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# 2012 Annual Report





## Our Mission

Engineering World Health (EWH) is a non-profit organization that mobilizes the biomedical engineering community to improve the quality of health care in hospitals that serve resource-poor communities of the developing world. With this professional expertise, we install donated and newly-designed medical equipment, carry out repairs and build local capacity to manage and maintain the equipment. We also harness the resources of collegiate engineering programs through a network of university-based chapters and contract with Duke University to manage a summer program that sends student biomedical engineers to developing country hospitals where they repair broken equipment.

## Our vision

Engineering World Health will be recognized internationally as a leader in:

- Developing and introducing novel health care technologies appropriate for resource-poor settings
- Responding to the challenges of developing self-sustainability in maintaining and repairing medical technology in developing countries
- Mobilizing the biomedical engineering community to improve the quality of health care in resource-poor settings
- Providing students and volunteers with the life-changing experience of contributing to improving lives in vulnerable communities.

## Our values

- Finding workable solutions through innovation and creativity
- Serving while learning from the most vulnerable communities
- Promoting self-reliance
- Balancing challenge and safety for students and volunteers

## From the Executive Director



Dear Friends,

This has been a year of achievements for Engineering World Health! We have expanded our ability to enhance health care delivery in the developing world and impacted the lives of countless individuals. In connecting with the biomedical engineering community to raise awareness of the needs of developing countries and to garner assistance from our colleagues, we have witnessed a transformation in our professional community.

I want to express my heartfelt gratitude to the amazing staff, volunteers, partners, donors and board members who have devoted their passion, talent and resources to EWH! The primary programs through which EWH accomplishes its mission – the Summer Institute, Biomedical Engineering Technician Training Programs (BMET) and other student programs – took giant steps this year.

The 2012 EWH Summer Institute sent 49 students to Central America and Tanzania through our partnership with Duke University. Students repaired 450 pieces of equipment, totaling an estimated \$900,000 (if replaced with new equipment, including shipping costs). We are excited to announce expansion of our Summer Institute through a new partnership with Texas A&M University, launching in Rwanda in summer 2013. The Duke partnership and the new program with TAMU establish EWH as a provider of summer experiences for multiple universities that want to offer living/learning/serving opportunities abroad for their students.

The goal of our GE Foundation BMET programs has been, first, to train technicians, but ultimately to create a locally sustainable training program in each country we serve. I am so proud to announce that EWH BMET Honduras has secured an agreement with GE and Instituto Nacional de Formación Profesional (INFOP) for the first self-sustaining BMET school in Central America!

Additionally in 2012, BMET Rwanda graduated its first class from the three-year training program and achieved Rwandan academic accreditation. The training program is transitioning to Integrated Polytechnic Regional Centre (IPRC) where it will continue with local government support. In both Honduras and Rwanda, EWH has established locally sustainable programs to provide the education needed by hospital technicians to keep equipment in service and save lives. BMET Cambodia has begun classes and BMET Ghana initiated the development of a Center of Excellence in Sunyani Regional Hospital. GE Foundation has reaffirmed its commitment to the BMET program to allow EWH to complete transition to local sustainability in Honduras, Rwanda, Cambodia and Ghana.

The EWH student program has expanded into STEM curriculum development. University chapter members are creating designs for the developing world, as well as taking their EWH inspiration to a new level by creating spin-off projects of their own.

We have attracted new board members and transitioned to a new Chair – both signs of a maturing, healthy non-profit. I am excited about EWH's future and am confident of our ability to save lives through the enhancement of medical care delivery throughout the developing world. Thank you to all who have helped us grow.

Catherine R. Peck  
Interim Executive Director and CEO



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## What We Do ~ Fulfilling Our Mission

Through EWH's Biomedical Equipment Technician (BMET) Training Programs in Cambodia, Ghana, Honduras and Rwanda, EWH installs donated and newly-designed medical equipment, repairs broken equipment, and trains local technicians to manage and maintain equipment.

### Biomedical Equipment Technician (BMET) Training Program

With funding from the GE Foundation, EWH began its Biomedical Equipment Technician (BMET) Training Program in late 2009 in Rwanda. Thanks to further funding from the GE Foundation, EWH has added BMET training programs in Cambodia, Honduras and Ghana. The training programs feature needs-based curricula tailored to each country, curricula developed in partnership with Duke University.

An introductory BMET training course is offered in Rwanda and Cambodia, through which students learn a broad base of skills tailored to the maintenance and repair of biomedical equipment. Technicians attend a two-month intensive course twice per year and reinforce classroom learning with hands-on practice at their hospital. The hospitals begin reaping the benefits immediately after the first session of classes. After three years and six training sessions, students receive certification as a Biomedical Equipment Technician (BMET).

In Ghana and Honduras, a significant number of Biomedical Equipment Technicians have some level of introductory training already. In these locations, EWH provides continuing education to practicing BMETs, offering knowledge updates to support the advanced technology being installed by GE and other equipment manufacturers. EWH's BMET training programs are also promoting the development of professional societies of biomedical technicians and engineers.



*Students in Cambodia study basic repair procedures for electronic circuit boards.*

## **EWH Kits Program**

Needs identified in developing country hospitals where EWH works are recorded by BMET managers and Summer Institute participants during their time in-country. These needs become EWH's list of Projects That Matter. Promising technologies arising from the Projects That Matter challenges may be suitable for further development in the EWH Kits program.

EWB Kits provide low-cost educational opportunities to train Biomedical Equipment Technicians (BMETs) in developing countries. Kits provide hands-on training, insight and understanding of important biomedical engineering concepts and the practical electronic fabrication skills needed by both engineers and technicians. Kits transfer knowledge from the developed world to developing world students, bridging the gap from theoretical knowledge to practical knowledge. Technical understanding and maintenance support for even a simple device can be the difference between life and death in the developing world.

Kits are used in developed country university settings to teach fundamentals of electronics and to provide service opportunities for our university Chapters. EWH Chapters build kits that are then used for educational purposes in developing country BMET programs. Even broken kits can be used to teach troubleshooting to BMETs in poor countries where electronic components are in short supply.

Kits are also used for STEM and Girls Engineering Change outreach programs, providing young students an introduction to the possibilities of biomedical engineering careers.

## **Chapters**

Students who participate in EWH University Chapters learn about the medical technology issues unique to resource-poor settings in the developing world, issues that often exacerbate health care challenges. Chapters provide ways for students to contribute solutions to these technology issues, a new context for their chosen profession, and an understanding of their potential to make lasting contribution toward improving the lives of people who live in the world's most vulnerable communities. Currently, EWH chapters can be found in the United States, Mexico, Sweden, Nigeria and Yemen.

EWB Chapter members are involved in activities such as:

- design projects for the developing world,
- the EWH Design Competition,
- biomedical equipment repair and evaluation,
- EWH Kit builds,
- working with EWH partner NGOs involved in developing world biomedical research, and
- STEM outreach to local schools using EWH curricula/modules.



*The EWH Chapter at Northwestern University performs a volunteer mission project.*

## **Design Competition**

In August of 2009, EWH launched an annual design competition directed toward the needs of developing country health care. Participating students are invited to create a multi-disciplinary Innovation Team that unites engineering students from the EWH chapter with industry engineers experienced in industrial design, social entrepreneurship, business planning, etc. The teams can work with any organization from the global health community to identify one or more challenges to providing health care in developing countries, challenges that seem suited to a technology solution. Teams can also select projects from EWH's own Projects That Matter list.



*The 2012 EWH Design Competition winning device was a low-cost spirometer, a tool used in diagnosing and monitoring respiratory diseases.*

## Summer Institute

Since 2004, the EWH Summer Institute has provided young engineers with the chance to live in a developing country with a local family, learn a new language, and use newly acquired technical skills to improve health care in the community. One month of training is followed by a month of service in a local hospital during which participants install and repair medical equipment, train the staff, take inventory, solve problems, and perform other engineering duties. The program is open to qualified people from all countries: undergraduate and graduate students, postgraduates and young professional engineers. Participants experience the life-changing opportunity to contribute in a meaningful way to improved health care and international development.

## Student Programs

### • STEM Health Outreach

EWH partners with two organizations experienced in curriculum development to encourage pre-university students to consider pursuing careers in science, technology, engineering and math (STEM). These organizations are The Engineering Place, which provides K-20 education and resources through N.C. State University, and TechXcite, which provides after-school STEM curriculum developed by Duke University.

EWH has developed three different curricula:

- a hands-on introduction into biomedical engineering for elementary school students,
- a middle/high school curriculum for EWH electro-surgical unit (ESU) tester workshops, and
- a middle/high school curriculum titled Medical Technology for the Developing World.

The first two curricula were piloted at The Engineering Place's 2012 engineering summer camps in June/July 2012. Due to the curriculum's success, The Engineering Place will be using these activities again in 2013 at their Rocky Mount camp location. The curriculum titled Medical Technology for the Developing World, created in partnership with TechXcite at Duke University, will be piloted in 2013.



*Elementary students at Smith Magnet Elementary School learn about electrocardiograms during a STEM Family Night outreach event organized by N.C. State University.*

- **EWH Girls Engineering Change (EWH GEC)**

Among all engineers in the U.S., only 14 percent are female; among university women, only 15 percent are pursuing engineering degrees. To encourage girls who may be considering an engineering career, EWH is working with an enthusiastic team of female volunteers to run hands-on kit builds for local middle and high school girls. Participating students interact with passionate female engineers who are only a few years older than they are.

The idea originated from an EWH Chapter member at Duke University, Christine Schindler, who successfully proposed this commitment to action at the 2012 Clinton Global Initiative University.

President Clinton said if Schindler’s engineering mentorship program is a success, he would like to help raise funds at the annual Clinton Global Initiative meeting to scale her project, a move that could assist more women in considering careers in the STEM fields.



*EWH encourages girls to explore engineering careers.*





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## The Year in Review

### Biomedical Engineering Technician (BMET) Training Programs

#### Rwanda

EWH transferred the Rwanda BMET program from Kigali Health Institute (KHI) to the Integrated Polytechnic Regional Center (IPRC) in the spring of 2012. As of September 2012, the EWH program is an accredited educational program at IPRC. An agreement between EWH, IPRC, and the Rwandan Ministry of Education allows all graduates to receive degrees from IPRC. In September 2012, IPRC started a three-year, full-time, advanced diploma program.

The first class or cohort to graduate from the EWH BMET program began their last academic session in September 2012, with plans to graduate in November 2012 under the IPRC. The second class should graduate in November 2013. EWH's role in this program is now purely supportive. We help IPRC to build labs, train trainers and optimize the curriculum, but IPRC has full ownership.

EWH Rwanda is ready to start phase two of the program. With the extension of GE Foundation's sponsorship and partnership, EWH is collaborating with IPRC and the Ministry of Health to implement Centers of Excellence, Train the Trainer programs, and mentoring of BMETs by senior BMETs from developed countries. EWH assists IPRC and continues to train faculty to sustain BMET training after EWH leaves in 2015.



*An instructor teaches Rwandan students about anesthesia machines.*

## Honduras

The EWH BMET training program in Honduras successfully delivered four sessions of continuing education to groups of 20 BMETs from 13 hospitals around the country in fiscal year 2012.

With 12 total sessions planned over three years, fiscal year 2012 saw the completion of sessions five through eight, covering the topics of neonatal technology, sterilizers and medical gases, patient monitors, and radiology equipment. In each of these training sessions, the participants received practical, hands-on training in the maintenance and repair of medical equipment and put their training to use to benefit EWH partner hospitals in Tegucigalpa.

In September 2012, EWH and Duke University teamed up to conduct a study of medical equipment and BMET training in Honduras. The results of the study demonstrated the effectiveness of the training program, with BMETs trained by EWH showing greater initiative in preventive maintenance than other BMETs (45% of all repairs, as opposed to 14%,  $p=0.01$ ). Hospitals with a technician trained by EWH also had fewer pieces of equipment out of service (10.1% vs. 14.2%,  $p=0.035$ ).

These programs were executed with the collaboration of *Instituto Nacional de Formación Profesional (INFOP)*, the EWH educational counterpart in Honduras, and were made possible by the support of GE Foundation.



Honduran BMET students learn to calibrate an ultrasound machine at Hospital de Torax in Tegucigalpa through EWH's continuing education program in partnership with INFOP.

## Cambodia

The first intake of 11 students will start the full BMET program in first quarter 2013. In preparation for this launch and in response to the often low levels of schooling found among Cambodian hospital technicians, EWH offered a 16-week preparation course – four months of night classes in English, math and computers – in the fall of 2012. The preparation course is designed to ensure that students are able to fully engage with the advanced and technical content of the BMET course right from the start.



*Cambodian BMET students began their studies with a preparation course in fall 2012, sharpening their skills in math and computers.*

In 2012, work toward starting the BMET program in Cambodia included:

- preparing and translating course materials,
- preparing course equipment and the workshop space, and
- completing the overarching documentation and agreements for the program.

The six-semester BMET course will be delivered through the faculty of Health and Science of the local education partner, the University of Puthisastra.

## Ghana

The BMET program in Ghana began building the first Healthcare Technology Management (HTM) Center of Excellence (COE) at Sunyani Regional Hospital in fall 2012. To create the COE, everything was removed from the Clinical Engineering Unit workshop at Sunyani Regional. The space was washed, floors mopped, walls painted, and workbenches refinished and repainted.

*From this . . .*



*. . . to this.*

According to Daniel Hardy, the program manager for Ghana, these were simple, relatively inexpensive “first steps” in “pouring the foundation” for a new HTM COE.

“A major hurdle in building a sustainable COE is changing the paradigm of the participants, instilling a level of pride in themselves and in what they do,” Hardy said. “Cleaning, refinishing, redesigning and organizing their surroundings and work environment is a step in that direction.”

The draft Memo of Understanding for the Ghana COE program has been submitted to GE Foundation for review and approval. Once the MOU is signed, it will be presented to the Ministry of Health. Once approved, the serious work of building a Healthcare Technology Management Center of Excellence can begin, which will have the potential to impact 22 public hospitals in the Sunyani region.

Two other GHS hospitals have been identified as sites for HTM COEs: Mampong District Hospital and Kintampo District Hospital. The Ghana OTGC has “planted the seeds of change” and has already seen improvement in the workshop environment at Mampong. While much more needs to be done to make this shop ready, they have started the process on their own.

## Chapters

In 2012, EWH supported 24 student chapters affiliated with universities all over the world. Students are learning about the work of EWH at these universities:

- California Polytechnic State University
- Clemson University
- Cornell University
- Case Western Reserve University
- Duke University
- University of Illinois at Chicago
- ITESM Campus Chihuahua (Instituto Tecnológico de Estudios Superiores de Monterrey)
- ITESM Campus Monterrey (Instituto Tecnológico de Estudios Superiores de Monterrey)
- Johns Hopkins University
- Lund University
- University of Maryland
- University of Michigan
- North Carolina State University
- NIBE-FUTO (Nigerian Institute for Biomedical Engineering - Federal University of Technology, Owerri)
- Northwestern University
- University of Portland
- Purdue University
- Stony Brook University
- Texas A&M University
- University of California, San Diego
- Vanderbilt University
- Washington University in St. Louis
- Western New England University
- University of Science and Technology Sana'a, Yemen

## Design Competition

In 2012, the EWH Chapter at Washington University-St. Louis won the first place award for a low-cost spirometer that monitors lung function. University of California-San Diego took second place for an HIV treatment failure detection system, and California Polytechnic State University received third place for a low-cost, reusable and robust sterilizer tester. These awards were presented at the 2012 BMES conference in Atlanta, Georgia.

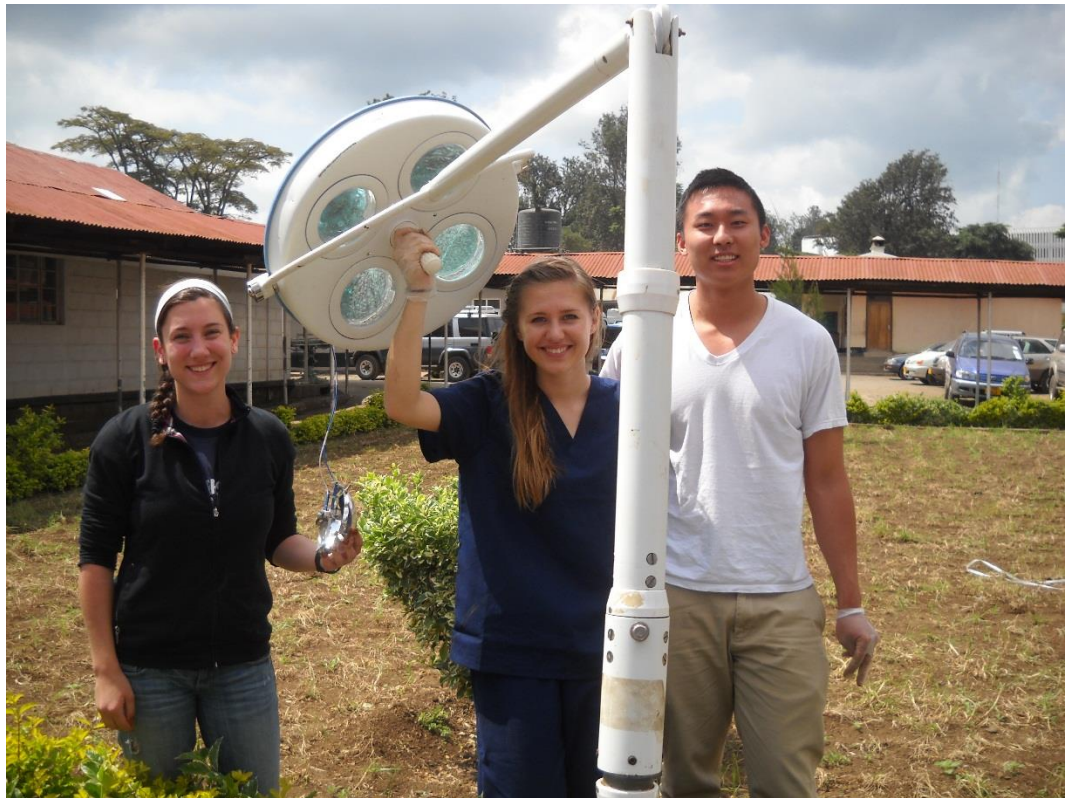


### **2012 EWH Design Competition Winning Team**

*Students from Washington University-St. Louis receive their first place prize, from left, Olga Neyman, Andrew Brimer, Abigail Cohen, Mohammad Kiani (EWH Board Member), Braden Eliason, and Charles Wu.*

## Summer Institute

The Duke-EWH Summer Institute completed another successful year in 2012 with 54 participants (49 students, three On-the-Ground Coordinators, and two instructors) in 25 hospitals in Nicaragua and Tanzania. Applications came from 33 U.S. institutions (among them, Vanderbilt, Georgia Tech, and Duke) and 10 foreign institutions (Imperial, U of Bristol, Oxford, Queen's University, Newcastle University, all located in England, Universidad de Monterrey in Mexico, U of Toronto and McMaster University in Canada, University of Bucharest in Romania, and Aalborg University in Denmark). Of the 118 applications, an increase of 25 applications from last year, 67 students were given offers, and 50 students accepted, with 49 final participants.



*EWH Summer Institute engineers at work in Tanzania.*

During the summer program, students touched 570 pieces of equipment, returning to service 79 percent of the equipment they touched (450 pieces). At an estimated average new price of \$2,000 per piece of equipment (purchased new and shipped), students repaired nearly \$900,000 worth of equipment in 2012. It would require approximately six 40-foot containers from a typical U.S. non-profit to ship as much working equipment as the students repaired this summer.

Since 2003, a remarkable 3,624 pieces of medical equipment have been put back into service by the EWH Summer Institute program. At an estimated \$2,000 per piece of equipment new, this is more than \$7.24 million worth of equipment placed back into service.

Students completed 32 in-depth needs-finding interviews in 2012. The needs uncovered in these interviews will be reflected in the Projects That Matter design challenges posted on the EWH website. Students also completed inventories of medical equipment to allow hospitals to better organize their equipment donations and requests. Inventory was taken at seven different hospitals in Tanzania, and in 12 hospitals and clinics in Nicaragua.

Students also found time to work on secondary projects, in addition to those planned by their On-the-Ground-Coordinator. For example, in Tanzania, the Tengeru Hospital (Meru District Hospital), did not have a neonatal unit, so staff transferred all the premature babies to Mt. Meru Regional Hospital. The Tanzania Ministry of Health provided the hospital with a new Infant Radiant Warmer (Neonatal Resuscitation Table) and Oxygen Concentrator to start a premature unit. SI students set up those new machines and trained staff on how to use them. They also created Operation Instructions, an Alarm Reference Guide, and Modes Information Sheets for the machines, translating the handouts into Swahili. To prepare the room for use, students cut foam mattresses for the infant bed frames and donated fleece blankets. With their secondary budget, they had curtains made for the room.



*Boaco, Nicaragua, Summer 2012.*

Students offered the following one-word descriptions of their Duke-EWH Summer Institute experience: adventure, amazing, brilliant, creative, different, enlightening, eventful, eye-opening, fulfilling, fun, great, immersive, impactful, informative, instructive, intense, interesting, life-changing, new, opportunity, phenomenal, simple, stretching, surprising, troubleshooting, unique, unpredictable, useful, wet, whirlwind.

In summary, the Duke-EWH Summer Institute is delivering an exceptional educational opportunity for participants, and an amazing delivery of working medical equipment to its hospitals.

*The 2012 Summer Institute report was provided by Robert Malkin, Ph.D., director of the Duke University Developing World Healthcare Technology Laboratory and founder of Engineering World Health, and Liz Henderson, assistant director for the Duke-EWH Summer Institute.*





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**Engineering World Health  
Statements of Financial Position  
September 31, 2012 and 2011**

	2012	2011 As Restated
<b>ASSETS</b>		
Current Assets		
Checking/Savings	\$ 655,031	\$ 435,939
Investments	321,434	297,363
Accounts Receivable	11,430	3,556
Inventories, net	-	763
Prepaid Expenses	<u>2,323</u>	<u>19,893</u>
TOTAL CURRENT ASSETS	990,218	757,514
Property Plant & Equipment		
Computer equipment	17,854	13,653
Furniture and fixtures	<u>173</u>	<u>173</u>
	18,027	13,826
Less accumulated depreciation	<u>(7,386)</u>	<u>(4,525)</u>
PROPERTY AND EQUIPMENT, NET	<u>10,641</u>	<u>9,301</u>
TOTAL ASSETS	\$ 1,000,859	\$ 766,815
<b>LIABILITIES &amp; NET ASSETS</b>		
Current Liabilities		
Accounts payable and accrued expenses	\$ <u>88,032</u>	\$ <u>191,377</u>
Net Assets		
Unrestricted	522,478	236,632
Temporarily restricted	390,349	338,806
TOTAL NET ASSETS	<u>912,827</u>	<u>575,438</u>
TOTAL LIABILITIES & NET ASSETS	\$ <u>1,000,859</u>	\$ <u>766,815</u>

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EWH could not conduct this important work with your help.***



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