Engineering World Health Summer Institute
Rwanda 2017
Final Report

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Executive Summary

The 2017 EWH Summer Institute in Rwanda was a highly productive contribution to the Rwandan health care system. This year we had 16 participants, 2 On-the-Ground-Coordinators, and 1 Instructor. There were 5 male and 11 female participants; 13 are undergraduate students, 2 graduate students, and 1 alumnae. The participants represented 10 different universities and 5 nationalities.

During the first month of the program, the participants underwent intensive language, cultural, and technical training conducted at Integrated Polytechnic Regional Centre (IPRC) in Kigali. The technical training comprised lecture, lab, and hospital visits. For their cultural excursion, the group visited Nyamata Genocide Memorial Centre.

For the second month, participants were placed in 9 hospitals throughout Rwanda and collectively repaired over 150 pieces of equipment. Equipment ranged in complexity from scales to patient monitors. Notable, high impact repairs include a UPS in the neonatology ward, an anesthesia machine and suction machine that were required and immediately put back into use, a patient monitor that was repaired just in time for surgery, and an infant incubator that participants worked on for 4 days, finally fixing it and seeing a baby in it the very same day.

Participants completed 7 needs finding interviews, plus other staff interviews and tasks to generate ideas for secondary projects and other potential solutions. This included completing inventories of medical equipment to allow hospitals to better organize their equipment donations and requests.

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

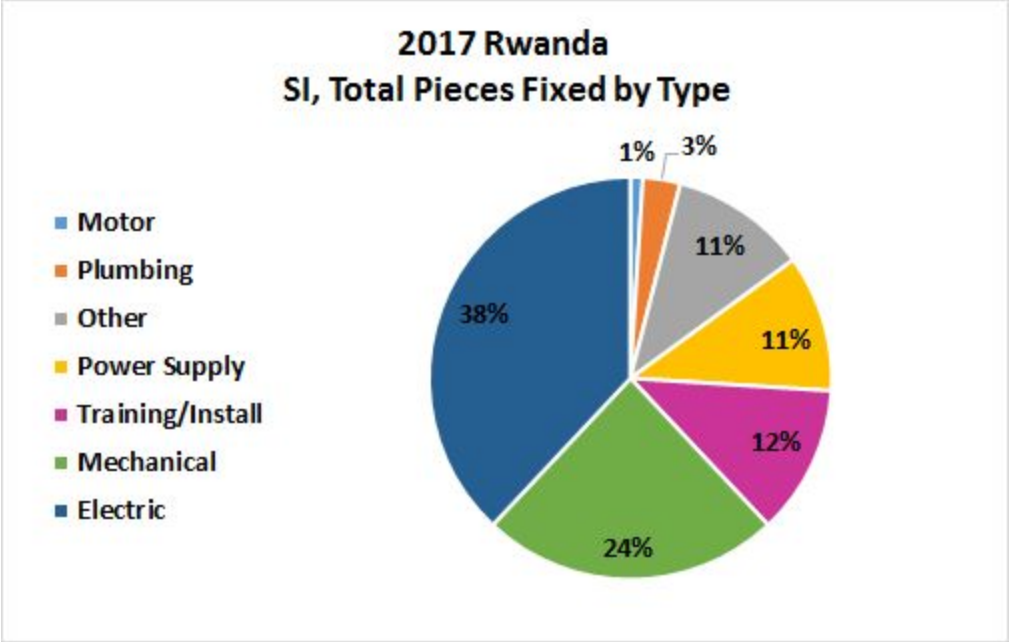
Types of Medical Equipment Repair

The 16 participants repaired 160 pieces of medical and hospital equipment, totaling approximately USD320,000 [1] of equipment repair service.

Repairs by Type of Equipment

Type of Equipment	Total Pieces Repaired	Type of Equipment	Total Pieces Repaired
Anesthesia Machine	2	Microscope	5
Aspirator/Suction Machine	4	Nebulizer	3
Autoclave	1	Operating Table	1
Automatic Voltage Regulator	1	Oxygen Concentrator	26
Blood Clotting Time Meter	1	Pacemaker	1
Blood Pressure Device, Automatic	5	Patient Monitor	7
Computer	1	Phototherapy	2
Dental Drilling Machine	1	Printer	1
Distiller	3	Pulse Oximeter	2
Furniture	2	Scale (laboratory and in wards)	16
Hot Plate	1	Ultrasound machine (imaging)	3
Incubator (infant)	13	UPS (various)	2
Infant Warmer (Radiant or other)	6	Vacuum Extractor (for delivery)	1
Infusion Pumps	1	Water Purifier (for lab, in wards)	4
Lamp, examination	3	X-Ray Film View Box	8
Lamp, surgical	3	Other	30

Repairs by Type of Fix



Needs Assessments

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 to 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 2017 SI participants completed 7 interviews in 6 hospitals. Based on these interviews, the following are some of the most needed items:

Way transport equipment from the maintenance shop to the hospital departments
Means to deliver oxygen to hospital departments that does not require transportation of the oxygen tanks through dangerous conditions
Method to sterilize intubation tubing
Sediment free water input for water distillers is essential to the sterilization process to reduce residue build up, maintenance and extend the lifetime of the equipment.
Way to secure oxygen tanks at the oxygen plant after they have been refilled
Means by which to test the oxygen concentration of output air from the oxygen tanks and concentrators in order to evaluate these systems and their effectiveness

Secondary Projects

Participants completed secondary projects at all hospitals. EWH provides funds for participants to work on such projects in addition to equipment repairs and maintenance. These projects included:

Hospital One

The participants here designed an oxygen cylinder rack to hold oxygen cylinders. There is an oxygen plant at this hospital where oxygen cylinders are filled and sent to hospitals around the country. Before, the filled tanks were placed around the room with nothing to hold them in place, which is very dangerous due to the explosive nature of the cylinders should one fall.

The participants designed the rack and brought it to a welder to be built. The rack holds 54 cylinders, the maximum the participants ever saw in the room. The rack has hooks on the rails at one cylinder width intervals, so that no matter how many tanks are on the rack, they are able to be held securely.

Additionally, the participants bought and installed hand sanitizer dispensers around the hospital, working with the pharmacist to ensure alcohol and glycerin were available to make sanitizers and refill the dispensers. The participants observed that many doctors and nurses were unable to wash their hands before treating patients, so the presence of the hand sanitizer dispensers should provide the staff with a way to quickly sanitize their hands before administering treatment.

Before

After

"Tertiary Project"- Hand Sanitizers

Hospital Two

With the help of a local intern, the participants here were able to do their needs finding reports with nurses in the pediatrics unit. One person they spoke with said that they really needed places for parents to sit by the patient's bed, because currently they would sit in the bed with the patients, which wasn't always good.

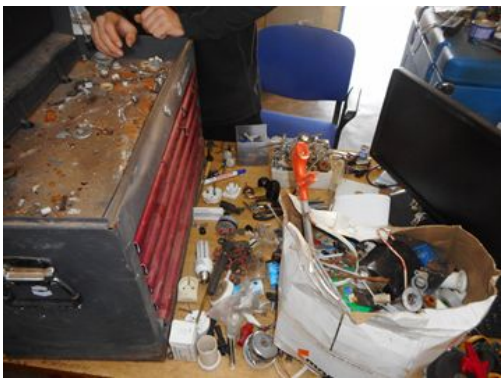
The participants contacted a carpenter and ordered 3 long benches and 15 stools that could be moved around the pediatrics ward as needed. The participants completed the project a few days before they left, so they were able to see the benches and stools put into use.

Stools prior to installation

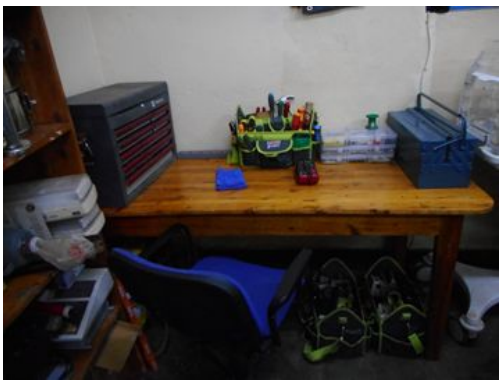
Stools in use in the pediatrics unit

Hospital Three

These participants organized the BMET workshop and physical therapy units in their hospital. The participants categorized the parts, refurbished the corroded tool chest, brought in a table, ran power to the table, brought new tools and batteries in addition to the ones that were donated from their EWH toolkit, and finally completed a thorough cleaning of the shelves and desk.



Before



After

Hospital Four

Here the participants set out to build large biofilters to provide clean drinking water for patients and employees at the hospital. They designed and built a washable biofilter that was meant to filter out microbes such as e. Coli and coliforms, as well as metals. Because it took some time for them to get verification from a lab that their water was safe to drink, they also began building a distillation machine in case the filtered water was not drinkable.

Distillation Machine

Hospital Five

Participants here designed a permanent and robust system which allowed two water distillation systems to run from the same water outlet. Before the system was implemented there was a shortage in distilled water throughout the hospital. This resulted in the closure of certain laboratory services and unsafe practices were adopted, for example unclean tap water was being used for laboratory experiments, or an autoclave which had been permanently hooked up to tap water. The new system increased the amount of available distilled water in the hospital and allowed maintenance to be carried out whilst a second distiller was still available. Additionally, both distillers are drained out of the window into a rain barrel instead of down the drain. The water in these rain barrels is now used by hospital staff for general cleaning.

The participants included a quick-start guide for one of the distillers because it isn't as intuitive and user error was common, as well as guides for starting up and shutting down each distiller in French and English.

Before

After

Hospital Six

The participants at this location installed drainage pipes and faucets in the sinks in the laboratory and kitchen, and replaced lights in the kitchen. Previously, the staff in these areas did not have easy access to running water. The participants traveled with one of the maintenance workers to pick up all necessary materials. They found the project to be quick to complete and extremely useful to the hospital staff.

Preparing for installation

The pipes installed

Hospital Seven

The participants here built new clotheslines for the hospital. When the first arrived, they observed that the staff had to hang clothes over fences behind the laundry building due to a shortage of clotheslines. The clotheslines that were there had fallen into significant disrepair: posts were coming up from the ground and broken, lines were sagging so that clothes touched the ground. In addition to installing and repairing clotheslines, the participants also installed stop valves and faucets in the pediatric unit.

Newly Installed Clotheslines

Instructors

The instructor for this summer was Dr. Michael Moreno. The On-the-Ground-Coordinators were Bob Lathrop and Peter Dobbs. Peter also served as the teaching assistant. Kinyarwanda and cultural lessons were conducted by Francis Habiyambere.

French lessons were taught by Anne Solange. All classes were taught at IPRC-Kigali campus.

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