Engineering World Health Summer Institute Nicaragua 2017 Final Report

Engineering World Health CEO:
Leslie J. Calman, PhD
EWH SI Coordinator:
Maddy Bishop-Van Horn
Teaching Assistant:
Jack Livingston
On-the-Ground-Coordinators:
Alyssa Paul and Jack Livingston
Instructor:
Iyad Obeid, PhD
Associate Professor of Electrical and Computer Engineering, Temple University

Executive Summary

The 2017 EWH Summer Institute in Nicaragua was a highly productive contribution to the Nicaraguan health care system. We had 11 participants: 4 male and 7 female, 1 graduate student and 10 undergraduates, in addition to our On-the-Ground-Coordinators (OTGC) and 1 instructor. The participants represented 9 different universities and 3 nationalities.

During the first month of the program, the participants underwent intensive language, cultural, and technical training conducted at Nicaragua Spanish Language School. The technical training comprised lecture, lab, and hospital visits. The group went on an excursion to various Nicaraguan towns for a view of Laguna de Apoya; a visit to Masaya Volcano, its museum, and Masaya market; and a traditional ceramics demonstration at Pueblos Blancos.

During the second month, participants were placed in 5 hospitals throughout Nicaragua. Collectively, they repaired 165 pieces of equipment. Equipment ranged in complexity from hot plates to defibrillators. In addition, they completed preventative maintenance on 58 pieces of equipment and installations of and trainings on 19 pieces of equipment.

Notable, high impact repairs included a patient monitor that was older than the participant fixing it, modifying an x-ray film box to be compatible with a different bulb, and 3 IV pumps that had been discarded as irreparable but were immediately put back into use once repaired.

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

In summary, the Nicaragua SI was highly productive and made a genuine contribution to health care delivery in the hospitals served.

# Types of Medical Equipment Repair

The 11 participants and 1 OTGC repaired or completed preventative maintenance on 223 pieces of medical and hospital equipment, totaling approximately USD $446,000 [1] of equipment repair service.

<u>Repairs/Maintenance by Type of Equipment</u>

Type of Equipment	Total Pieces	Type of Equipment	Total Pieces
Air Conditioner	2	Microscope	12
Aspirator/Suction Machine	5	Nebulizer	34
Autoclave	10	Oven, Lab	1
Automatic Voltage Regulator	3	Oxygen Concentrator	1
Blood Pressure Device, Automatic	1	Patient Monitor	20
Blood Pressure Device, Manual	3	Phototherapy	1
Ceiling Fan	1	Printer	1
Centrifuge (electric/hand operated)	22	Pulse Oximeter	2
Change Over Switch	1	Scale (laboratory and in wards)	1
Computer	2	Shaker Machine	9
Defibrillator*	1	Stethoscope	2
Drying Machine	1	Ultrasound machine (imaging)	5
ECG	5	UPS (various)	5
Electrosurgery Machine*	1	Ventilator	14
Fetal Stethoscope	4	Washing Machine	1
Furniture	3	Water Bath (laboratory)	1
Hot Plate	1	X-Ray Film Dryer	1
Incubator (infant)	5	X-Ray Film View Box	1
Infusion Pumps	10	X-Ray Machine*	2
Iron (for clothing)	1	Other	15
Lamp, examination	9		

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

Repairs by Type of Fix
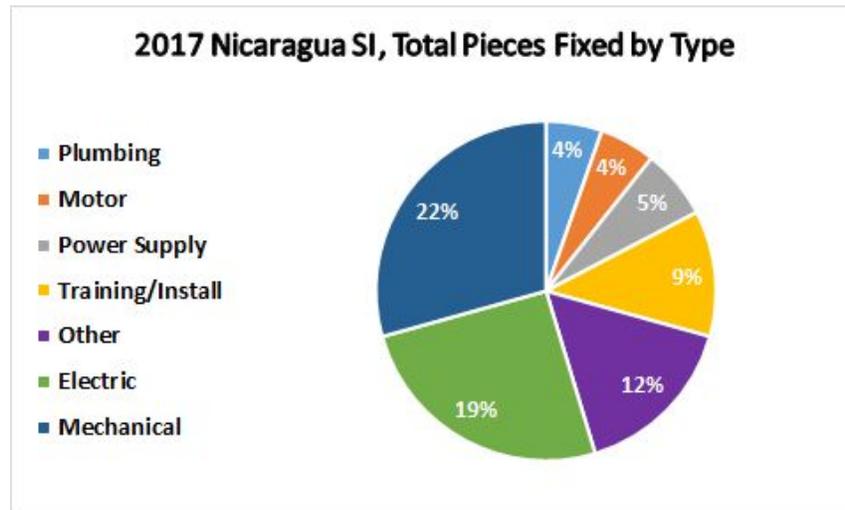
Needs Assessments

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. These interviews provide a snapshot of specific needs in low resource hospitals. Some of these needs may become incorporated into the projects that matter list.

The 2017 SI participants completed 7 interviews in 5 hospitals. Based on these interviews, the following are some of the most needed items:

Individualized nebulizer system
More EKG paper, or a machine with inexpensive EKG paper
Water control system to prevent flooding in heavy rains
Manuals or systems to assist BMETs in knowing equipment's faults when it is delivered
Supplies for treating burns (gauze or fabric)
X-ray printer
X-ray radiation protection

Secondary Projects

EWH provides funds for participants to work on such additional projects in addition to equipment repairs and maintenance. Participants completed secondary projects at all 5 hospitals.These projects included:

Emergency Alarm System

Two participants built an alarm system for their hospital. There was no alarm system in the hospital; in the event of an emergency, the protocol was to notify the information desk and bang on items such as gas tanks to alert others in the hospital.

The participants installed 5 alarm systems that connect to switches at the information desk. All alarms are connected to switches at the information desk, four of them together and one with an independent switch. Now in the event of an emergency, hospital personnel can notify the front desk, in person or via phone, to activate the alarm system.

Manualitos

One group of participants wrote/translated small manuals that described basic errors and problems encountered with equipment, as well as reminded users to leave notes about faults when taking equipment to BMETs. This will streamline the repair process and reduce the amount of equipment needing repair.

Patient Support for Amputees

One participant's hospital has a technician who makes prosthetic limbs, but no structure with which to support amputees while taking measurements for these prosthetics. The participant in this hospital used hammock material to construct a support for patients while the technician takes measurements. The support will also be useful for amputees when they want to first practice standing and will need support.
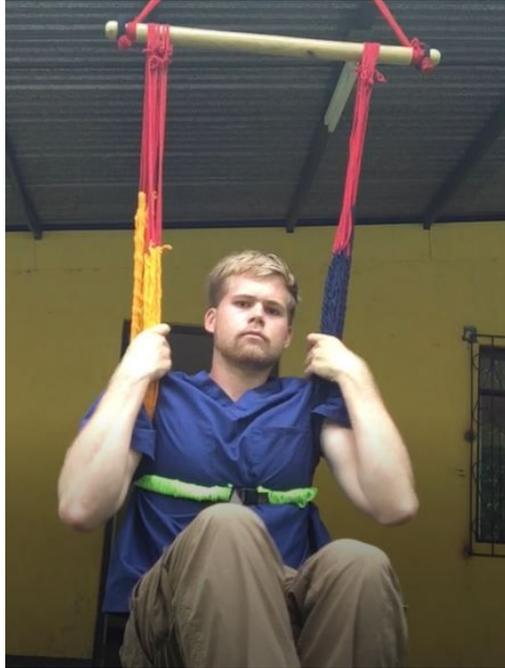
OTGC Jack tests the patient support system

TV for Pediatrics Ward

One of the hospitals has a pediatrics ward that is sparsely furnished with only beds, so the children quickly become bored with nothing to do. These participants used their stipend to purchase a TV that came with built-in games. They also plugged in a USB with music and kids movies and connected an antenna so it could play a few channels.

Participants install the TV in the pediatrics ward

New Workplace for Technicians

The participants constructed a new workplace in the maintenance center for the electromedical equipment and technicians. The space provides the technicians with a larger, air-conditioned workspace to repair and perform preventative maintenance. For the project, participants found a location, installed beams for wall and ceiling support, attached the ceiling and cut metal to appropriate wall lengths, installed the walls and finally the floors. While they were not able to stay to see the walls put up, they were able to leave the hospital with all of the materials needed to complete this aspect of the structure.

Workshop under construction

Instructors

The instructor for this summer was Iyad Obeid, Associate Professor of Electrical and Computer Engineering at Temple University, Philadelphia, Pennsylvania. The On-the-Ground-Coordinators were Alyssa Paul and Jack Livingston. Jack also served as the teaching assistant. Language and cultural training were provided by Nicaragua Spanish Language School (NSLS). Classes were taught at NSLS- Grenada campus.

---

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