



**Engineering World Health Institute
Cambodia 2018
Final Report**

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Executive Summary

The 2018 EWH Institute in Cambodia was a highly productive contribution to the Cambodian health care system. This year we had 34 participants, in addition to two On-the-Ground-Coordinators and one instructor. There were 20 male and 14 female participants, 32 undergraduate students and two graduate.

During the first month of the program, the participants underwent intensive language, cultural, and technical training conducted at the University of Puthisastra. The technical training comprised lecture, lab, and hospital visits. In order to better understand some of the history of Cambodia, the group went on an excursion to Toul Sleng Genocide Memorial Museum and to the genocide memorial park at Choeung Ek.

For the second month, participants were placed in 14 hospitals throughout Cambodia and collectively repaired over 300 pieces of equipment. Equipment ranged in complexity from delivery beds to x-ray machines. Notable, high impact repairs include an infant incubator that was immediately put back into use, restoring a hospital's only autoclave, and a particularly time-sensitive repair to a surgical lamp as the patient was being prepped for surgery. Also notable, two participants sat in on 6 surgeries, then realized that every single ESU used during the surgeries had been repaired by the participants the day before. Participants completed 14 hospital need reports, plus other staff interviews and tasks to generate ideas for secondary projects and other potential design projects.

In summary, the Cambodia 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

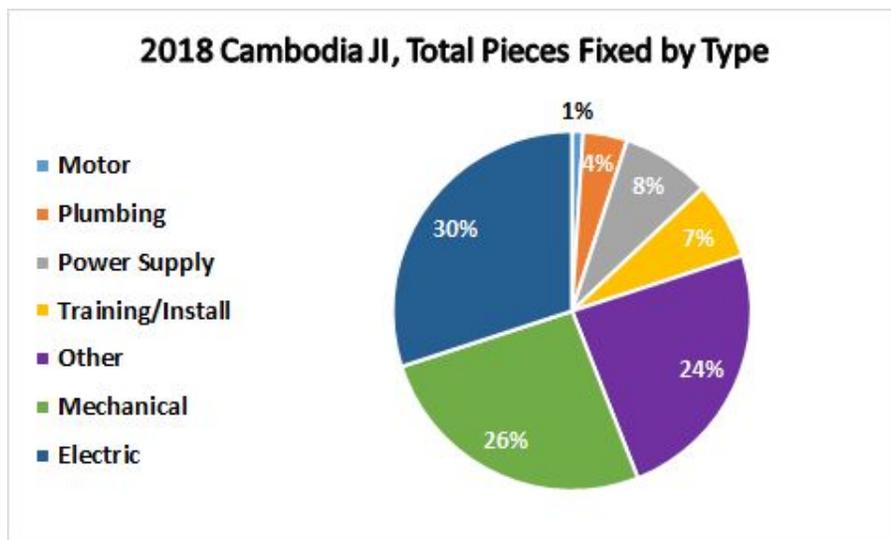
The 34 participants repaired 306 pieces of medical and hospital equipment, totaling approximately USD \$612,000 [1] of equipment repair service.

Repairs by Type of Equipment

Type of Equipment	Repair Total	Type of Equipment	Repair Total
Air Conditioner	2	Lamp, examination	14
Anesthesia Machine	5	Lamp, surgical	22
Aspirator/Suction Machine	23	Microscope	3
Autoclave	16	Nebulizer	8
Automatic Voltage Regulator	1	Operating Table	3
Bed, delivery	3	Ophthalmoscope	2
Blood Bank Refrigerator	6	Oven, Lab	1
Blood Pressure Device, Automatic	3	Oxygen Concentrator	9
Blood Pressure Device, Manual	1	Patient Monitor	24
Centrifuge (electric or hand operated)	3	Pulse Oximeter	6
Computer	3	Scale (laboratory and in wards)	1
Dental Drilling Machine	2	Shaker Machine	1
Distiller	2	Television	1
Drying Machine	1	Ultrasound machine (imaging)	4
ECG	11	UPS (various)	5
Electrosurgery Machine	4	Vaccine Refrigerator	1
Fetal Stethoscope	4	Ventilator	9
Furniture	13	Water Bath (laboratory)	1
Generator	1	Water Purifier (for lab, in wards)	3
Incubator (infant)	6	X-Ray Film Dryer	3
Infant Warmer (Radiant or other)	13	Other	57
Infusion Pumps	5		

Repairs by Hospital

Hospital	Pieces Touched	Repaired	Abandoned	Repair Percentage
Hospital 1	49	46	3	94%
Hospital 2	34	24	7	79%
Hospital 3	24	13	11	54%
Hospital 4	16	15	1	94%
Hospital 5	25	16	9	64%
Hospital 6	19	15	4	79%
Hospital 7	21	10	11	48%
Hospital 8	28	19	9	68%
Hospital 9	22	16	6	73%
Hospital 10	28	20	8	71%
Hospital 11	16	14	2	88%
Hospital 12	22	9	13	41%
Hospital 13	44	35	9	80%
Hospital 14	21	19	2	90%
Hospital 15	42	32	10	76%
Total	411	206	103	74% 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.

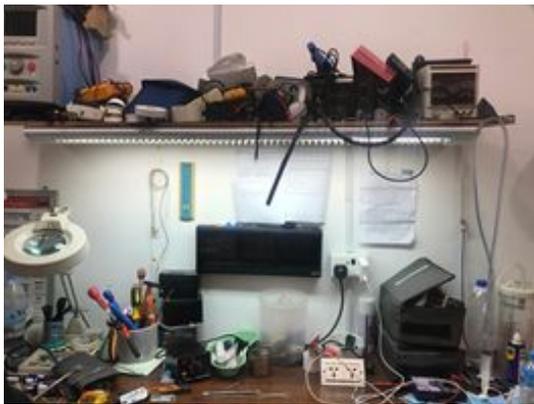
The 2018 Cambodia participants completed 14 interviews in 14 hospitals. Based on these interviews, the following are some of the most needed items:

- Positive sanitation patterns and cleaning methods
- Access to distilled water or clean water without producing waste or important water from external sources
- Neonatal suitable nasal aspirators and CPAP machines
- Permanent work area for BMETs
- Appropriate acceptance of donated equipment accompanied by a user manual suitable for staff
- Education on safe disposal of sharps
- Way to renew zeolite canisters
- Reusable blood pressure cuffs with no rubber
- Patient monitors that can be easily repaired

Secondary Projects

Hospital 1

The participants here built a tool-board for the BMET in the hospital, and generally cleaned up the workspace. The tool board was made using recycled wood from pallets found outside the workshop, nails, screws, and velcro. The board installation cleared up space on the workbench, allowing for a more organized and efficient workspace.



Before



After

Hospital 2

The participants here had two secondary projects. The first was developing a program and quick start guide that would simplify the calculations and theory behind charging batteries. They found that much of the equipment in the hospital was not in service because the batteries had gone flat. The quick start guide instructs how to connect batteries to a variable power supply and the calculations required, and the program assists the user through any measurements or readings and removes any possible calculation errors when determining charge time and resistance required for charging. The program and quick start guide were designed to be used by any EWH participant in all hospitals with the potential to be used by local BMETs (by adding translation). The second project was organizing the workshop. The participants created a tool board for the storage of tools, cleaned the room, and provided ideas on ways to process information and equipment that comes to the room.

Hospital 3

This group's project consisted of two parts. The first was the repair and restoration of

a children's playground, located within the vicinity of the neonatal ward. They repaired the swings with the help of a local welder, then painted them to breathe new life into the area. The second project arose from an opportunity presented by a group from the Australian Red Cross. The Red Cross group requested the participant's assistance with repairing equipment for the National Blood Transfusion Centre (NBTC) in Phnom Penh. With the permission of the OTGC, the participants spent time repairing equipment in that facility and were able to fix a variety of equipment for the centre.

Hospital 4

This group devised a sanitation campaign that encouraged staff and patients to utilize the alcohol dispensers located throughout the departments. They designed posters to place above dispensers and raised staff awareness, ensuring they pass on the sanitation message to patients and their families. Alcohol refills were purchased, and various dispensers filled. The hospital director was also notified to try to make this a sustainable project, which would undoubtedly have an impact.

A smaller project included further cleaning the workshop, under the recommendation of the previous' years group. Scraps were disposed of, tools reorganized, and dust and cobwebs cleaned.

Hospital 5

This group's secondary project was to improve the condition of the BMET workshop. They installed a fan for climate control, cleaned the workshop and sorted all the tools. They also went to the abandoned old workshop and brought over the parts found there to make more spare parts available in the future, including spare parts that are very expensive and difficult to find.

Hospital 6

This group's secondary project was to build an inverter circuit/transformer to convert 12V DC electricity to 240V AC to run a halogen light over a dimmer circuit. The hospital's BMET requested this, as the power in the hospital sometimes goes out, and he wanted to be able to run a light to continue working in these events. The BMET was very happy with the final result, and found that he could run other equipment off of his motorcycle battery through this device.

Hospital 7

The secondary project here was a tool cart. This tool cart consisted of a portable trolley mounted on 4 lockable wheels with a small workbench. The trolley was constructed by welding together metal tubing. Sheets of 16mm plywood were used as paneling. Additionally, nails were hammered into the plywood to allow for tools to be hung on the trolley for quick access. With this cart, BMETs now can easily move around their tools, and the added workbench provides a more ergonomic working surface.



Hospital 8

This group's secondary project was renovating the workshop. Before the renovations, the bench and cupboard were very disorganized and despite the BMET knowing where everything was kept, the space was completely unworkable. They spent days clearing all of the boxes under and on top of the bench and then organizing the contents of those boxes by accessory types. They cleaned all of the surfaces, rearranged the furniture so there was a good working space for equipment as it was brought in to be fixed. They refurbished an old hospital bed to use as a table. They said cleaning and organizing the workshop early in their stay was one of the best decisions they made. Not only did it provide a good workspace, but it also allowed them to find a great deal of spare parts which became useful for repairing equipment. Before they left, they

purchased better storage containers and hung up a whiteboard, pinboard and two curtains.

Hospital 9

This group took inventory of the entire hospital and found as many manuals as possible to collect. This included online manuals, emailing companies for manuals and scanning of physical copies the BMET already owned. All manuals were given to the BMET, with the group showing him how to access the files. Copies were forwarded to the EWH BMET library and Frank's Workshop to share information there.



Hospital 10

These participants made quick start electronic guides for the hospital's BMET team. The guides were created so that they could be used for newly trained BMETs in future years. After training the BMETs on how to use the guides they were able to understand and apply their newfound knowledge instantly with reference to the guide. The project was very well received by the hospital and BMETs.

Hospital 11

The secondary project here was a complete renovation and organization of the BMET workshop. The group purchased and donated a vacuum cleaner to the hospital to help with the process. They cleaned all desks and benches, organized files in file holders, collected and arranged all random, loose items in the workshop and painted a new sign for the BMET for his new workshop. They reported that the BMET's reaction was more than they had hoped for, and he was very pleased with his new space.

Hospital 12

This group set out to organize and paint the drawers in the BMET workshop. The group completed this task, but realized that much more organization was needed, so they purchased storage containers to organize the tools, spare parts, electrical components, and the like. They also purchased table top drawers to free up desk space in the office, resulting in a much more organized work space for the hospital's BMET.



Before



After

Hospital 13

This group worked to refurbish the playground at the hospital. The original playground was nearly 10 years old with very solid, and even dangerous, equipment. The group was able to construct a lot of new equipment using tires from the hospital that were going to be disposed. They said the project was very well received by the children.



Before



After

Hospital 14

This group's secondary project was constructing a distillation system. There are a total of two such systems in this hospital, but they are small and are used for laboratory purposes. They aimed to make a large one that could be used in the kitchen to make water safe for cooking and drinking. They were able to install a device before leaving, providing safe water for the kitchen and staff.

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