



PARTNERSHIP FOR GLOBAL HEALTH TECHNOLOGIES

SEPTEMBER 2017, ISSUE 6

OUR VISION

The Partnership for Global Health Technologies (PGHT) is a collaboration between medical students from the State University of Zanzibar (SUZA), Mnazi Mmoja Hospital, Muhimbili University, 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 East Africa.



The lab team is currently working to design an affordable and robust diagnostic to address pre-eclampsic liver failure. This semester, they focused on testing and validating their assay in the lab.



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. Following submission of our first manuscript on the project, the modeling team is now focusing on modeling how access to material and human resources at Mnazi Mmoja Hospital impacts maternal morbidity and mortality.

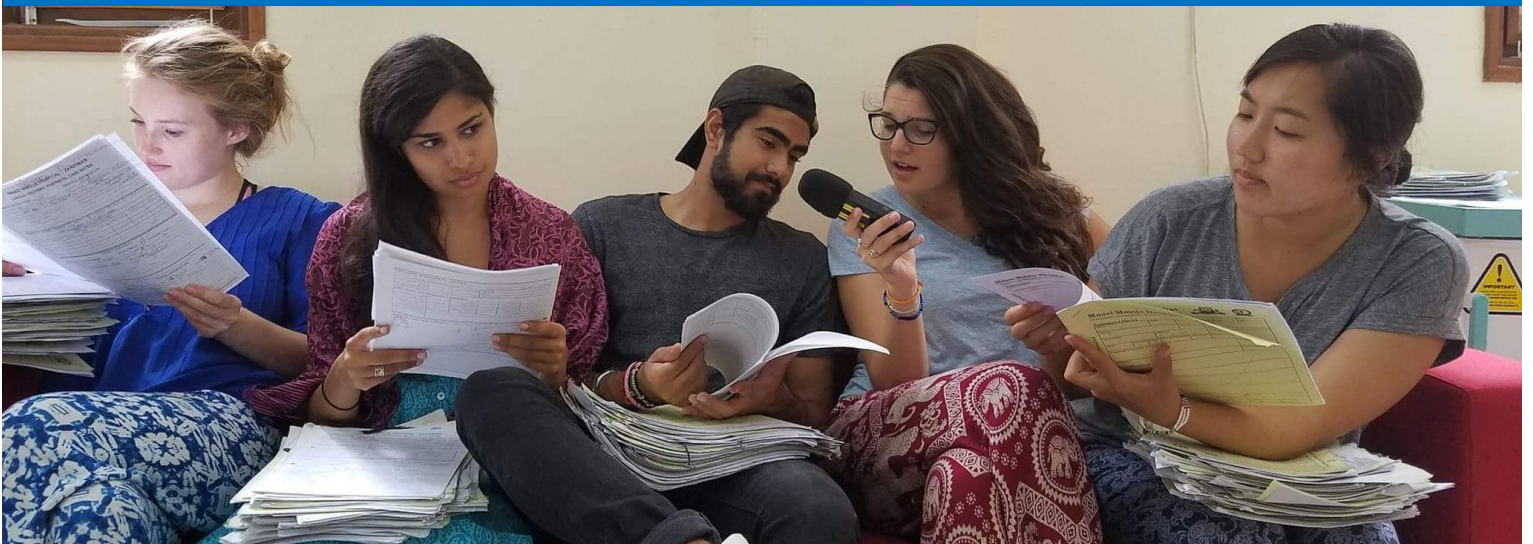


The quality control team is examining image processing techniques to distinguish between quality and defective malaria rapid diagnostic tests (RDTs) . This semester, they began using Python to develop techniques for image recognition.



MATHEMATICAL MODELING OF MATERNAL HEALTH AT MNAZI MMOJA HOSPITAL

The modelling team made good progress while in Zanzibar this summer. Tasked with gathering data that would make the model location specific and hence a more powerful tool for policy change, our strategy was to use patient records to extract the information we needed. Though our approach was sound and we hit the ground running, accomplishing all the logistical and administrative requirements, we were definitely surprised once we began reading patient records. The differences between healthcare in places like the United States and Zanzibar was unexpected for many of us. From reading through patient records it became clear that the staff was stretched thin and material resource shortages were often, despite this we were optimistic that the records still contained valuable information. We dedicated ourselves to going through patient records, organizing and digitizing them. This entailed using a scanning app to convert the hand-written records to PDF format allowing them to be accessed anywhere. This digitization also allowed us to create a database which will allow us to analyze the large number of records and filter information to calculate probabilities on a variety of things, such as incidence rates for a number of conditions or the probability of mortality from one of these conditions.

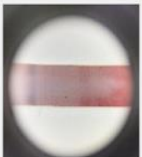




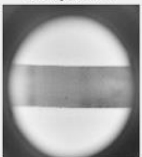
Middle of Test Strip



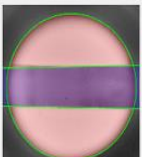
Distorted



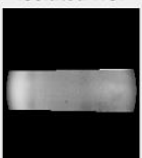
Grayscale



ROI selection



Isolated ROI



QUALITY CONTROL OF MALARIA RAPID DIAGNOSTIC TESTS

The Quality Control (QC) group working on Malaria Rapid Diagnostic Tests (mRDTs) had a productive summer carrying out data collection at the District Hospital in Bagamoyo, Tanzania. The goal of data collection was to capture a series of images for each mRDT under controlled conditions for the duration of the test. Samples for microscopy and PCR were also collected in order to help verify the results of the mRDT diagnosis as well as identify possibly discrepancies due to misdiagnoses. In total, 210 mRDTs were imaged and 1,284 images collected. The goal for this upcoming semester is to use image processing techniques and data clustering algorithms on the images collected in order to distinguish between proper and defective mRDTs. This will ultimately allow the team to make progress towards creating a non-destructive method for assessing the quality of mRDTs that can be performed at the point of care.

MOBILE ACUTE OBSTETRICS BOARD APPLICATION DEVELOPMENT

In the Spring of 2017, the PGHT team began a collaboration with Dr Benoit Jacod and Tanneke Herklots to develop a Mobile Acute Obstetrics Board app for Android (with plans port to iOS). This tool will help medical staff at Mnazi Moja Hospital manage patient flow through their wards from admission to outpatient by allowing doctors and nurses to sort patients by severity level, set individual patient alerts for timely status updates, and foster medical staff accountability by keeping a log of actions. Most of the major functions have been implemented over the summer (patient entry, patient database, patient alerts). A working prototype is scheduled by the end of the year.

The screenshot shows the mAOB App interface on a mobile device. At the top, the status bar shows 4G signal, battery level, and time 1:46. The app title 'mAOB App' is in a blue header. Below it, a patient ID 'MXXXXXXXXXX-01' is displayed. The form includes fields for 'Gravida: 1', 'Para: 0', and 'GA: 22'. The 'Reason for Admission' is set to 'Labour'. Under 'Risk Factors', there are checkboxes for 'Hb' (7-10, <7), 'C/S' (1, 2+), 'Fetal' (Twins, Breech, Preterm), 'History' (P 5+, PPH), and 'Referral' (Yes, No). The 'Breech' checkbox is checked. A 'Comments' section is at the bottom with a 'SUBMIT' button.

Gravida: 1		Para: 0		GA: 22	
Reason for Admission: Labour					
Risk Factors:					
Hb	C/S	Fetal	History	Referral	
☒ 7-10	☒ 1	☐ Twins	☒ P 5+	☒ Yes	
☐ <7	☐ 2+	☒ Breech	☐ PPH	☐ No	
		☐ Preterm			

Comments

SUBMIT

POINT-OF-CARE LIVER FUNCTION MONITORING

This past summer, the team continued work on a liver enzyme test, here at Boston University. We continued to characterize the coupled reaction involving AST- an enzyme elevated when the liver is damaged. We primarily focused on the second half of the coupled reaction in which one of the products of the AST reaction, glutamate, is oxidized by glutamate dehydrogenase. Therefore, we are currently in the process of determining the optimal glutamate, NAD⁺, and enzyme concentrations needed to observe the reaction via absorbance spectrometry within the time frame desired. Ultimately, we hope to take the product of this reaction and oxidize it with the ferricyanide ion- measuring the current increase of this reaction via cyclic voltammetry. In the end, we will determine a relationship in which when we observe a current reading on a voltammeter, we can determine the amount of AST present. Once we finish characterizing the AST reaction, we hope to start designing the device in which we aim to measure both AST and ALT enzyme levels for an accurate assessment of liver function in patients with preeclampsia.



LIFE IN ZANZIBAR

I had left Boston almost 72 hours before, and in that time I had slept maybe 10 hours total, the only two words of Swahili I knew were Asante (thank you) and Urojo (a traditional Zanzibar soup), yet here I was in a house about a 20 minute drive from Stonetown, surrounded by 2 dozen people who I could only assume were relatives of my host family. On the way, my host father had explained that the event was a birthday party, for a relative of my host mom. At that point I felt confused and very far from home. Flash forward 6 weeks to my last morning in Zanzibar, I had said goodbye to my host mother already, as she left for visiting relatives. The nanny, Nadia, had given me my favorite foods for breakfast: chapati and fresh watermelon. In those six weeks, my Swahili had much improved, thanks to our wonderful instructor at SUZA, Fatma. I was able to thank Nadia for everything, tell her that she was a great cook, and that I would miss her and the rest of my family. She asked if I would return to Zanzibar - my response: Ndiyo (yes).

In 6 weeks, I along with 8 other PGHT students were able to immerse ourselves in the rich Zanzibari culture. Although our host families spoke varying levels of English, we each formed a strong bond with these people who opened our home to us. We tried many new foods and two group favorites were clear: chapati and Urojo. We were able to visit many different tourist spots, including beautiful beaches and my personal favorite: a giant tortoise sanctuary. While all these sights were amazing in many ways, it was the everyday experiences which stood out to me. We became friends with an employee in one our favorite lunch spots, we got to know our student collaborators at SUZA, and we practiced Swahili with waitresses at a nearby cafe (we also ate more slices of date cake than I think any of us wants to count). Host families provided many of the best experiences of Zanzibari life: one student recount the nightly conversations with his host mom every morning when we met at the hospital. I attended the birthday party on my first night, and later a family wedding, which may have been one of my favorite nights in Zanzibar: I spent time with Nadia and my host mother as we listened to a chorus sing and watched the beautiful bride process into the room. My host aunt asked whether I was understanding the event: I responded that I did not understand the words, but I understood the emotions. She said that was good. I was so grateful to have spent 6 weeks with such an amazing family, a wonderful teacher, my fellow students, and our collaborators at SUZA and MMH. As I was about to leave, my host father asked if I wanted to see what the construction in the building was, he then showed me into the room that when i had arrived was an undeveloped storage space, it was now a small apartment - just a bedroom and bathroom, adjoining the family apartment. Now, he said, you can come visit us again.

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MESSAGE FROM THE DIRECTOR

Dear Friends of the PGHT Program,

This past summer was our most exciting and rewarding summer program.

First, this summer, we welcomed two students, Hakeem Angulu (Harvard) and Megan Calfas (Stanford), to the program. Both of the students came from partner HHMI programs and added tremendous richness through their creativity, perspective and motivation. We hope that in the future, we will continue to welcome more students from other institutions and benefit from their experience.

Second, we added a second site in Bagamoyo this year. Students in the Bagamoyo site worked closely with colleagues at Muhimbili University of Health and Allied Sciences (MUHAS) and worked on deploying our system to test malaria diagnostics.

Third, our Zanzibar team, for the first time worked with not only with the students at State University of Zanzibar but also physicians and staff members at Mnazi Mmoja Hospital, and collected vital data on both the clinical and socio-economic drivers of maternal mortality and morbidity. Teaming up with colleagues from Utrecht in Netherlands, this group has developed a first systems level map of maternal health at the hospital and is already in discussions with the local ministry of health for future and sustained partnership.

Our program continues to grow and our results continue to excite us, but the biggest success of our effort is the impact it has on our students. Our students go to our field site with passion, and come back from the program more engaged and even more eager to make the world a better place through innovation, understanding and an unwavering commitment to tackle some of the most complex challenges of our time.

We hope that these young ambassadors will forever be the agents of positive change in all of their spheres of interaction and influence.

I look forward to your continued support, mentorship and partnership.

Yours,

Muhammad

MUHAMMAD H. ZAMAN

HOWARD HUGHES MEDICAL INSTITUTE PROFESSOR

Generously Supported By:



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