TECHNOLOGY AND MATERNAL CARE IN ZANZIBAR
2015 BASELINE ASSESSMENT
Sara Gravelyn, Boston University

INTRODUCTION

Improving maternal mortality is one of the United Nation's Millenium Development Goals (MDGs), yet it continues to be a preventable cause of death that disproportionally affects developing countries. While Tanzania has made significant progress towards meeting MDGs for child mortality, the maternal mortality ratio seems to have stagnated, with only minor improvements since the MDGs were set forth in 1990.

Zanzibar has seen greater improvement than the mainland, but neither will reach their 2015 MDGs. The fact that maternal mortality in Zanzibar is not consistently decreasing, even slowly, is concerning. Though data in Zanzibar is hard to come by and often unreliable, data from the Health Management Information Unit within the Ministry of Health shows that while institutional MMR dropped as low as 221 per 100,000 live births in 2012, there was a sharp increase with numbers as high as 310 per 100,000 in 2013.  

<table>
<thead>
<tr>
<th>Tanzanian MMR (PER 100,000 LIVE BIRTHS)</th>
<th>Mainland</th>
<th>Zanzibar</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>454</td>
<td>279</td>
</tr>
<tr>
<td>TARGET 2015</td>
<td>133</td>
<td>170</td>
</tr>
</tbody>
</table>

Source: Tanzania MDG Report 2010

Boston University and the State University of Zanzibar (SUZA) aim to address some of the shortcomings in maternal care through the Global Health Technologies Program. Thanks to a grant from Howard Hughes Medical Institute, engineering students from Boston and medical students from SUZA will collaborate on a research project with the final goal being the creation of an affordable and reliable medical device that is relevant and useful in Zanzibar and beyond. Summer of 2015 marked the inaugural trip to Zanzibar to begin field research. Due to limited time, the 2015 trip focused only on the largest island of the Zanzibar Archipelago, Unguja.

Based on pre-departure literature review, anemia, postpartum hemorrhage (PPH), and pre-eclampsia were identified as the greatest health problems facing mothers in Zanzibar. Anemia rates in Tanzania are considered critical with four in ten women experiencing some level of anemia. These rates are even higher in Zanzibar, particularly in Unguja North and Pemba North where percentages are as high as

---

62% and 64% of women with anemia respectively. Hypertensive disorders in pregnancy, including pre-eclampsia, and hemorrhage were the leading causes of maternal death in 2012 and 2013. Though research was not limited to these conditions, there was a focus on confirmation of their prevalence and data collection that will aid in addressing them.

**METHODS**

The aim of the collaborative project between Boston University and SUZA is to identify the greatest challenges facing maternal care in Zanzibar, determine a feasible technological intervention appropriate for the local population, and create a device to aid in the reduction of maternal deaths. The principal purpose of this research trip was to conduct a baseline health assessment. Interviews were conducted across Unguja at a variety of hospitals, including the only referral hospital, cottage hospitals, and smaller community hospitals to get a true understanding of current conditions and identify areas for possible improvements. Only by truly appreciating the situation on the ground can a suitable, sustainable solution be implemented. A total of seven health facilities were visited: Mnazi Moja Hospital (MMH), Rahaleo Reproductive and Child Health (RCH) Clinic, Mwembeladu Hospital, Makunduchi Cottage Hospital, Kivunge Cottage Hospital, Bumbwinini Hospital, Fuoni Hospital. Other than Rahaleo, which only operates as a clinic, interviews were conducted with staff from both the antenatal/RCH clinics as well as the maternity ward/delivery room. Additionally, the research team went into the community near Fuoni Hospital to speak with traditional birth attendants (TBAs), and TBAs from the surrounding area came to Bumbwinini Hospital for interviews.

Three teams of two students, one from each university, interviewed mothers and health workers. All interviews with mothers and TBAs were conducted in Swahili, with English translation provided by SUZA students. Interviews with health workers were conducted in English and Swahili, depending on the English proficiency of the interviewee. Four different question sets were prepared for mothers, lab technicians, TBAs, and other health workers including doctors, public nurses, nurse-midwives, and midwives. All questions were related to maternal care and treatment, but were tailored to obtain more specific information from the different groups.

Questions for mothers aimed to find the biggest barriers to good health faced by local women. They focused on the decision to access care as well as determining the major health conditions and behaviors of pregnant mothers in Zanzibar.

The intention of interviews with doctors, nurses, and midwives was to appreciate the conditions of local hospitals and better understand where improvements were

---

3 Tanzania Maternal Child Health and Nutrition Atlas: Data from the 2010 Tanzania Demographic and Health Survey. p. 17.
possible. Health staff was asked about the major challenges in maternal health on the Island as well as the principal health conditions seen in pregnant mothers.

Interviews with laboratory technicians were conducted to learn about current diagnostic methods available in Zanzibar. Questions aimed to understand the testing process as well identify possible barriers faced by both mothers and the laboratory staff such as cost and resource shortages.

Traditional birth attendants were interviewed to get an idea of why women are choosing to deliver at home rather than the hospital. Interviews also focused on training and tools used by TBAs, as well as traditional medicines used by local women.

The question sets for each group interviewed are included in the appendix of this document.

RESULTS

<table>
<thead>
<tr>
<th>UNGUIA INTERVIEW SUMMARY</th>
<th>BUMBWINI</th>
<th>FUONI</th>
<th>KIVUNGE</th>
<th>MAKUNDUCHI</th>
<th>MNAZI MOJA</th>
<th>MWEMBELADU</th>
<th>RAHALEO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTHERS</td>
<td>12</td>
<td>22</td>
<td>9</td>
<td>11</td>
<td>36</td>
<td>19</td>
<td>7</td>
<td>116</td>
</tr>
<tr>
<td>DOCTORS</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>NURSES/MIDWIVES</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>11</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>LAB TECHNICIAN</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>TBAS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>HEALTH WORKERS</td>
<td>7</td>
<td>10</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>5</td>
<td>56</td>
</tr>
</tbody>
</table>

A total of 116 mothers were interviewed at seven facilities across Unguja. There were 40 interviews conducted with health workers: 25 with doctors, nurses, and midwives, seven with lab technicians, and eight with TBAs. As some interviews were group interviews, the research team spoke with a total of 56 health workers across the seven facilities and the communities surrounding Bumbwini and Fuoni Hospitals.

MOTHERS
Complications found in interviews with mothers were consistent with pre-departure research. Anemia was the most prevalent condition found, present in 27 of the 116 women (23.3%). Hypertensive disorders, including pre-eclampsia and eclampsia, were the second most common condition, present in 16 women (13.8%). There were 14 women (12.1%) who experienced obstructed labor or required a cesarean section and seven women (6%) experienced either antepartum or postpartum hemorrhage.
Many women are attending antenatal care and the majority of the women interviewed attempt to attend the four recommended visits. Very few women attend the clinic early in pregnancy. Only seven of the women interviewed started receiving antenatal care (ANC) in the third month of pregnancy. The majority of the women interviewed started ANC at four or five months, but many waited until their sixth or seventh month to come to the clinic.

All women reported receiving regular testing at the clinic, which includes a physical examination, blood pressure measurement, a urine test, and blood tests for HIV, malaria, and Hb level. Depending on the clinic, women also had blood group and blood sugar tested. Few women reported routine ultrasounds. Women who had received ultrasounds had typically been ordered to receive one due to suspected complications.

Transportation was the most frequently noted barrier to care for mothers. Cost of transportation, cost of diagnostic testing, and cost of required supplements also impeded continuity of care for the women interviewed.

Health Workers
Health workers also identified anemia, hypertensive disorders, and PPH as the major health problems faced by mothers they treat in their facilities. Of the 25 interviews conducted, anemia was the most frequent condition mentioned with 19 health workers stating it was a chief problem in pregnant mothers. Hypertensive issues in pregnancy, including pre-eclampsia and eclampsia were mentioned as major problems seen in pregnant mothers in 17 interviews and PPH in seven. When asked the number one problem faced by mothers in Zanzibar, anemia was identified by 16 of the 25 providers, hypertensive disorders by four, and PPH by four. One provider did not identify the greatest health condition faced by mothers.

Anemia is treated with ferrous sulfate and folic acid supplements. They are provided for free to the mother unless there are stock outs, in which case the mother must use her own funds to purchase them from a private pharmacy. Hemovit is also sometimes prescribed but must be purchased at the pharmacy. Women are also advised to modify their diet. If anemia is severe (Hb less than 5 g/dl) a blood transfusion is usually given. If the facility cannot handle the transfusion or is out of blood, the patient is referred to MMH.
Hydralazine and other antihypertensive drugs are used to control pre-eclamptic patients. The biggest complaint with hydralazine is that the patient must be closely monitored when the drug is administered, which is not always possible with limited staff. Magnesium sulfate is injected if eclamptic convulsions begin.

Oxytocin is the common drug used to induce labor as well as to control severe bleeding after delivery. Kivunge and MMH use oxytocin to induce labor, but use misoprostol for PPH.

Health workers were interviewed regarding the greatest challenges in caring for pregnant mothers and the greatest failures in maternal care. Interview subjects stated many obstacles, but unanimously agreed that staff and equipment shortages were the greatest barriers to providing quality, reliable maternal care. Health education was continuously mentioned as a failure in current treatment methods, especially at the community level.

Delivery kits were the most commonly mentioned item in short supply, followed by baumanometers. Most baumanometers are automated and battery operated. Doppler fetal heart rate monitors, a suction to clear the infant’s airway, and additional Hemocue machines or other, more accurate methods of anemia testing were also commonly mentioned items needed in hospitals.

Facilities receive new drug supplies every three months, but nearly all report their supplies lasting for only one to one and a half months. This is attributed to overcrowding at the health centers. Supplies are sent based on the designated coverage area of the hospitals, however due to perceived quality of care or possibly due to shortages at other centers, hospitals treat numerous patients from outside their coverage areas.
LABORATORY TECHNICIANS

The laboratory technicians confirmed the testing mothers stated receiving during ANC visits. Urinalysis is free at Makunduchi, but typically costs range from 500-1,000 TSH for the patient. The test consists of visual examination, microscope examination, and chemical test strip and can be done in minutes. Strips are readily available, come in bottles of 20, and expire six months after the bottle is opened. The bottle of strips is available for as little as 10,000 TSH but different brands can be as much as 22,000 TSH.

The most common method of testing Hb levels found is the use of Hemocue. The test can be completed in as little as three minutes. It can be plugged in but has battery backup, which is important with frequent electricity cuts in Zanzibar. At almost all facilities patients pay 2,000 TSH for the test. Makunduchi offers the test for 1,000 TSH and Bumbwini gives a 500 TSH discount in the RCH Clinic, charging mothers 1,500 TSH. Rahaleo has a test option in addition to Hemocue, the Emission Plus, available for 1,000 TSH. Fuoni is the only hospital visited not using Hemocue, and instead using test strips. The biggest issues identified with Hemocue are cost to patients, shortages of reagents, and shortages of micro-cuvettes for blood collection. The micro-cuvettes cost 55,000 TSH for a pack of 50. They are expensive, hard to obtain, and difficult to keep in stock.

Fuoni and Mwembeladu use Glucoplus to test for blood sugar. It is a one-minute rapid test and costs the patient 1,000 TSH. There are no issues with the functioning of the Glucoplus, however there are problems with test strip stock outs.

Malaria and HIV testing are done via rapid tests and take about 15 minutes to display the test result. They are free for the patient, paid for by the Ministry of Health. Other common diagnostics available included rapid syphilis testing, widal test for typhoid, and sputum tests for tuberculosis. Blood group was tested at most facilities, but Bumbwini had no test for blood group.

TRADITIONAL BIRTH ATTENDANTS

Eight TBAs were interviewed in the areas surrounding Bumbwini and Fuoni Hospitals. All TBAs used gloves and used a new razor blade and thread to cut the umbilical cord. The razor blade is usually boiled and one TBA even boils the thread. The mother is responsible for bringing the blade and thread, and sometimes is required to bring mackintosh sheeting. A kanga is used if there is too much bleeding.

The majority of TBAs interviewed use some kind of traditional medicine to induce labor or clear out the uterus after delivery. Some of the traditional herbs used to induce labor are lemon roots, mchunga, and mzalia nyuma, and after labor barika, mtule, and mudim msitu are used. Ginger is mixed with water and used in paste form for tears and also in tea for bleeding. One TBA said she did not use traditional medicine with pregnant women as it caused miscarriages. If a woman came to her who had used traditional medicines, she could help her deliver, but she may lose the ability to reproduce in the future. She said she only used traditional medicine if a
spirit was disturbing the mother. She described pre-eclampsia and eclampsia as a spirit trying to play with the woman, and said to cure it she put *mpachu* and *majani ya vitungu swaumu* in charcoal and let the smoke enter the woman and chase the spirit away.

Almost all of the interviewed TBAs had attended at least one training seminar at the hospital. One did not attend training, but had learned additional skills from her stepmother who was a doctor. TBAs estimate they are assisting with approximately two to three deliveries per month. One woman used to see as many as three to four deliveries per day. All TBAs interviewed recommend women go to the hospital to deliver. They only assist in deliveries if there is insufficient time to safely get to a facility.

**DISCUSSION**

**MOTHERS**

As with any interview, data is subject to the responses received by the interviewee. Most mothers said they took prescribed supplements every day, though some did mention side effects such as nausea. Providers however, frequently mentioned patient noncompliance with prescribed supplements as a major problem. Many mothers also said they experienced no complications during pregnancy. Sometimes this was true, although sometimes after further probing or asking specific questions about blood pressure or Hb level, complications were identified. Subjectivity is further complicated as data was recorded as translated responses. Often long responses from mothers were reduced to a short summary in translation.

The majority of the mothers interviewed were from RCH clinics. While the information received was still useful, the best data came from mothers in the maternity ward. These women could give a better picture of their entire experience, including the total number of ANC visits and complications experienced during pregnancy and delivery. Interviews from RCH clinics skewed data on number of ANC visits as some women were in the middle of their pregnancy. For this reason, number of ANC visits was generalized in this report instead of giving concrete numbers.

For both mothers and health workers, new questions arose as a result of initial interviews that were not on the original transcript. The research team felt these questions were important to ask going forward, and they have also been noted in the appendix.

**HEALTH WORKERS**

One issue that came up throughout interviews was cost and availability of ultrasound. There are few ultrasound machines available, and many facilities borrow the machine from MMH for one day per month. There are also limited health workers who can operate the machines. The test ranges from 7,000-10,000 TSH,
which is a major barrier for most women. Currently ultrasound is not done as a routine test in Zanzibar, rather only when complications are suspected.

Management was only specifically mentioned by one provider as a major barrier, but is an overarching issue that affects all aspects of the health system. Equipment shortages are ubiquitous. The equipment that is available is not maintained, and is used until it is in a state of disrepair. Interviewed health staff said that sometimes there are not even working light bulbs in the operating theaters, forcing them to do cesarean sections with very limited light. One machine in the clinical chemistry lab at MMH has been out of order for over three months due to the need for a new light bulb.

Staff shortages and overcrowding are evident. It was not uncommon to interview multiple mothers occupying the same bed. At MMH the head midwife said they sometimes have up to five mothers in one small bed, and one mother interviewed delivered alone as there were no health workers around when her baby was coming.

MMH especially is extremely overburdened, as it is the only referral hospital on the island. Reliable sources inside the hospital put MMR at MMH as high as 529 per 100,000 in 2013. Many hospitals only deliver the second through fourth child as the first pregnancy and fifth and beyond are considered high risk. The majority of PPH cases are transferred to MMH. Not only is MMH getting all high risk cases, most of the transfer patients they receive are arriving in states of irreversible shock. Oxytocin is used at MMH to induce labor as it can be regulated, which is important before the child is delivered. For PPH, the primary goal is to start uterine contractions and misoprostol is preferred. Unlike oxytocin, misoprostol also does not require refrigeration.

LABORATORY TECHNICIANS
Most laboratories are small rooms with poor ventilation. The microscope is usually the only device requiring electricity as Hemocue can also operate on batteries. Most diagnostics are simple tests that can operate free of electricity. Any advanced testing is sent to MMH.

Test strips for anemia were not used at many of the centers visited, and one doctor interviewed mentioned the large distrust of anemia strips within the local health community. Due to numerous false positives and false negatives, doctors in Zanzibar do not trust the results of anemia strip tests, especially for pregnant mothers. Despite its issues, Hemocue appears to be the trusted standard.

Urinalysis is an extremely common test, yet none of the labs have collection containers for urine samples. They use whatever container they have available. One lab used empty IV fluid bottles to give to mothers for urine samples. The only consistently available containers for specimen collection are for sputum samples to diagnose tuberculosis.
The biggest issue in laboratories seems to be reagent stock outs. In MMH, the only electrolyte machine used by multiple departments has been out of order for over four months as it is out of reagents. The lab must request new reagents from the hospital store, the store then puts in a request with management, and management must get approval from the Director. To illustrate again lack of quality management, there is no working system in place to ensure that necessary reagents, drugs, and equipment are stocked in a timely matter in most facilities.

**Traditional Birth Attendants**
The TBAs attribute the drop in deliveries they are assisting with to more hospitals and better education of women. Though the numbers are down, home births in Zanzibar are still prevalent with facility delivery rates as low as 40% in parts of Unguja and 24% in Pemba North. The TBAs interviewed typically only assist in deliveries at home if there is no time to get to a facility, but still had some women who prefer to deliver at home due to privacy concerns. One TBA said if a home delivery is planned, women buy oxytocin at the pharmacy and bring it with them so they are prepared in case of an emergency. None of the TBAs had an emergency plan or had dealt with a true emergency situation. In the future, speaking with TBAs in remote communities that are not in close proximity to hospitals may provide a more accurate representation of home births in Zanzibar.

**Recommendations**
Due to time restrictions research was limited to facilities in Unguja. The research team was unable to visit Pemba Island, where health conditions and access to care are generally worse. Limiting interviews to facilities and clinics also largely excluded the women choosing not to participate in ANC. In the future, it will be beneficial to visit more rural areas, including Pemba, and speak with women in the communities. Community visits will give more information on behavior during pregnancy, specifically about ANC, as well as opinions on hospital delivery. It will also be beneficial to learn more about the prevalent health conditions and management of illness in the community, and if it differs from the results found in the hospital.

It is clear that quality, consistent health education is desperately needed in Zanzibar. An aggressive health education campaign that reaches women in the community is recommended, with emphasis on advising women to start ANC as soon as they suspect they are pregnant. From pre-departure research and interview results, it is uncommon for women to start clinic visits before 20 weeks of pregnancy. Though family planning is sometimes rejected in Zanzibar due to cultural reasons and fear of weight gain from contraceptives, efforts should be continued as lack of spacing between pregnancies increases the risk of PPH. Radio is likely the best method to reach communities. As simple cellular phones are abundant even in remote areas and local cellular companies already send daily promotional text messages, the

---

research team recommends also exploring partnerships with companies such as Airtel, Tigo, and Zantel to send public service announcements regarding maternal health via text.

Due to limited staff and unaffordability of some diagnostic testing, a rapid bedside test for diagnosis of renal and liver function would be of great benefit to health workers caring for mothers. Tests for renal and liver function are performed to diagnose pre-eclampsia, but according to staff at MMH, mothers must go private hospitals to receive the test. The private facility test price of 40,000 TSH makes it an enormous barrier to most mothers in Zanzibar. An affordable, rapid test would save health workers time and help them understand their patient’s condition at the point of care. It would also save mothers the huge cost burden of testing at private health centers. If successful, a rapid test could also have applications outside of the maternal health field.

Though testing exists for anemia, it is not always accurate and shortages of reagents and other items make testing unreliable. Another potential device is a more accurate rapid test for anemia that clearly indicates severity. Additionally, most facilities visited had shortages of baumonometers or issues with broken devices. A better design for measuring blood pressure that is extremely durable and resistant to conditions in facilities in Zanzibar would also be of great use.
APPENDIX

INTERVIEW QUESTIONS:

Health Workers (doctors, nurses, midwives):
• What do you see as the biggest barrier to maternal care?
• What do you see as the biggest health problem pregnant mothers face?
  o PPH, Anemia, Pre-eclampsia and eclampsia
• What risk factors lead to this problem?
• What is currently being done to treat it?
• What do you see as potential solutions/interventions?
• What is the biggest failure in the current course of treatment?
• Why do you believe so many women are still delivering at home instead of in the facility?
• Are women coming to the hospital for antenatal care?
• Have you seen devices or drugs that were not adopted by the population? Why?
*Additional Questions
  • Is ultrasound available at the facility? Is it routine? How much does it cost?
  • Are there devices that the facility needs but doesn’t have? (Biggest equipment shortages)

Mothers:
• How many antenatal visits did you attend?
  o If no, why?
  o If yes, what type of care did you receive?
• Did you have any complications during your pregnancy?
  o If yes, which kind? Did it influence your decision to deliver at the hospital?
• In regards to accessing and receiving care, what was the most difficult part of the childbirth process for you?
• Why did you choose to deliver in the hospital vs. at home?
*Additional Questions
  • What month did you start ANC?

Lab Staff
• What kind of lab screenings/tests are done for pregnant women?
• What kind of device is used for the screenings?
• What resources are required to operate the device (electricity batteries, etc.)?
• What is the cost of lab services?

TBAs
• How did you learn your craft/how long have you been practicing?
• Have you received any formal training?
• What tools do you use to assist in delivery?
• Do you use traditional medicine?
• What are your emergency procedures?
• How many deliveries do you assist with each month?
• Why do women choose to deliver at home instead of the hospital?