Engineering World Health Summer Institute
Tanzania 2017
Final Report

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Executive Summary

The 2017 EWH Summer Institute in Tanzania was a was a highly productive contribution to the Tanzanian health care system. This year we had 24 participants, in addition to our two On-the-Ground-Coordinators and one instructor. There were 9 male and 15 female participants, all undergraduate students. The participants represented 9 different universities and 4 nationalities.

During the first month of the program, the participants underwent intensive language, cultural, and technical training conducted at MS- Training Centre for Development and Cooperation. The technical training comprised of lecture, lab, and hospital visits. The group went on an excursion to a waterfall in Moshi and a coffee plantation.

For the second month, participants were placed in 11 hospitals throughout Tanzania and collectively repaired over 350 pieces of equipment. Equipment ranged in complexity from hot plates to x-ray machines. Notable, high impact repairs include repairing two ultrasounds essential for diagnosing patients, an infant incubator that was immediately put back into use, an autoclave that was in very high demand, and the hospital's industrial washing machine.

Participants completed 11 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 Tanzania 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 24 participants repaired 355 pieces of medical and hospital equipment, totaling approximately USD $710,000 [1] of equipment repair service.

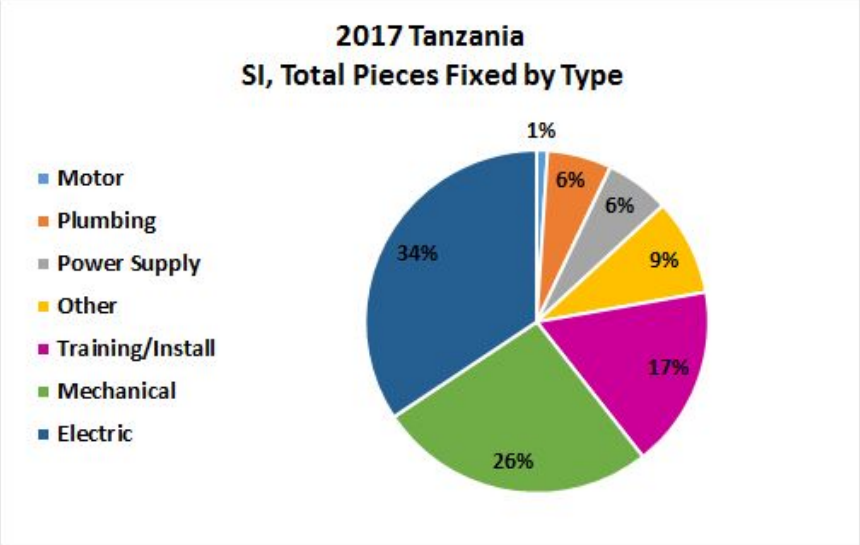
Repairs by Type of Equipment

Type of Equipment	Total Repaired	Type of Equipment	Total Repaired
Air Compressor	4	Operating Table	5
Anesthesia Machine	1	Ophthalmoscope	1
Aspirator/Suction Machine	23	Oven, Lab	1
Autoclave	12	Oxygen Concentrator	17
Bed, delivery	5	Patient Monitor	1
Blood Bank Refrigerator	2	Photocopier	1
Blood Pressure Device, Automatic	11	Phototherapy	2
Blood Pressure Device, Manual	27	Printer	1
Ceiling Fan	2	Pulse Oximeter	3
Centrifuge (electric or hand operated)	3	Scale (laboratory and in wards)	11
Distiller	1	Stethoscope	7
Drying Machine	1	Telephone	1
ECG	7	Television	1
Electrosurgery Machine*	1	Thermometers	1
Fetal Stethoscope	2	Transformer	2
Furniture	7	Ultrasound machine (imaging)	8
Glucose level kit (or glucometer)	1	UPS (various)	2
Heart Lung Machine	1	Ventilator	1
Hot Plate	1	Washing Machine	2
Incubator (infant)	4	Water Bath (laboratory)	2
Infant Warmer (Radiant or other)	27	Water Purifier (for lab, in wards)	1
Iron (for clothing)	1	X-Ray Film Dryer	1
Lamp, examination	11	X-Ray Film View Box	2
Lamp, surgical	10	X-Ray Machine*	2

Nebulizer	5	Other	109

*User training and/or low voltage and peripherals repairs only

Repairs by Type of Fix



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 2017 SI participants completed 11 interviews in 11 hospitals. Based on these interviews, the following are some of the most needed items:

A functional blood culture incubator and photmeter, specific test reagents and accurate electrolyte measurements that do not fluctuate
Common clear sterile guidelines
Low cost incubator to place infants before they are transferred
A way to sterilize equipment at hospital that is robust and can be made and fixed on site, preferably autoclaves.
Basic medical equipment
A cheap way to get distilled water instead of using reverse osmosis machine.
A sterilization system to house the larger sterilization containers.

Low cost way to get oxygen to more patients, as well as more nurses
The hospital needs to be able to analyze a blood sample for white blood cell count, red blood cell count, hemoglobin, platelets, and hematocrit

Secondary Projects

Hospital One

The participants built adjustable child crutches, as the crutches at the hospital were only for adults. They consulted with a physical therapist at the hospital to determine the correct sizes and the range that should be provided. They made the crutches out of PVC piping, used silicone sealant for the rubber foots, and worked with a local tailor to create the padding for the piece that supports the arm. The participants were able to build 5 pairs of crutches while in-country.

Hospital Two

The participants here cleaned up, organized, and added shelves to the store room. The doctors here found this project very useful because they didn't know if there was anything still useable inside the store room before this project. After the project, the staff was able to locate a lot of useable equipment inside the room, and now have more space and shelves to utilize.

Hospital Three

Here the participants installed direction signs in the hospital to direct patients to different departments around the hospital. They first planned to make the signs themselves but were able to get in contact with a sign maker that the hospital had used previously. In total, they installed 10 wooden signs and 2 ground mounted signs.

Signs

Hospital Four

During the needs findings assessment, the participants found that the hospital was in desperate need of wheelchairs. They first intended to build new wheelchairs from scratch, but assessed the supplies available at the hospital and found it would be more efficient to assemble, clean, repair, and paint the wheelchairs from abandoned parts. In total, they were able to build 8 fully functional wheelchairs.

The fleet of wheelchairs

Hospital Five

The hand sanitizing stations were adapted from an EWH Nepal secondary project. They recycled plastic water bottles to hold the sanitizer, pumps from soap bottles, and extra tubing to extend the pump straws. They also included laminated posters with Swahili instructions and pictures on how to use the sanitizer. In all, 9 sanitizing stations were installed.

Hospital Six

These participants designed and implemented a foot-activated faucet in the minor operating theatre so that doctors and nurses did not have to touch the faucet after cleaning their hands. The doctors and nurses in the minor theatre were very happy about the installation, and they were asked to install two more.

Testing out the pedals

Hospital Seven

This hospital would dry their x-ray film out in the courtyard in the sun, or hang in the windows if it was raining. These participants created an x-ray film drying cabinet that the doctor can put x-ray films in. The top part of the cabinet has wiring, fan, and a heating element, and the bottom part has space to put the film inside. Now, the doctors are able to more quickly dry film, even when raining, and also can have more patient privacy.

Hospital Eight

The participants here created a manifold oxygen delivery system. They secured one oxygen cylinder outside of Surgical ICU A using a chain, and used a tube which went through the wall into the ICU, supplying two beds with oxygen using flow meters. The installation process went very smoothly; they were able to obtain almost all the parts

necessary from the hospital's engineering department and Dr. Kaino, the head of anesthesia.

Hospital Nine

Here the participants secured oxygen canisters to the wall to prevent them from falling. The operation theater has an integrated oxygen system and has space for four oxygen canisters, with the cage for the oxygen canisters and the regulator box located outside the theater. When the participants arrived at the hospital, there were four free-standing canisters attached to the system and one extra free-standing canister. In many of their interviews, there was a need for oxygen concentrators and oxygen canisters in the wards. These canisters are valuable to the hospital and should be properly secured to ensure no accidents happen.

With the leftover money, the participants bought two manual blood pressure cuffs and a blood glucose meter with testing strips. These devices were needed by the doctors, as found in their needs assessment interviews.

Instructors

The instructor for this summer was Dr. Larry Fryda. The On-the-Ground-Coordinators were Sarah Patterson and Paul Kline. Paul also served as the teaching assistant. Language and cultural training were handled by MS- Training Centre for Development Cooperation (TCDC). Classes were taught at TCDC- Arusha campus.

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