use their engineering skills to improve global health. EWH MAK Chapter offers young professionals an eye-opening, life-changing experience that will encourage life-long engagement with global health, and enable them immediately to provide meaningful service to patients in the developing world.

2.0 Biomedical engineering hospital program (BME-HOP)

2.1 Introduction

This is a voluntary program that was initiated by students in 2014 and implemented under the student association "Makerere University Biomedical Engineering Students' Association" which is the lead association registered and recognized by the University as the official Biomedical Engineering students' body in Makerere University, College of Health Sciences.

Health technologies are essential to the provision of healthcare to citizens and is an important player in both the European and global economy for a functioning health system. Medical devices in particular are crucial in the prevention, diagnosis, and treatment of illness and disease, as well as patient rehabilitation. (Recognizing this important role of health technologies, WHO May 2007).

Hence medical equipment is extremely valuable and has the potential to significantly improve health care in developing countries. To aid the world's poorest health care systems, western hospitals often donate used medical equipment when updating their inventory.

However, the World Health Organization (WHO) estimated that 70% of medical equipment donated to developing nations is unusable due to ignorance by the users, frequent breakdowns, and failure to install the equipment. The World Health Organization, however, also estimated that 10 million children in the developing world die due to inadequate medical care and inadequate technologies.

According to a study carried out by Tropical Health and Education Trust (THET) in Uganda, less than 50% of medical equipment are in working state and over 50% of these are out of service, this is similar to all developing countries. A study by the Ministry of Health Uganda shows that 17 out of a total of 76 Public and NGO hospitals in Uganda revealed that 30% of the faulty stock would be worth repairing with great challenges cited as lack of the skilled personnel to carry out the work (Biomedical Engineers). Uganda today has a lot of equipment coming in due to the high demand for health care delivery both purchased and donated.

Despite these increasing equipment intakes, these equipment lack maintenance, monitoring, and repair in case of fault. The National Advisory Committee on Medical Equipment (NACME) reported in 2009 that showed a lack of expertise to work on equipment and that currently, Electrical and Mechanical engineers carry out the work of Biomedical Engineers. However, in 2011,

Makerere University opened up a degree program for Bachelor of Science in Biomedical Engineering which aims at equipping students with skills to manage medical equipment, and design and develop solutions to the health challenges.

Makerere University Biomedical Engineering Students under the umbrella association "Makerere University Biomedical Engineering Students' Association (MUBESA)" joined the rest of the world of biomedical engineers and signed up for a student chapter in the Engineering World Health (EWH) Makerere chapter and IEEE Uganda subsection to improve health care delivery through Biomedical engineering in Uganda. Biomedical Engineering Hospital Outreach Program (BME HOP) is one of the activities performed in this collaboration of student societies.
The project is in line with the existing issues being faced by the local populace of the area and would focus efforts towards the following:

- **Increasing awareness on linkages between medical technology and healthcare delivery.**
- **Improving healthcare through adoption of good medical equipment management practices.**

2.2 Problem statement

Medical equipment breakdown and inadequacy poses severe threat to the underprivileged and the rural masses, by reducing their access to quality healthcare. Communities, relying on available facilities are the worst hit and often fall victims even to a slight setback. The huge attention being given to medical equipment issues is evident from the fact that several international and national agencies have tried to reduce medical equipment breakdown.
Health facilities worldwide are facing tremendous pressure to meet the demand of the growing population. Medical equipment breakdown further adds to this existing pressure. Studies reveal that poor equipment management and disuse will reduce healthcare delivery by affecting all dimensions of healthcare.
There is a need to improving medical equipment management to reduce the vulnerability of rural communities to the poor healthcare services. This would be possible by introduction of fundamental changes in medical technology management practices. Integration of technical

knowledge with innovations in medical technology also has a huge scope to improving the healthcare system in our setting.

Hence activity programs such as **BME-HOP** can significantly add value in the field of biomedical engineering purposely by giving students support like any other clinical activities to visit upcountry health facilities to provide services on medical equipment to improve on their proficiency, quality and quick performance. Specifically, Biomedical engineering at Makerere University designed BME-HOP program with the hope to add assistance on available man power to offer a better service.

2.3 Background of BME-HOP

Specific to Makerere University, the students of BME were able to form a students' association which is called **MAKERERE UNIVERSITY BIOMEDICAL ENGINEERING STUDENTS ASSOCIATION (MUBESA).** This association has supported students to further understand what biomedical engineering is all about. The association has been able to hold different activities both at university and National level.

It has recently managed to be among the premier organizers of the First bi-annual National Biomedical Engineering Conference which took place on 16th -17th January 2017. This conference brought together different stakeholders of biomedical engineering in and out of the country including Health professionals, WHO, delegates from Kenya- USA, UK, Ministry of Health Uganda, academia, regulatory bodies and the biomedical engineers and technicians out already in the field.

To build a resilient engineering skills, MUBESA has continued to sustainably organize activities which are ranging from innovation, to offering servicing such as repair, and equipment maintenance to, maintain the functionality of existing technologies such the provide quick and safer service. This is through organizing major activities such as **Freshman's challenges** and **BME-HOP**, both continue building the skilled, experienced and updated environment in the field of Biomedical Engineering.

2.3 Objectives

BME-HOP is a voluntary program that was initiated by students in 2014 and implemented under the student association "Makerere University Biomedical Engineering Students' Association" which is the lead association registered and recognized by the University as the official Biomedical Engineering students' body in Makerere. The main goals of the project are;

- To reduce the rates of equipment failure in Ugandan health facilities through repair, maintenance of medical equipment, and user training of health workers.
- To find out the gaps on the existing technology in the healthcare so that the professionals can develop new and simple ideas for healthcare technology through research and innovation.
- To study health challenges faced by patients and medical personnel in health facilities so that students innovate to find solutions to them.

The very first BME-HOP was conducted at Kawolo Hospital in the Buikwe district in May 2015 (solely funded by students' generous contributions). The project featured 35 biomedical engineering students from Makerere University, 4 biomedical students from the University of British Columbia, and 7 Biomedical engineering lecturers and professional engineers. The project involved repair, maintenance, and user training on most medical equipment. 45 pieces of equipment were presented faulty and 36 of these were left functioning. The 4th BME-HOP was conducted at Arua Regional Referral Hospital in March, 2019.

2.4 BME-HOP in Tooro Sub-Region

BME-HOP provides a platform for Hospital Physicians, Practicing Biomedical Engineers, and Biomedical Engineering Students to work together through brainstorming to solve medical equipment and health-related challenges, which lead to a decrease in the number of equipment failures or breakdowns in Ugandan Hospitals hence improving efficiency at work.

Hence this 2022 year's 5th BME-HOP has been organized by **MUBESA** in conjunction with **EWH** to take place in Tooro sub region covering 4 hospitals of Fort-portal RRH, Rukunyu HC IV, Kyenjojo General Hospital, and Kyegegwa General Hospital.

On 5thJuly, 2022, BME-HOP activities commenced by holding a small meeting with the Engineering workshop staffs led by Mr Rauben and Mr. Richard both at Fortportat RRH who later introduced the student team to the entire administration of Fortportal Regional Referral Hospital who warmly welcomed all Biomedical Engineering students from Makerere University. The administration further oriented the students team by giving guidelines on how activities will be conducted. Activities expected to perform included assessment, testing, repair maintenance among others, of medical equipment, and a team involved Biomedical engineering finalists and continuing students from Makerere University, Biomedical technicians/Engineers from Fort-portal Regional referral hospital, a Biomedical Engineer from JMS.

First day: BME-HOP committee holding a meeting with Engineers at Regional Equipment Maintenance workshop at Fort-portal RRH

In second photo (Eng. John from JMS(R), Mr. Richard and Mr. Rauben both from FortPortal RRH)

2.5 Theme

‘‘Improvement of Healthcare services delivery in the Tooro Sub-region through providing volunteer services by Makerere University Biomedical Engineering students in collaboration with other professional Biomedical engineers by increasing functionality rate of medical equipment’’

2.6 Vision

To reduce the percentage of medical equipment breakdowns at health facilities in addition to designing sustainable innovative solutions to health challenges in Uganda.

2.7 Mission

To be the leading hospital outreach program in medical equipment repair, maintenance, and user training for higher standards of medical equipment management and functionality towards better healthcare delivery in the country.

2.8 Objectives of BME-HOP

- To reduce the failure rate of medical equipment at health facilities through innovations, repair, and maintenance to save human lives thus promoting patient safety and improvement in health centers in our country.
- To expose biomedical engineering students to the biomedical engineering field and provide hands-on experiences for greater motivation and appreciation of the Biomedical Engineering program.
- To increase collaboration between the medical equipment supply companies involved in this BME-HOP program with the health facilities in the Fort portal region.
- To build up a spirit of volunteering among the students.
- To raise awareness about the need for biomedical engineers in the country.
- To promote and carry out user training of medical workers and other health professionals on medical equipment servicing and maintenance in health care centers.
- To increase the visibility of Biomedical Engineering as a discipline that offers solutions to health care challenges in our country and the world at large.

2.9 Specific objectives of the 5TH BME-HOP.

- To reduce the rates of medical equipment failure in Ugandan health facilities through repair, servicing, maintenance and user training of the health workers on equipment.
- To find out the gaps on the existing in healthcare technology and develop new and simple ideas for healthcare technology through research and innovation.
- To enable BBI students gain practical knowledge of Medical equipment before their internship placements. (Year Ones and Twos). Part of learning opportunity.

2.10 Strategy/Methodology

Depending on the workload of the selected hospital and the distance from the University, the required number of days to execute the work at hand was decided by the project coordinating teams lead by the President MUBESA and the Min Research and innovation MUBESA (Program chairperson) but the emphasis is placed on reducing costs while achieving efficiency. Different health care facilities around the country; western, southern, central, eastern, and northern Uganda have a chance to be selected to benefit from our services, however, due to the limited resources, the nearest health care centers usually stand the highest chance of being picked.

The selected health facilities were visited before the date of the program to have a survey of the condition of the medical equipment and organize precisely for the BME HOP before the actual day. This process was made possible with the guidance from the respective hospital administrators from which this activity was to take place.

During these outreach programs, at least 6 professional biomedical engineers who may be either the Biomedical Engineering lecturers or the practicing engineers come along with the students. They guide the students on the approach to most of the medical equipment challenges and altogether provide free repair, maintenance, and servicing of all medical equipment in the health Centre. This is not limited to the above as the health care workers are given user training programs to improve their outcomes with medical equipment.

2.10 Proposal FOR 5th BME-HOP 2022 in Tooro Sub-region

This year's BME-HOP was proposed to take place in Tooro sub-region to cover 5 health facilities. After several successful meeting while planning on how to make this activity successful, different individual gathered to give advice towards this event. This included forming of committees to aid the smooth running of this program's activities.

2.11 THE COMMITTEE MEMBERS

S/N	NAME	POSITION
1	Ogoola Ronald	MUBESA President
2	Jjukko George William	EWH President
3	Bua Isaac	Advisor 5TH BME-HOP
4	Asiimwe Ambrose	Chair Person Organizing Committee 5TH BME-HOP Minister Research and Innovation MUBESA
5	Lutaaya Edward	Vice C/Person 5TH BME-HOP
6	Tugume Mark	Finance
7	Atamba Edgar	Secretary
8	Mugaba Jessy John	Welfare
9	Ssendikwanawa Nicholas	Publicity
10	Kadodo vannesa	Publicity
11	Wamani Derrick Eric	Welfare

Shows organizing committee of the 5th BME-HOP in Tooro sub-region

Some of the 5th BME-HOP organizing committee members in Tooro Sub-region

Some of the 5th BME-HOP organizing committee members with senior technician (2nd Right) from Fort-portal RRH Tooro Sub-region.

3.0 Region Selection

This being the 5th BME-HOP outreach, several regions had been visited in previous years, and therefore through several consultations between the organizing committee and several advisors including Biomedical Engineering Unit of Makerere University and the alumni and BME students' leaders, it was proposed to conduct this year's BME-HOP to Tooro sub region covering five (5) hospitals served by Fort-portal RRH.

Hospitals selected for this program included;

-Fort-portal Regional Referral Hospital. Fort Portal Regional Referral Hospital is a hospital in the city of Fort Portal in the Kabarole district in the western region of Uganda. It is the regional referral hospital for the districts of Bundibugyo, Kabarole, Kamwenge, Kasese, Ntoroko, and Kyenjojo. The hospital is approximately 294 kilometers (183 miles), by road, west of Mulago National Referral Hospital, Uganda's largest referral hospital.

-Kyenjojo General Hospital. The hospital is off of the Mubende-Kyegegwa-Kyenjojo-Fort Portal Road, in the town of Kyenjojo in Kyenjojo District, approximately 50 kilometres (31 mi), by road, east of Fort Portal Regional Referral Hospital.

-Rukunyu General Hospital located in Kamwenge district.

-Bukuku Health Centre IV located in Kabarole District.

-Kyegegwa general hospital in kyegegwa district

3.1 Pilot study.

We proposed to have a pilot study from Tuesday, 24th May to Friday, 27th May 2022. And the team headed by the president MUBESA departed from Makerere University and travelled to carry out a pilot study in the hospitals of interest within Tooro Sub-region.

This aimed at identifying major medical equipment problem including ones that needed spare parts to ensure proper planning for the actual day of BME-HOP. And also to aid the committee gather the necessary resources including developing the appropriate budget and necessary tools needed for this outreach.

This took a period of 4 days and the pilot was assisted by the technical engineers and technicians from respective hospitals/health facilities from Tooro sub-region.

3.2 Day for BME-HOP in Tooro Sub Region.

The BME-HOP activities began on Monday 4th July 2022; this was the departure day for students from Makerere University. This took a period of four (4) days with three (3) full working days. This commenced on Monday to Friday as the final day of this activity.

During this program, several hospitals within Tooro Sub-region were visited including Fort portal RRH, Kyenjonjo General Hospital, Rukunyu HC IV, and Kyegegwa Hospital.

Several and different activities were performed by students from Makerere University with supervision from hospital technical personnel that provided assistance during repair, installation, Calibration, and maintenance.

Maintenance

During maintenance activity, different tasks were carried out including cleaning to remove any dust, and also removing any waste matter from inside the medical equipment. Also visual checks were conducted to check for any damages of parts of the equipment and possible leakages. Functional checks were also considered such that there is no faulty with the equipment especially after use of the equipment.

During performing of these different activities, the hospital staffs provided job cards where activities performed and the information about the equipment worked on were recorded.

After every activity on a particular equipment, they were handed over to the facility administrators for use or storage depending on the urgency of need.

3.3 Activities performed

On arrival at each facility, all medical equipment that had technical issues, were presented to the team for assessment and generate appropriate plan on how to solve their problem. The students were 35 in number, and this number was divided into several groups for a different activity and each group was attached to a technical personnel in the field to help do quality work such as assessment/inspection, calibration, repairing, maintenance, installing as well as learning.

Medical equipment available from the targeted facilities included: Autoclaves, Oxygen concentrators, operating beds, centrifuge, BP machines, surgical lights, mobile refrigerators, patient monitors, pulse oximeters, High team sterilizers etc.

3.4.0 Definition activities

3.4.1 Inspection

Inspection refers to scheduled activities necessary to ensure a piece of medical equipment is functioning correctly. During this activity both performance inspections and safety inspections were conducted. This occasionally occurred in conjunction with preventive maintenance, corrective maintenance, or calibration.

3.4.2 Testing

The initial inspection performed on a piece of medical equipment prior to it being put into service. Whenever the device was brought, first this was to first test its functioning status and information obtained was always obtained on job card and a plan to nonfunctional equipment was discussed appropriately amongst the team and solution was always suggested and performed.

3.4.3 Calibration

Some medical equipment, particularly those with therapeutic energy output were calibrated and advised to be calibrated periodically. This means that energy levels are to be measured and if there is a discrepancy from the indicated levels, adjustments must be made until the device functions within specifications. This activity was mostly performed on patient monitors, laboratory equipment

3.4.4 Repair

This activity involved use of tools and open an equipment to replace a spare part (if available). This procedure restored the physical integrity, safety, and/or performance devices/equipment which were not functional.

3.5 Performances


4.0 Some of the activities performed at different hospitals during 5th BME-HOP in Tooro Sub-region.

4.1 Achievements:

For three days, the team managed to service, repair and provide maintenance of **38 Medical Equipment**, including 12 oxygen concentrators, 3 autoclaves/ High steam sterilizers, 4 mobile operation surgical lights, 2 operation bed, 1 Centrifuge, 5 BP machines, 6 patient monitors, 2 refrigerators, 1 pulse oximeter, 1baby incubator 1 phototherapy machine and installation of solar batteries. 80% of these are functional. However, this contributed only 60% of our set goals for this 5th BME-HOP program in Tooro sub-region.

4.2 Job cards indicating activities performed

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Tel 0772 - 873994
0783 - 524213

MINISTRY OF HEALTH
FORTPORTAL REG. REF. HOSPITAL
P.O.Box 10
FortPortal

MINISTRY OF HEALTH

JOB CARD

Date: 08/July/2022

Job Card Serial Number: 1734

Health Facility	Department	Section/ Room
Kyenjojo G.H		

Name of Equipment/Furniture/ Other repair works	Original Operational Status
Auto clave	A. B. C. D. E. F

Serial No./ Engraved No.	Model Name / Model No.
110113201-002 KYJ/HOSP/AM/02	SA300H-F-A2..

Fault Reported/ Detected
- Blocked tubes
- Disconnected earthwire & connectors
- Rusty reservoirs
- Due for service

Work done
- Serviced the machine
- Unblocked water tubes
- Connected earthwires and connectors

Extra work to be done/Advise to the Health Facility/Remarks
Installed

Name of Eng/Tech	Signature
Asiimwe Ambrose	[signature]
Arinaitwe Vivian	[signature]
Ahurinimwe Allan	[signature]
Mugaba Jessy John	[signature]

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty

Final Operational Status After Maintenance: A. B. C. D. E. F (tick or circle)

Estimate Date of Next Service (Month/Year) /

Follow-up Contact No. for Maintenance Team Member Tel

Comment and Endorsement by User Department/Health Facility in charge

Endorsed by	Name: Nkoba Saul Title: Hospital Administrator Signature: [signature]	Stamp: KYENJOJO GENERAL HOSPITAL Date

Note; Original-kept by Workshop, 1st Copy-kept by HF, 2nd Copy-Retained in Job Book

JOB CARDS INDICATING ACTIVITIES PERFORMED

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MINISTRY OF HEALTH
FORTPORTAL REG. REF. HOSPITAL
P.O.Box 10
FortPortal

JOB CARD

Date: 8/7/2022 Job Card Serial Number: 1729

Health Facility	Department	Section/ Room
KYENJOJO G.H		

Name of Equipment/Furniture/ Other repair works	Original Operational Status
OXYGEN CONCENTRATOR	A. (B.) C. D. E. F
Serial No./ Engraved No.	**Model Name / Model No.**
CEB0121020618	Newlife Intensity 10

Fault Reported/ Detected
- Low percentage oxygen out put 70%
- Due for service

Work done
- General mentainance by replacing filters, cleaning
- Fastening loose rubber tubbings

Extra work to be done/Advise to the Health Facility/Remarks
- Refill the distilled water in the humidifier
- Service after 6 months, user trained

Name of Eng/Tech	Signature
MALUKU JULIUS	
KAKETO CREVINE	
ATUSIMIRE ALAN	

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty
- Filters	01
- Rubber tubing	01

Final Operational Status After Maintenance: (A.) B. C. D. E. F (tick or circle)

Estimate Date of Next Service (Month/Year) /

Follow-up Contact No. for Maintenance Team Member Tel

Comment and Endorsement by User Department/Health Facility in charge

Endorsed by	Name Nkaba Sauh	Stamp KYENJOJO GENERAL HOSPITAL
	Title HOSP Administrator	
	Signature	Date

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JOB CARD

Date: 8th/08/2022 Job Card Serial Number: 1722

Health Facility	Department	Section/ Room
Kyenjojo General Hospital		
Name of Equipment/Furniture/ Other repair works: Operating light		Original Operational Status: A. B. C. D. E. F
Serial No./ Engraved No.: BCM/CPC/SMGL/KYEN/E/045		Model Name / Model No.

Fault Reported/ Detected: Non Castors not moving Blown fuse

Work done: Trouble shooting

Extra work to be done/Advise to the Health Facility/Remarks: Servicing

Name of Eng/Tech	Signature
[illegible]	[signature]
Atukwi Patricia	[signature]
Byamugisha John	[signature]

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty
Fuse	1

Final Operational Status After Maintenance: A✓ B. C. D. E. F (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: H/Admin; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

Note; Original-kept by Workshop, 1st Copy-kept by HF, 2nd Copy-Retained in Job Book

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JOB CARD

Date: 08/07/2022 Job Card Serial Number: 1723

Health Facility	Department	Section/ Room
KYENGOJO G.H		
Name of Equipment/Furniture/ Other repair works: OXYGEN CONCENTRATOR		Original Operational Status: A. B. C. D. E. F
Serial No./ Engraved No.: 224958906 0521		Model Name / Model No.: YS-WIN-NS.

Fault Reported/ Detected: Depleted battery.

Work done:
- Servicing and cleaning.
- Filter replacement

Extra work to be done/Advise to the Health Facility/Remarks: Replace Battery

Name of Eng/Tech	Signature
Rashid Ntanda.	[signature]
Namuli Shadiah	[signature]
Akiiki Stella	

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty
Filter	1

Final Operational Status After Maintenance: A✓ B. C. D. E. F (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: H/Admin; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

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JOB CARD

Date: 08/07/2022 Job Card Serial Number: 1725

Health Facility	Department	Section/ Room
Kyenjojo G.H		
Name of Equipment/Furniture/ Other repair works: Refrigerator		Original Operational Status: (A) B. C. D. E. F
Serial No./ Engraved No.: KGHL/GPE/007		Model Name / Model No.

Fault Reported/ Detected: Gas leakage - Due for service

Work done:
- Replacement of dry filter
- filling the gas

Extra work to be done/Advise to the Health Facility/Remarks

Name of Eng/Tech	Signature
Nambalirwa Aidah	[signature]
Gawaya Mercy Alice	[signature]
Odongo Sam	
Wamani Derick Eric	[signature]

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty
Filter	01

Final Operational Status After Maintenance: (A) B. C. D. E. F (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: H/Admin; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

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JOB CARD

Date: 08/07/2022 Job Card Serial Number: 1727

Health Facility	Department	Section/ Room
Kenjojo G.H		
Name of Equipment/Furniture/ Other repair works: Baby Incubator		Original Operational Status: A. B. C. D. E. F
Serial No./ Engraved No.: B 00' 01140401005		Model Name / Model No.: A120

Fault Reported/ Detected: Due for service.

Work done: Servicing

Extra work to be done/Advise to the Health Facility/Remarks

Name of Eng/Tech	Signature
MUGALU DAVID M.	[signature]
[illegible]	[signature]
Nassaka Pamela Kibuuka	[signature]

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty

Final Operational Status After Maintenance: A✓ B. C. D. E. F (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: H/Admin; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

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JOB CARD

Date: 08 / July / 2022
Job Card Serial Number: 1730

Health Facility	Department	Section/ Room
Kyenjojo G.H		

Name of Equipment/Furniture/ Other repair works: Operation light
Original Operational Status: A. B. C. D. E. F
Serial No./ Engraved No.: 23681
Model Name / Model No.:
Fault Reported/ Detected: Due for service; Unfunctioning bulb
Work done: We have serviced the machine.
Extra work to be done/Advise to the Health Facility/Remarks: Reconnecting the switch

Name of Eng/Tech	Signature
KATO H	[signature]
MUHINDO EDREEN	[signature]
KAMYA ABDUL AZIZ	[signature]
Nabukeera Sylvia	[signature]

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty

Final Operational Status After Maintenance: (A) B. C. D. E. F (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: Hospital Administrator; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

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FORTPORTAL REG. REF. HOSPITAL
P.O.Box 10
FortPortal

JOB CARD

Date: 08 / July / 2022
Job Card Serial Number: 1731

Health Facility	Department	Section/ Room
Kyenjojo G.H		

Name of Equipment/Furniture/ Other repair works: Oxygen concentrator
Original Operational Status: A. B.✓ C. D. E. F
Serial No./ Engraved No.: 249658060521
Model Name / Model No.: Y5WNNS
Fault Reported/ Detected: Low oxygen pressure; Due for service
Work done:
- Serviced
- Replaced filters

Extra work to be done/Advise to the Health Facility/Remarks: Alarm battery needs to be replaced. Service after six months

Name of Eng/Tech	Signature
Nabukeera Sylvia	[signature]

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty
Plug	01
Filter	01

Final Operational Status After Maintenance: A.✓ B. C. D. E. F (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: Hosp Administrator; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

Note; Original-kept by Workshop, 1st Copy-kept by HF, 2nd Copy-Retained in Job Book

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F/P REG. MAINT: W/SHOP
Tel 0772 - 873994
0783 - 524213

MINISTRY OF HEALTH
FORTPORTAL REG. REF. HOSPITAL
P.O.Box 10
FortPortal

JOB CARD

Date: 08 / 07 / 2022
Job Card Serial Number: 1735

Health Facility	Department	Section/ Room
KYENJOJO GH	NICU	

Name of Equipment/Furniture/ Other repair works: 5-Way Oxygen Splitter
Original Operational Status: A. (B) C. D. E. F
Serial No./ Engraved No.: 22011700
Model Name / Model No.: 5WOS
Fault Reported/ Detected:
Work done: Installation
Extra work to be done/Advise to the Health Facility/Remarks:

Name of Eng/Tech	Signature
OKILENG JOSEPH	Joe.
KAKEETO GREAVINS	Kakeeto
BME HOP	

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty

Final Operational Status After Maintenance: (A) B. C. D. E. F (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: Hospital-Administrator; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

Note; Original-kept by Workshop, 1st Copy-kept by HF, 2nd Copy-Retained in Job Book

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Tel 0772 - 873994
0783 - 524213

MINISTRY OF HEALTH
FORTPORTAL REG. REF. HOSPITAL
P.O.Box 10
FortPortal

JOB CARD

Date: / /
Job Card Serial Number: 1739

Health Facility	Department	Section/ Room
Kyenjojo G.H		

Name of Equipment/Furniture/ Other repair works: Oxygen Concentrator
Original Operational Status: A. B. C. D. (E) (F)
Serial No./ Engraved No.: MZJ10AS09285
Model Name / Model No.:
Fault Reported/ Detected:
- Low pressure of O_2
- Due for service
- Missing Humidifier.
- Missing regulator knob

Work done:
- Replaced humidifier
- Serviced

Extra work to be done/Advise to the Health Facility/Remarks: Service after 6 months

Name of Eng/Tech	Signature
Mukwaya Prue Kabanda	[signature]
Vanessa	
Joan	
Aziz & Patricia	

Name of Casual Labourer	Contact No.	Cost

Spare Parts Used and Other Supplies

Name	Qty

Final Operational Status After Maintenance: A. B. C. D. (E) (F) (tick or circle)
Estimate Date of Next Service (Month/Year) /
Follow-up Contact No. for Maintenance Team Member Tel
Comment and Endorsement by User Department/Health Facility in charge

Endorsed by — Name: Nkoba Saul; Title: Hospital-Administrator; Signature: [signature]; Stamp: KYENJOJO GENERAL HOSPITAL; Date

Note; Original-kept by Workshop, 1st Copy-kept by HF, 2nd Copy-Retained in Job Book

4.3 Some Oxygen concentrators from Kyenjojo General hospital

Team of Biomedical Engineering students and Mr. Richard with some of oxygen concentrators worked on (functional) at Rukunyu HC IV.

Number	Model/ Serial Number
1	MZ310509285
2	MZ310509288
3	N5130265
4	CBB0121020618
5	AE19090853
6	MZJ10566499
7	MZJ10509293

Table shows serial numbers of some oxygen concentrators worked on during BME-HOP

5.0 Benefits of BME-HOP

5.1 Students*:*

- Skills and experience through hands on training.
- Networking
- Internship opportunities
- Innovation and research areas.

5.2 Makerere university

- Increased confidence in offering BBI program at University

5.3 Hospitals/communities*.*

- Increased functionality rate of medical equipment
- Increased service delivery
- Saving lives
- Reduced time wastage.

5.4 Failures

We failed to accomplish our set goals by 40% i.e.

- Failed to reach one Hospital, (Bukuku General Hospital) under our program due to smallest budget as a result of lack of a sponsor for this program hinder most activities to be accomplished as earlier planned.
- Lack of spare parts led the team achieve 80% of the equipment at disposal, as some equipment required replacement of new spare parts.

5.5 Recommendations

As Biomedical Engineering program particularly students' leaders, we appeal to the Ministry of Health of Uganda under Biomedical engineering department to adopt BME-HOP outreaches as they bring health technology services nearer to the community in shortest time and cheap cost hence saving lives, and reduce costs of medical equipment program. This can be through sponsoring this program whenever it is to be conducted to any place in Uganda depending on availability of participants.

Makerere University should also adopt BME-HOP and also provide necessary support and considered under beneficial activities at College of Health Sciences.

We also appeal to stakeholders to provide support towards the pending budget of certificates, Magazines, and calendars for the 5th BME-HOP activity in Tooro Sub-region.

There is a need for Biomedical engineering services to be extended increase work force in health facilities all over the country to ensure all medical equipment are in functional state all the time to avoid delay and deny of health service to people that need it.

5.6 CONTACT PERSONS OF THE 5TH BME-HOP

1.OGOOLA RONALD

President MUBESA

+256705514832/**ogoolaronald@gmail.com**

2.ASIIMWE AMBROSE

Minister Research and Innovation (MUBESA)

Chairperson 5th BME-HOP in Tooro Sub-region

+256778171238/ ambroseasiimwe899@gmail.com

3.JJUUKO GEORGE WILLIAM

President EWH

+256 703986640 /+256 776230523

jgeorgewilliam0526@gmail.com.

APPENDICES

5.7.1 APPENDIX I: Biomedical Engineering Students on the final day of BME-HOP at Kyenjojo General Hospital.

APPENDIX II: MAK Biomedical Engineering Students with a Biomedical Engineer (Right) from JMS

APPENDIX III: MAK Biomedical Engineering Students together with Field experts carrying out Part of various activities on Medical Equipment in Tooro sub-region including Repairing, Maintenance, calibrations etc.


OPERATING THEATRE


IEKO

REFERENCES

https://www.researchgate.net/publication/327460116_Role_and_Impact_of_Biomedical_Engineering_Discipline_for_Developing_Country_Perspective

https://www.studenthub.ug/courses/95/bachelor-of-sciences-in-biomedical-engineering

https://chs.mak.ac.ug/programmes/programmes-college/bachelor-science-biomedical-engineering-0

ENGINEERING GALA RECESS

SECTION 1: Preparations

The EWH speaker (Mr. Lutaaya Edward) brought an idea of promoting EWH to engineering courses rather than Biomedical engineering which is the most represented program within the organization. This idea was to organize the "**engineering recess gala**" which had to bring together all year one engineering programs at the College of Engineering Design Art and Technology, Makerere University namely; Biomedical, Electrical, Computer, Telecommunication, Mechanical and Civil engineering. The football gala was aimed at promoting EWH and also bringing engineering students together to let them know that they must work together using their expertise to improve Uganda's and the world's health system.

During the organization, EWH suggested collaborating with Makerere Engineering Society (MES), to smoothen the funding process and also to boost the participation of all the above engineering programs since MES is well known to them more than EWH. Unfortunately, MES couldn't join EWH because they were fully engaged in organizing the freshmen's and women's orientation.

EWH, therefore, undertook the initiative of solely organizing the football gala in the following steps,

Teams: because this gala was the first to be organized by the EWHMak chapter, only four engineering programs were contacted namely; Biomedical, Electrical, Computer, Telecommunication engineering, and unfortunately, only three teams (except computer engineering) turned up for the gala.

Pitch booking: the speaker with the help of the publicity secretary Magaba Jessy, wrote and delivered the letter seeking to use the Makerere University main pitch to the Sports near the swimming pool. The letter was well received and permission was granted to EWH to use the pitch for the gala on Friday 4th February 2022 from 10:00 – 12:00 pm.

Flyer: the MUBESA member of the publicity committee Mr. Kato Wabbi was contacted and designed the gala's social media flyer shown below;

Balls and Jerseys: a ball and two sets of bibs in green and orange color were booked for Biomedical and telecommunication engineering respectively.

Budget:

Item	**Amount (UGX)**
Balls	20,000
Water	50,000
Glucose	3,000
Whistle and cards	5,000
Referees	20,000
Airtime	2,000
Award	50,000
Total	**150,000**

SECTION 2: The Event

Teams: three teams turned up for the gala are Biomedical, Electrical, and Telecommunications engineering.

Match	**Time**	**Result**
Biomedical vs Telecom	11:00 – 11: 50 am	0:1
Electrical vs Biomedical	12:00 – 12:50 am	2:0
Telecom vs Electrical	1:00 – 2:00 pm	0:0 (1:3(P))

The electrical engineering team merged as the winners of the "Engineering recess gala". and hence the winner of the UGX. 50,000 prize money

Income

Party	**Amount (UGX)**
EWH	100,000
Biomedical engineering	20,000
Telecommunication engineering	20,000
Electrical engineering	20,000

Total	**160,000**

Expenses

Item	**Amount (UGX)**
Balls	20,000
Water	38,000
Glucose	3,000
Whistle and cards	5,000
Referees	10,000
Award	50,000
Lunch for EWH officials	4,000
Total	**130,000**
Balance	**30,000**

SECTION 3: Recommendation

Teams: all the six engineering programs at CEDAT should be informed about in time to ensure their participation.

Funding: more funders should be sourced to make the event more colorful, EWH should also fund more than UGX. 100,000 and teams should be charged more but affordable fees.

Recurrence: the gala should be organized by EWH annually and during the recess period.

Compiled by:

Lutaaya Edward

Speaker EWH Makchapter

APPENDIX

Figure..1: winning team; Year one Electrical engineering team

Figure.2:runners up; Year one Telecommunications engineering team

Figure.3: First runners up team; Year one Biomedical engineering team