



**Engineering World Health Summer Institute
Tanzania 2018
Final Report**

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Program Partners:

Duke University

MS-TCDC

Executive Summary

The 2018 Engineering World Health Summer Institute in Tanzania was a great success. This program, run in partnership with Duke University, hosted 22 participants from 6 different countries.

The participants stayed with homestay families for the first month, and in a mix of guest houses and homestays for the second month. During the first four weeks of the program, the group underwent intensive technical and language (Swahili) training conducted at MS-TCDC, a training centre in Usa River. Their technical training was both lab and lecture, with weekly visits to Arusha hospitals to provide the participants with hands-on experience before beginning their hospital placements.

After their training, participants were transported to one of our partner hospitals. This year, we expanded from our longtime base in the Arusha/Moshi area to include four new hospitals in the Lushoto region. Participants worked in groups of 2 or 3. This summer, we were able to work with 10 hospitals in Tanzania. During their 5-week placements, **the participants repaired 433 pieces of equipment worth approximately US \$866,000^[1].**

The participants were joined at the end of the program by EWH President and CEO, Leslie Calman. Leslie was able to attend the Tanzania Institute's final conference and see all the participant's final presentations. While in Tanzania, Leslie also gathered participant feedback, all of which was extremely positive. When asked if they would recommend the program, every participant said yes. All reported feeling needed by the hospital, and also felt they made a significant contribution.

In addition to our regular activities, we were able to provide SolarSPELLs to all our partner hospitals in Tanzania thanks to the work of Sarah Patterson, one of our On the Ground Coordinators (OTGC). SolarSPELL is a Solar Powered Educational Learning Library: a ruggedized, portable solar-powered digital library over an off-line WiFi hotspot, designed to simulate an online experience. It helps to provide content to BMETs in low-resource areas, giving them improved access to resources and helping them to fix life-saving pieces of equipment. These resources include textbooks, lessons, service manuals, equipment overviews, troubleshooting flow charts, and more. Our participants installed the devices and trained technical staff on their use.

We are grateful to all who helped make this program not only possible, but a success in the eyes of our participants and our partners in Tanzania.

Medical Equipment Repair

The 22 participants repaired or completed preventative maintenance on **433 pieces** of medical and hospital equipment, totaling approximately USD \$866,000^[1] of equipment repair service. Their work is summarized in the following charts:

Repairs/Maintenance by Type of Equipment

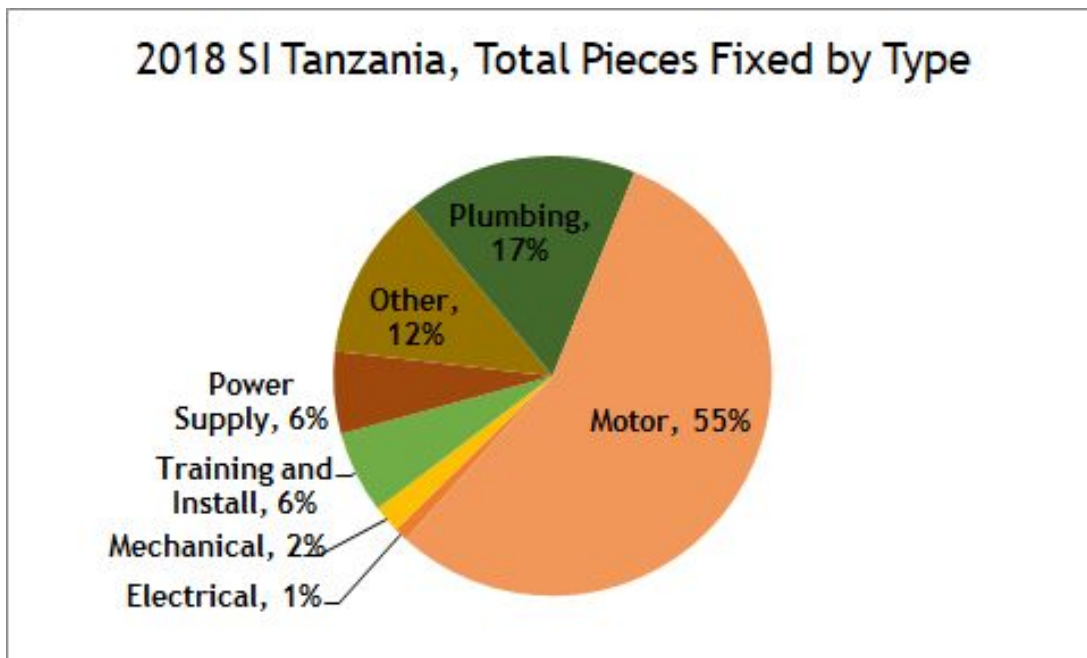
Type of Equipment	Total Pieces	Type of Equipment	Total Pieces
Air Conditioner	1	Lamp, surgical	5
Aspirator/Suction Machine	7	Microscope	3
Autoclave	22	Operating Table	4
Automatic Voltage Regulator	3	Otosopes	1
Bed, delivery	1	Oxygen Concentrator	32
Blood Pressure Device, Automatic	39	Patient Monitor	1
Blood Pressure Device, Manual	69	Phototherapy Device	1
Centrifuge (electric or hand operated)	1	Printer	4
Computer	7	Pulse Oximeter	9
Dental Drilling Machine	2	Scale (laboratory and in wards)	21
Distiller	1	Skin Grafting Machine	2
EKG	3	Stethoscope	18
Fetal Stethoscope	1	Thermometers	6
Furniture	19	Transformer	1
Glucose level kit (or glucometer)	2	Ventilator	3
Incubator (infant)	3	Water Purifier (for lab, in wards)	1
Infant Warmer (Radiant or other)	2	X-Ray Film View Box	1
Infusion Pumps	8	X-Ray Machine*	1
Iron (for clothing)	1	Other	117
Lamp, examination	10		

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

Repairs by Hospital

Hospital	Items Touched	Repaired	Abandoned	Repair Percentage
Hospital 1	38	25	13	66%
Hospital 2	146	105	41	72%
Hospital 3	40	30	10	75%
Hospital 4	88	67	21	76%
Hospital 5	39	30	9	77%
Hospital 6	44	20	24	45%
Hospital 7	28	24	4	86%
Hospital 8	44	35	9	80%
Hospital 9	35	19	16	54%
Hospital 10	101	78	23	77%
Total	603	433	170	72% avg

Repairs by Type of Fix

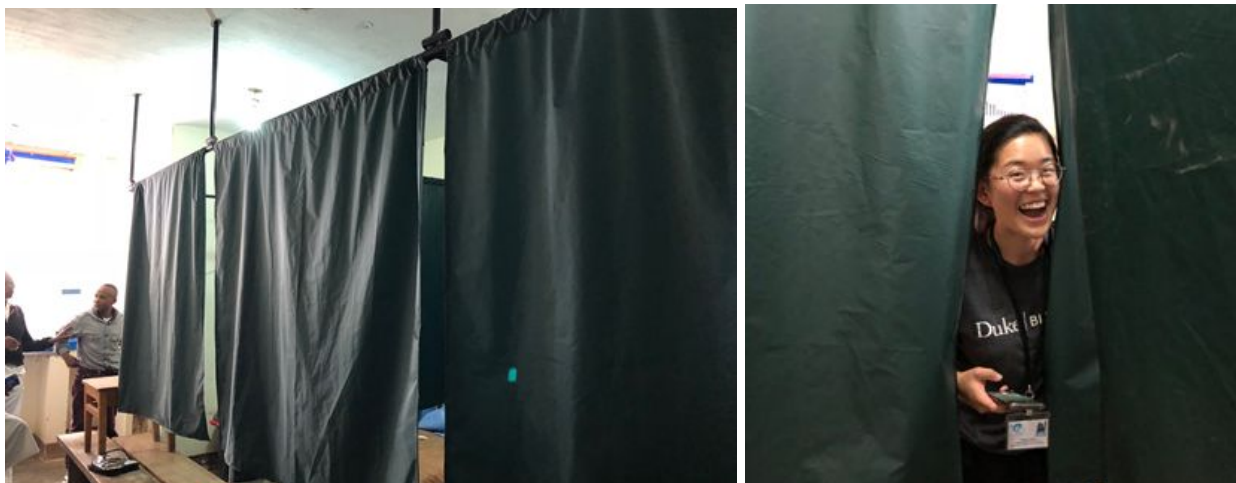


Secondary Projects

Each team is encouraged to complete a secondary project for their hospital during their placement. Through interviews with hospital staff, the participants identify a need in the hospital, and are given a budget of \$100 per person to use in a creative way to meet that need.

Hospital 1

For their secondary project, this group decided to construct partitions for the minor operating theatre. When performing needs interviews, a doctor in the minor theatre expressed a need for a way to separate the patients. He described how every day they have several patients who have severe injuries that are often bloody, unpleasant, and painful. In its current state there were three beds for patients with no separation or privacy. This meant that if someone was going through a painful stitching job, for instance, anyone in the room could witness it and the patient would feel no privacy. Due to the expressed concern of the doctor, they decided to take on this task as the secondary project. They designed partitions that would separate the patient beds from one another and the beds from the rest of the room. They also used curtains that could be easily pushed to the side to give the doctors more control over the room's environment. A nurse expressed the need for curtains that could be easily cleaned because of the bodily fluids present in the minor theatre. She specifically asked for the same curtain material used in the maternity ward. The group was able to import the material from Nairobi in order to construct liquid proof curtains that will allow for easy cleaning and will help keep the environment clean.



Installed Curtains

Hospital 2

This group installed lights and sockets to a backup generator to ensure continuous power in the technician's workspace. The project went very well and was very well received by the hospital.



Working Light

Hospital 3

This group's secondary project had two parts: a decoration mural for the *wadi ya watoto* (children's ward) & organizing the workshop/library space for the hospital. For the mural for the children's ward, they used soda bottle caps that were littering the grounds. They wanted to improve the atmosphere of the children's ward while also cleaning up the hospital itself, and hopefully discouraging others from littering their soda caps. They hoped that organizing the workshop/library will increase the amount of people who enter and use the space, either for the Solar SPELL or to use the many literary resources that are available there.

Hospital 4

The Coordinator of Quality Improvement Initiatives in the hospital told this group that in his opinion, one of the biggest problems for the hospital is there is no Planned Preventative Maintenance (PPM). Therefore, this group decided to take the first step to making a plan. They first did an inventory of the main equipment of the hospital. Based on this inventory and the observation that there were a lot of broken oxygen concentrators in the workshop, they decided to focus on the maintenance of oxygen concentrators. This group's secondary project consisted of three aspects: making a quick start guide for the weekly and daily maintenance of oxygen concentrators (in English and Swahili), finding replacement air inlet filters for all oxygen concentrators

that were missing them, and conducting a training session for over 30 staff members, showing how to conduct maintenance of oxygen concentrators.



Oxygen Concentrator with Quick Start Guide

Hospital 5

This group installed curtains in the ICU to provide the patients with more privacy. They were able to design, fabricate, and install the curtains in a relatively limited amount of time. They purchased pipes and pipe fittings from Tanga and used a fabric that was stored away in the hospital storage for the curtains. The pipes as well as the ceiling attachments were cut to size and modified with the assistance of the *fundis* (hospital technicians). The fabric was then cut to size and sewn such that pipes could fit through it.



Installing the Pipes for the Curtains

Hospital 6

This group conducted two secondary projects. For the first, they asked the head nurse of the hospital what projects she would like completed while they were at the hospital. One of the projects she requested was to make and refurbish privacy screens which were broken throughout the hospital. She said the Tanzanian government had conducted an inspection of the hospital a few months before EWH's arrival and had cited the hospital for not using enough privacy screens on the hospital premises. The participants collected the broken privacy screens and, along with the hospital *fundi* (technician), began repairing the screens. They took pieces from about 10 screens and used spare parts to make 8 functional screens. They worked with the *fundi* at the hospital to develop a method for repairing the screens so that more can be repaired in the future.



Repaired Screen and Spare Parts

The second project was sorting two boxes of blood pressure cuff parts. They were given two large boxes of cuffs on their first day and then found another box of blood pressure cuff bladders. They came to realize that the nursing/medical officer students and the hospital wards are in constant need of new blood pressure cuff parts. Sorting these boxes of parts would help the hospital know what sphygmomanometer parts are bad and which can be used to replace bad parts. They first washed 25 bladders and cuffs because they had been sitting in storage and had become dirty. Then, they tested every bladder, bulb, dial, valve, connector and set of extra tubing remove the bad parts from the good parts. They set the parts in

respective piles so that they good and bad parts did not get mixed up. They traveled to Moshi, Tanzania, to purchase more dials, as there was a shortage. They gave the sorted blood pressure cuffs to a nurse so she could dispense them to the wards and to the hospital's students at the appropriate times.



Organized Blood Pressure Cuffs and Spare Parts

Hospital 7

Their secondary project was the renovation of the office where the hospital's *fundi* works. They installed shelves so that he can organize the small things better, and a large desk so that he has plenty of space to work. Beforehand, the messy state of the office made it a difficult working environment.

They installed one long shelf above the desk, and two short shelves on the other side of the office. They first bought the wood at a store near Tengeru. After purchasing the wood, they brought it to a carpenter in Tengeru to build the shelves and desk. The project was very well received by the Fundi.



Finished Room with Desk

Hospital 8

This group painted worn-down stretchers so that they could be used in the new emergency department opening at the hospital. The hospital was on a major time crunch to open the emergency department and in desperate need of presentable stretchers. The process involved cleaning the rust off the stretchers and then painting with a base layer of red oxide (primer) and then two or more coats of white paint. The project was successful and fun, as they completed painting seven stretchers that were immediately put into use in the emergency department.



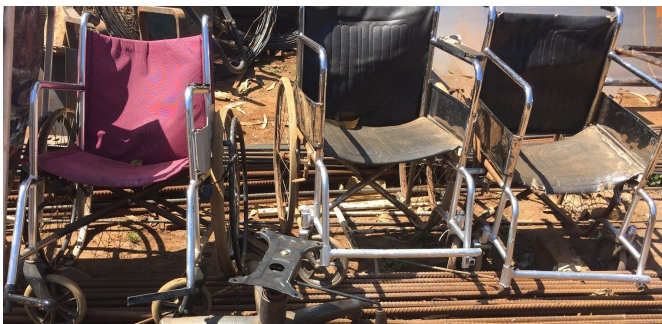
Participant Painting a Stretcher



Finished Stretchers

Hospital 9

The goal of their secondary project was to find a local solution to common recurring problems at the hospital. This was achieved by creating a working relationship between the hospital and the local welder. The hospital is without a biomedical engineer, so when equipment breaks there is no one available to repair it. This group worked to open a door for the hospital, so they could become more independent by having a local repairman. Once establishing this relationship, they were able to work with the welder to repair and modify wheelchairs, an office chair, autoclave hinges, and stretchers for the operating theatre.



Repaired Wheelchairs



Repaired Autoclave Hinge

Hospital 10

This group's secondary project was to renovate the stairs that the physical therapy department has by putting wooden boards on the stairs, derusting the metal surface of the frame, and painting them to make them weather resistant. They found transporting the wood to be a problem, but otherwise the project went smoothly and was very appreciated by the hospital.



In Progress



Finished Stairs

Participant Debriefs and Feedback

Engineering World Health seeks not only to assist the hospitals in which our participant volunteers work, but also to influence the volunteers' own development as engineers and as global citizens. Our participant feedback was extremely positive, with many saying this program exceeded their expectations. When asked if they would recommend this program, the answer was a unanimous "yes." Some of the words used to describe the program were restorative, creative, *Nilijifunzi* (Swahili for 'I learned'), and indescribable. The OTGCs, Instructors, and homestays received excellent remarks. All participants said they felt very needed by the hospital and appeared to have made a significant contribution. The largest challenge for most was the communication barrier with the language; one of the OTGCs is fluent in Swahili, which was a big help. Some participants encouraged EWH to provide more guided field trips during the first month, specifically to a hardware store to assist with language practice and cultural integration.

Participants had many great things to say about the program. One said the program made them excited to learn, providing a hands-on experience that wouldn't be available in internships. Another said the program was challenging but very enriching, reflecting that you learn a lot about yourself going through hardships. One said she was surprised by her own ability to solve things. Others said the program helped to make them better designers, more open-minded about engineering, working with others, and the world overall.

Acknowledgements

The On the Ground Coordinators were Catherine Namayega and Sarah Patterson. The engineering courses were taught by Dr. Larry Fryda. Language and cultural training were provided by MS-TCDC. Thank you to all who helped make this program possible.

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