



**Engineering World Health Summer Institute
Uganda 2019
Final Report**

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Executive Summary

This year was Engineering World Health's third summer partnering with Duke Engage to run the Summer Institute in Uganda. We had 10 participants from Duke University and 5 participants from Ugandan universities whose participation was enabled by Dr. Monty Reichert of Duke University and by EWH financial aid. Of the three Summer Institutes we've held in Uganda, this year was the best so far.

We made a major change to the program structure this year, and it proved to be a substantial improvement both for the student experience and for the services they were able to provide. In previous years, participants stayed in Kampala after training was completed, rotating through hospitals in Kampala in groups of 2 or 4, spending about one week in each hospital. After two years it became clear that these hospitals did not have as much need as more rural hospitals, and that the student experience would also benefit from placements where there was more need. This year, after training in Kampala, participants were placed in hospitals outside of the capital city, and remained in the same hospital for the duration of the working portion of the program.

During the training component of the Institute, the group underwent four weeks of intensive cultural and technical training conducted at Makerere University by Dr. Robert Ssekitoleko and his team. After their training, participants began working in hospitals in groups of 3. During the five-week working portion, **the participants repaired 164 pieces of equipment worth approximately US \$328,000^[1]**. In addition, the participants completed a total of five secondary projects to address a hospital need outside of equipment repair.

The feedback gathered in exit debriefs was very positive this year. Duke University students were grateful for the opportunity to work and live with Ugandan university students, and vice versa. Overall the groups were able to complete a significant number of repairs and impactful secondary projects, resulting in a very successful summer in Uganda.

Medical Equipment Repair

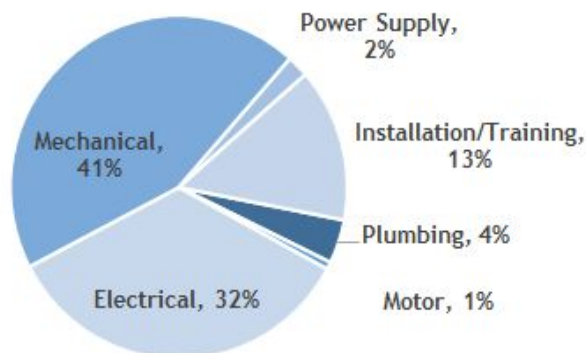
Our participants' main objective during the Institute program is to improve healthcare delivery at their hospitals by repairing hospital equipment, conducting preventative maintenance, and assisting local users and technicians in the proper maintenance and usage of equipment. The training portion of the program prepares them to complete repairs in a low-resource setting. Once the training is complete, participants are placed in one of our partner hospitals with EWH-provided toolkits to complete as many repairs as possible. Participants do not repair every piece of broken equipment that they encounter, which is to be expected, as there are many barriers to equipment repair. The most common barriers we see are lack of parts and repairs that require more advanced knowledge.

The 15 participants encountered 223 pieces of broken medical and hospital equipment and repaired or completed preventative maintenance on **164 of those pieces**, totaling approximately US \$328,000^[1] of equipment repair service. Participants complete a "Work Summary Form" during their time in the hospital to document the pieces of equipment they encounter, the reason the piece of equipment was broken (e.g, power supply issue, blown fuse, etc), and if the repair is successful. Their repair work is summarized below.

Repairs by Type of Fix

Participants indicate the primary reason for the item being out of service, selecting from the following categories. This year, mechanical and electrical issues were the main issues seen in the broken equipment. This chart summarizes data only from successfully repaired equipment.

2019 SI Uganda, Total Pieces Fixed by Type



Repairs/Maintenance by Type of Equipment

The table below summarizes the types of equipment on which participants completed repairs. Blood pressure devices, both automatic and manual, and scales make up the greatest percentage of successfully completed repairs. “Other” also makes up a large percentage, which is typical, as participants often encounter a number of devices not included in our provided list, or are unsure how to classify an item.

Type of Equipment	Total Pieces	Type of Equipment	Total Pieces
Air Compressor	1	Lamp, examination	3
Aspirator/Suction Machine	3	Lamp, surgical	3
Autoclave	3	Microscope	2
Automatic Voltage Regulator	3	Operating Table	1
Bed, delivery	4	Ophthalmoscope	1
Blood Bank Refrigerator	1	Oxygen Concentrator	13
Blood Pressure Device, Automatic	18	Phototherapy	1
Blood Pressure Device, Manual	23	Pulse Oximeter	8
Centrifuge (electric or hand operated)	1	Scale (laboratory and in wards)	30
EKG	1	Stethoscope	1
Furniture	3	Television	1
Incubator (infant)	4	Transformer	2
Infant Warmer (Radiant or other)	1	Vaccine Refrigerator	1
Iron (for clothing)	1	Other	30

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

Repairs by Hospital

The following chart breaks down the repairs by hospital group.

Hospital	Items Touched	Repaired	Abandoned	Repair Percentage
Hospital 1	54	40	14	74%
Hospital 2	66	54	12	82%
Hospital 3	39	33	6	85%
Hospital 4	45	29	16	64%
Hospital 5	19	8	11	42%
Total	223	164	59	74% avg

Secondary Projects

In addition to repairs and maintenance, 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, then are given a budget of \$100 per person to use in a creative way to provide for that need. This year's Uganda program participants really went above and beyond, with many groups fundraising through the crowdfunding website GoFundMe. The additional funds allowed for the participants to complete very impressive projects and greatly impact their hospitals.

Group 1

This group's secondary project had three components. First, they sanded and painted a total of 21 beds: 13 in the children's ward and 8 in the female ward. They also raised money to purchase equipment for the male ward: their goal was \$1000 to get blood pressure machines, a thermometer, a glucometer, 5 drip stands, a sterilization drum, a weight scale, and a pulse oximeter. Ultimately, they raised \$730 and bought "the male ward a pulse oximeter, a weighing scale, a glucometer, 5 packs of glucometer strips, a thermometer, 2 analog blood pressure machines, 2 sterilization drums, and 4 kidney bowls. Their final project was to make signs for various wards in the hospital. They made signs for the radiology department, maternal ward, main lab,

TB lab, male ward, main operating theatre, minor operating theatre, OPD, and private wing.



They painted all 21 beds. They began trying to paint and sand themselves, but after one day they had only gotten through one bed and two drip stands. They decided it would be a better use of resources to hire a painter and people to help. The rest of the beds and drip stands got sanded and painted in two days.

In their report, the group recommended that this project be picked up next year. Lack of equipment is such a large need in this hospital, so fundraising and providing the equipment and/or funds to the hospital could make a significant difference.



Group 2

This group repaired and repainted 35 patient beds and 5 cabinets from the maternity ward. Before the project, the beds were severely rusted, with many containing bent/collapsed supports, rendering them useless. Many patients in the maternity ward were forced to sleep on the floor as a result. Many beds also had broken chain links, making it dangerous for patients to lay on them.



Beds Before (top left), During (top right), and After Refurbishing

Several beds had to have their legs cut in order to make them properly leveled. The group replaced the beds' wire mesh, sanded them, and then gave them a fresh coat of grey paint. Additionally, they refurbished two examination tables from Maternal and Child Health Care (MCH) department. They removed the leather from the examination beds, washed the foam with disinfectant, and installed new leather.



Examination Tables Before and After

Group 3

This team had three secondary projects they felt would greatly benefit their placement hospital. The first was to build a ramp connecting the entrance of the outpatient department (OPD) for improved disability access. Participants observed multiple doctors having to physically lift patients in wheelchairs above the stair and the uneven rocky path in front of the OPD, causing much discomfort for both the doctors and the patients. Their solution was to construct a smoothed concrete ramp that would significantly improve access for patients with disabilities in the hospital.



Before and After Ramp Installation

The second project concerned the need for a portable generator in the neonatal intensive care unit (NICU) of the hospital. The town experiences frequent power outages, often for extended periods of time. The hospital has one main generator capable of powering essential pieces of equipment, but this did not always extend to the maternity ward. There were often times when incubators, oxygen concentrators, infant warmers, and other devices essential to the survival of infants could not be used simply because there was no available power source. The hospital had a backup generator set aside for the NICU, but it was not in use due to the lack of a safe structure to house the generator. They determined that the construction of a plastered brick shed with a locked metallic door for the backup generator would ensure proper, sustained care for all infants in the NICU even during power outages.



Generator Housing Area

The third and final project was sparked by the participant's daily walks between wards to retrieve, repair, and return medical equipment. In their hospital, the wards are connected by narrow walkways with awnings for shelter from the rain. Since the hospital is often overcrowded and there are no dedicated places for family members to wait, these walkways are usually packed with families of patients and other loved ones sitting on the floor or on mats brought from home. This makes it difficult for nurses to transport beds through the walkways and for doctors to move efficiently between wards. They concluded that the construction of two roofed shelters, one in front of the maternity ward and the other between the female and pediatric wards, would greatly improve accessibility for hospital staff and provide a more secure, comfortable waiting area for attendants.



Hallway Before Shelter; New Shelter Occupied By Visitors

Overall, these secondary projects went very well. The participants said they were lucky to have administrative staff that was very friendly and cooperative with their proposed projects. The participants worked alongside the Principal Nursing Officer of the hospital and the hospital's engineer to determine what materials the group needed to buy, the cost of such materials, and the work to be done that day. The group said the Principal Nursing Officer had a very fast pace of work and also understood that the group was operating on a limited budget, both of which were extremely helpful. This group set up a GoFundMe to fundraise for the completion of the projects and were able to fundraise enough to complete all three projects. The participants carried out the budgeting, scheduling, and design of the projects, but the actual construction was done by the hospital's engineer and his workers, as the work required labor beyond the participant's capabilities.

The participants were able to observe that their work made a difference right away. The ramp was used immediately by patients and doctors to enter and exit the OPD. Both shelters were completed on a Friday, and participants noticed them filled with attendants on Monday. There was noticeably more room on the actual walkways, which made it easier to transport equipment to and from various wards. The generator shed was also completed within a few days, and currently the last step remaining is for the electrician to install the cable behind the shed that can connect to the generator.

Group 4

This group's secondary project was a renovation of the Children's Ward. They repainted the exterior of the building and added "Welcome to the Children's Ward" to the front. Additionally, they added mosquito netting to all 36 windows. Finally, they repaired 8 ceiling tiles and sealed the leaks in the ceiling to prevent further damage from occurring. The project was very successful. Upon the advice of the 2018 Iganga group, who had conducted a similar project at the Women's Ward, the participants were able to hire extremely hardworking individuals to help them complete the project.



Group 5

This group's ultimate goal was to make the pediatric branch of their placement hospital more child-friendly. They repainted 98 beds that were rusted and scraped. In the main two wards, they painted the beds grey, and in the malnutrition ward, they painted the beds dark red.



The Beds Before (left) and After (center and right)

The group hired a painter to paint pictures on the walls of the ward and in the hallway. On the same day that the beds were painted, the painter cut out pictures of a cow and a goat and used them as templates on the wall. The painter also painted

the alphabet in different colors in the hallways, as well as different fruits with vibrant colors. Additionally, the participants replaced any blown bulbs to improve lighting in the hallways and bathrooms. The painter repainted the gate to the children’s hospital because the letters were not visible anymore.



Wall Paintings in the Children’s Ward

Participant Debriefs and Hospital 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. The participants were proud of the work they completed in the hospitals and the number of repairs they achieved as a group. The decision to change the format of this year’s program to be the same as our other programs proved to be the right decision, as the participants had very positive feedback.

Below are two quotes, one from a Duke University student and one from a Makerere student, to give a brief snapshot of student takeaways from this program:

“I learned and developed skills to function independently in unfamiliar environments. It also gave me confidence in myself and the impact I can have in communities.”

“The SI program has been a perfect place for me to grow in my leadership and communication skills, both formal and informal...I believe that this program has played a great role towards my understanding of my future career as a biomedical engineer as well as the need of biomedical engineers in [Uganda] towards the provision of health care, especially in low income areas.”

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[1] EWH estimates the mean value of each repair at USD\$2,000.