Engineering World Health Institute
Uganda 2018
Final Report

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Executive Summary

The 2018 EWH Institute in Uganda was a highly productive contribution to the Ugandan health care system. This year we had 14 participants from the University of New South Wales and the University of Sydney, in addition to 7 Makerere Students. There were 15 male and 6 female participants.

During the first month of the program, the participants underwent intensive language, cultural, and technical training conducted at Makerere University. The technical training comprised lecture, lab, and hospital visits. The group took a tour of Kampala and watched a cultural dance troupe.

For the second month, participants were placed in 4 hospitals throughout Uganda. During the first month hospital visits and the second month hospital placements, the participants collectively repaired over 300 pieces of equipment. Equipment ranged in complexity from delivery beds to autoclaves. Notable, high impact repairs include essential oxygen concentrators, fixing an ultrasound machine that had been out of service for many years (forcing the hospital staff to use more expensive imaging techniques, such as x-rays), and a blood bank refrigerator that many people tried to fix previously to no avail. Participants completed 5 hospital need reports, plus other staff interviews and tasks to generate ideas for secondary projects and other potential solutions.

In summary, the Uganda January Institute was highly productive and an overall success. Participants gave a unanimous “yes” when asked if they would recommend this program.

Medical Equipment Repair

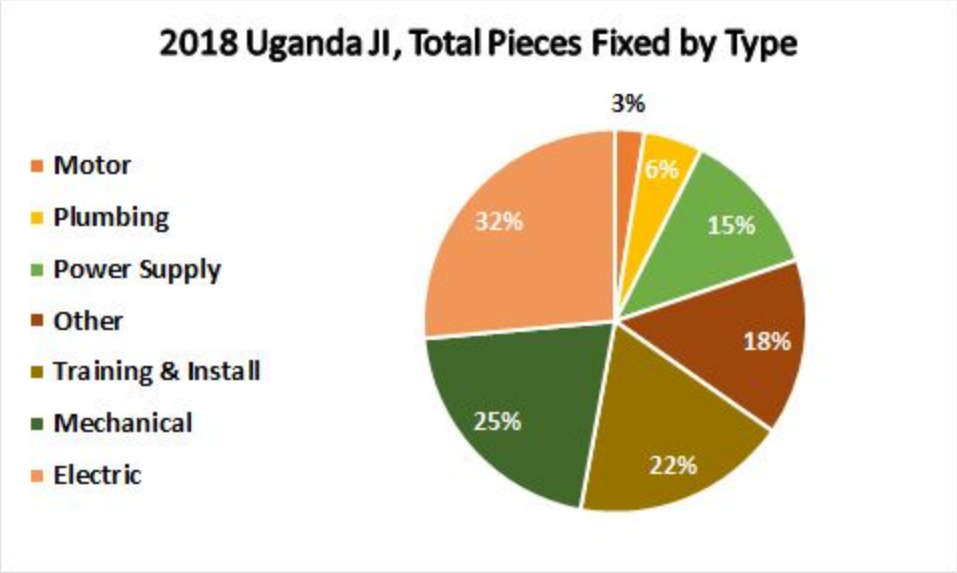
The 21 participants repaired 334 pieces of medical and hospital equipment, totaling approximately USD $668,000 [1] of equipment repair service.

Repairs by Type of Equipment

Type of Equipment	Repair Total	Type of Equipment	Repair Total
Air Compressor	1	Microscope	8
Anesthesia Machine	2	Nebulizer	1
Aspirator/Suction Machine	12	Operating Table	1
Autoclave	14	Ophthalmoscope	2
Automatic Voltage Regulator	5	Octoscopes	1
Bed, delivery	2	Oven, Lab	3
Blood Bank Refrigerator	2	Oxygen Concentrator	26
Blood Pressure Device, Automatic	23	Patient Monitor	2
Blood Pressure Device, Manual	29	Phototherapy Device	3
Centrifuge	4	Pulse Oximeter	6
Computer	3	Scale (laboratory and in wards)	7
Distiller	1	Shaker Machine	1
Electrosurgery Machine	2	Spectrophotometer/Colorimeter	3
Fetal Stethoscope	3	Stethoscope	6
Furniture	20	Transformer	1
Incubator (infant)	18	Ultrasound machine (imaging)	1
Infant Warmer (Radiant or other)	5	UPS (various)	4
Infusion Pumps	2	Vaccine Refrigerator	1
Lamp, examination	11	Washing Machine	1
Lamp, surgical	11	Water Bath (laboratory)	1
		Other	66

Repairs by Hospital

Hospital	Pieces Touched	Repaired	Abandoned	Repair Percentage
Hospital 1	113	93	20	82%
Hospital 2	63	58	5	92%
Hospital 3	21	18	3	86%
Hospital 4	92	66	26	73%
Hospital 5	7	6	1	86%
Hospital 6	19	16	3	84%
Hospital 7	7	2	5	29%
Hospital 8	16	8	8	50%
Hospital 9	16	16	0	100%
Hospital 10	53	39	14	74%
Total	**421**	**334**	**87**	**79% avg**



Needs Finding Interviews

Essential to improving healthcare delivery in the developing world is having a deep understanding of the challenges faced in low-resource communities. We ask our participants to be observant throughout their time in the hospital and try and identify some of the greatest needs. Participants conduct interviews with hospital staff to learn about the problem through the lens of various hospital branches (i.e. clinical staff, BMETs, health system leadership), then propose a solution to this problem.

The 2018 Uganda participants completed 5 interviews in 5 hospitals. Based on these interviews, the following are some of the most needed items:

Energy efficient wheelchairs for disabled children that is capable of navigating different kinds of terrain.
A robust database system that records and keeps details about all equipment breakdowns and the respective intervention procedure/fixes for the BME unit.
A reliable supply of distilled water for the proper operation of a steam autoclave to maintain sterility and longevity of the equipment.
An implementation of a system whereby hospital staff can request the services of the biomedical engineering department.
The installation of all required electrical fittings is necessary for generating a fully functioning and operational biomedical engineering workshop.

Secondary Projects

In addition to their primary task of repairing medical equipment, EWH asks participants to identify other ways they can use their skills to benefit the hospital. Through conversations and interviews with hospital staff and directors, the participants complete a secondary project to address a need within the hospital.

Hospital 1

The participants here chose to address the chronic shortage of distilled water by designing and constructing a still. The group got to the prototype stage and achieved some limited functionality. The still produces water, but not quickly enough or in sufficient volume to address the need identified. They did not have the opportunity to test the produced water, to determine whether it is sufficiently pure, so recommend continuing this project for subsequent EWH groups.

The still under construction

Hospital 2

This group's project was a water distillation system for the hospital laboratory. For a long time, the hospital lacked a reliable and cost-effective source of distilled water to

be used in their laboratories and for sterilization. They found a defunct distillation system in the hospital, so set out to restore the distiller to operational condition. Through repairing the distiller and installing a means for the collection of distilled water, the hospital has the capacity for producing approximately 50L of distilled water in a standard workday. This far outstrips the rate at which distilled water is consumed, thus the distiller only needs to be run once every few days depending on demand.

This project also provides an economical benefit, as the machine consumes 4kWh for every 6L of distilled water that it produces per hour. At 700 shillings per kilowatt hour, it costs approximately 400 shillings to produce a liter of distilled water whilst the market price for distilled water is 3000 shillings per liter. They recommend future participants investigate and maintain the distillation system.

Hospital 3

The Hospital Engineering Workshop was relocated while this group was on placement at the hospital, and the new workshop lacked any electrical wiring (switchboard, main circuit, additional circuits, power points or light fittings and connections.) Thus, their secondary project was to install as much of the electrical wiring as possible in the workshop. They installed the main circuit of wiring in the ceiling, the circuit board, and seven power points which function over two separate circuits.

Installation

Final Product

Hospital 4

Project 1: This group's project consisted of constructing a physiotherapy tool for children with cerebral palsy. The group worked closely with physical and occupational therapists at the rehabilitation center. Cerebral palsy is an abnormal brain development causing exaggerated reflexes, floppy or rigid limbs and involuntary motions. The tool is to be used by children during their rehabilitation at Katalemwa to help develop a proper posture and create normal muscle tone. The importance of treating cerebral palsy at an early stage is vital to improve motor functions for a better quality of life.

Assembling the parts

Project 2: In collaboration with physical therapists and technicians at the rehabilitation center, the participants designed a system to protect wheelchair user's arms when the wheelchair is on heavily congested roads. The system involves two free wheels and two handle bars which extends into the seating area. This design allows the user to keep his/her arms within the main frame of the wheelchair and use less effort to propel the wheelchair forward through the lever system (handlebars connect directly to the wheelchair). The participants reported that there are improvements that still need to be made to the design, but that the project can have a huge impact on the user's safety.

Propulsion system installation detail

Final assembly of the design

Hospital 5

In this hospital, it was found that there was no history tracking system when equipment was repaired or maintained, causing inefficiencies when troubleshooting. The current system is to label a very brief statement of the maintenance work performed and the date onto the equipment. Both the EWH group and the hospital BMET found this to be an inefficient way to track the work performed. Therefore, an equipment maintenance program was designed to enable the BMET to record and store details about all equipment breakdowns and the respective intervention procedures and fixes.

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[1] EWH estimates the mean value of each repair at USD$2000