

PARTNERSHIP FOR GLOBAL HEALTH TECHNOLOGIES

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OUR VISION

The Partnership for Global Health Technologies (PGHT) is a collaboration between medical students from the State University of Zanzibar (SUZA) and Boston University students. PGHT aims to improve the quality of health care in Zanzibar by applying biomedical engineering principles within a public health context. We use an interdisciplinary approach to address the most pressing issues in healthcare delivery in Zanzibar. In July and August of this quarter, a team of students spent 6 weeks in Zanzibar to inform our work in liver function monitoring, quality control of rapid diagnostic tests, and modeling patient access to health commodities as well as to investigate other issues in public health that may be addressed with medical technology.



The lab team is currently working to design an affordable and robust diagnostic to address pre-eclamptic liver failure. This summer, they focused on determining cultural and societal factors in Zanzibar to refine the design.



The public health team examines socio-ecological drivers of public health challenges to ensure adoptability and utilization of proposed technology and anticipate potential obstacles .



The mathematical modeling team uses dynamic health system modeling to model patients' access to quality health commodities, identify bottlenecks and inequities that hinder the system's responsiveness, and build capacity of health delivery. This summer, they focused on data collection in order to develop differential equations that may model patient access to health commodities.



The quality control team is examining image processing techniques to distinguish between quality and defective malaria rapid diagnostic tests (RDTs) . In Zanzibar this summer, they focused on observing methods of running RDTs and image data collection.



MODELING PUBLIC HEALTH CHALLENGES



Modeling research this summer focused on finding data on common maternal health drugs used in Zanzibar, specifically oxytocin and misoprostol used for postpartum hemorrhage (PPH). The Central Medical Store (CMS) in Unguja was visited several times to understand how often drugs arrive in Zanzibar, how often they are distributed to individual health facilities, and the conditions in which they are stored. CMS stores drugs procured by the government as well as drugs from donor agencies such as UNFPA. UNFPA supplies a large portion of oxytocin in Zanzibar and all of the available misoprostol. The team also met with the procurement office in the Ministry of Health to learn about the tendering process and obtain data on country of manufacture, the unit price of drugs, and the annual government expenditure on oxytocin. All information will be incorporated into the existing framework and assist in moving towards a running model.



LAB RESEARCH

To address the inconvenience and delay in liver function testing in Zanzibar, our lab team has designed an assay that is able to quantify the concentration of ALT— one of the biomarkers that make up the standard LFTs— in blood plasma within 15 minutes. Hence, this assay has the potential to circumvent the tedious procedures of monitoring liver function and allow for faster care of preeclamptic women. Current work in the lab has been focused on utilizing amperometry to develop a quantitative assay for ALT via a coupled enzyme reaction that generates a current measurable by a handheld glucometer. Recently, the lab team has managed to successfully develop the assay inside a test tube and able to verify whether all the reactants reacted as expected through the multiple reaction steps. The lab team has shown that ALT successfully catalyzes the main reaction to produce a product that continues to react with lactate dehydrogenase and NADH to generate ions in 10 to 15 minutes.

QUALITY CONTROL OF MALARIA RAPID DIAGNOSTIC TESTS

The investigation began with the Zanzibar Malaria Elimination Program (ZAMEP) in order to learn about current malaria control methods as well as the procedures for quality control of malaria rapid diagnostic tests (mRDTs). From here, the investigation branched out to health facilities around Zanzibar to collect data on mRDTs being administered in real-time. In total, three antenatal care health facilities were visited in 3 day periods. At each facility, an iPhone 6 camera was used in conjunction with a ProScope Micro Mobile microscope attachment to obtain six images of each mRDT before and after administration. For each mRDT, the runtime of each test was recorded along with any user errors as per guidelines from the World Health Organization in order to account for and identify outliers. A total of 1,284 images were captured on 107 mRDTs. The aggregated database will now be analyzed to determine if there are any significant and quantifiable differences between any groups of individual mRDTs.



MATERNAL HEALTH & LIVER FUNCTION MONITORING IN ZANZIBAR

In severely preeclamptic women, liver function tests (LFTs) and renal function tests (RFTs) are necessary for organ damage monitoring. LFTs are done in a laboratory setting using a chemical autoanalyzer. However, we found that between Unguja and Pemba Mnazi Mmoja Hospital was the only public facility that had a working clinical chemistry analyzer. Even so, they were often out of reagents. We spoke to doctors, laboratory technicians, and maternal patients in order to determine an affordable price point for our device, to identify the ideal end user, and to record the main barriers expecting mothers have in accessing care. Given the severity of the condition our device would be monitoring, ideally it would be implemented as a bedside test at tertiary care centers.



STUDENT VOICES

“This summer, I had the unique opportunity to learn about the maternal health care system in Zanzibar, Tanzania by engaging in dialogues with patients, physicians, and health leaders. Our questions were simple: ‘What are the delays in maternal health within the public sector, and how can we construct technological solutions to address these challenges?’ The perspectives that were gained have been invaluable in understanding the larger issues that affect the landscape of maternal health in Sub-Saharan Africa and in shaping development of our own point-of-care device for liver function.”

SAREM RASHID, B.S BIOMEDICAL ENGINEERING '18



MESSAGE FROM THE DIRECTOR

Dear Colleagues and Friends,

I am delighted to share with you our latest newsletter. It is our modest way of connecting with you all and sharing with you the exciting work going on in the program. Entirely driven by student enthusiasm and creativity, I hope this newsletter will give you a sense of ambitious and audacious projects carried out by our students. In the last quarter the student teams worked both in the lab and in the field. The work carried out by the students in Zanzibar integrates our key mission of design, innovation and contextual understanding of grand challenges in global public health. In addition to our work in device design, students also worked closely with policy makers and public health professionals in Zanzibar to understand the awareness, supply chain and capacity issues that are critical to providing quality care. From mathematical modeling to image analysis to device design, the work of PGHT students demonstrates a fundamental commitment to rigor, multi-disciplinary understanding and focus on impact on the society. I hope that you will continue to be a part of our journey and continue to engage with us in our pursuits to shape a better world through knowledge, understanding and innovation.

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