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Executive Summary

In 2016, WHO reported that an estimated 33% of all deaths in Tanzania resulted from NCDs, with 17% being from cardiovascular diseases including Rheumatic Heart Disease (RHD). Supported by a 5-year, $1.25m grant from Medtronic Foundation, Touch Foundation leveraged its long-term relationships in Tanzania’s Lake Zone to design a blueprint for an RHD identification and referral program that empowers and supports people and communities affected by RHD by establishing key systems and services, increasing access to critical medicines and technologies, and supporting health workers and decision makers.

The 3-phase program followed an iterative process:

Phase 1 of the program focused on carrying out a holistic assessment of the Tanzanian RHD continuum of care. The review illustrated a number of challenges around RHD service provision, most critically low RHD awareness (among both patients and providers), inconsistent uptake of health services by patients, as well as a lack of knowledge of the disease burden.

In response to these learnings, and working alongside regional and national health stakeholders, the program focused in Phase 2 to establishing a view of Lake Zone RHD prevalence, whilst testing initiatives that would allow routine, sustainable RHD identification and referral closer to the community. These initiatives focused on training non-specialist Healthcare Workers (HCWs) in simple echocardiography, the goal being to embed RHD screening into existing clinical routines at lower-level facilities (Health Centers and District Hospitals), which would streamline referral. The program also started to design and implement a fit-for-purpose data collection application and real-time data visualization dashboard to improve data capture and analysis.

Finally, based on key findings – particularly the lack of RHD hotspots –, Phase 3 sought to refine and package the tested activities in order to establish a replicable blue-print (referred to as a “Demonstration Project”) for establishing RHD screening routines in existing lower-level health system offerings in order to bring services closer to the community. Using already established clinical routines (Antenatal Care (ANC) clinics) as a vehicle, and supported by technologies that balance modern IT advancement with understanding of the Tanzanian context (e.g. portable ultrasounds, app-based data collection and visualization), the Demonstration Project illustrated how low cost, wide-reaching RHD service provision could work in a low-prevalence context.

If owned and scaled by the Government of Tanzania (GoT) or their partners, the program can ensure comprehensive and sustainable improve-ments for RHD identification, referral, and ultimately improved NCD care in Tanzania.

Touch Foundation would like to thank Medtronic Foundation and the wider RHD Action network for supporting RHD efforts in Tanzania.

Program Background and Objectives

In 2016, the World Health Organization (WHO) reported 59.9 million deaths globally, of which 71% (40.5 million) were due to non-communicable diseases (NCDs)\(^1\). Cardiovascular diseases account for the majority (44%) of those deaths associated with NCDs. The global health community is increasingly focused on NCDs as mortality continues to grow in low- and middle-income countries, where approximately 85% of reported NCD deaths occur\(^2\).

In these regions, socioeconomic and environmental factors such as poor housing, poor nutrition, overcrowding, and poverty contribute to the burden of NCDs\(^3\).

Rheumatic heart disease (RHD) is an NCD characterized by heart valve damage caused by repeated episodes of acute rheumatic fever (ARF), an autoimmune inflammatory reaction to a throat infection caused by group A streptococci (GAS) (streptococcal pharyngitis)\(^4\). Approximately 30 million people globally have been diagnosed with RHD\(^5\). In 2015, an estimated 305,000 deaths were due to RHD, and 11.5 million disability-adjusted life years were lost\(^6\). Unfortunately, the lack of reliable data and diagnostic capabilities in many parts of the world means that the burden of RHD described here is likely underestimated.

Tanzania is the largest country in East Africa, with
an estimated population of 58.5 million\textsuperscript{vii}. The average yearly household income is TZS 1.4 million\textsuperscript{iv}, or approximately $50 USD per month. Despite having the largest population in East Africa, Tanzania has the lowest population density, and more than two-thirds of the population live in rural areas\textsuperscript{iii}. In 2016, WHO reported that an estimated 33% of all deaths in Tanzania resulted from NCDs, with 17% being from cardiovascular disease\textsuperscript{vii}. The socioeconomic costs of RHD are high, as the disease is predominant among youth and the most commonly acquired heart disease in children, thus affecting members of the population in their most economically productive years of life.

Additionally, complications of cardiovascular disease are also a significant contributor to maternal and newborn mortality in Tanzania. A study at Muhimbili National Hospital in Dar Es Salaam identified RHD as the cause of cardiac disease in 17% of pregnant mothers with the condition\textsuperscript{viii}. Deaths from RHD are preventable with established medical knowledge and health care delivery. However, health system weaknesses and low resources in Tanzania contribute to an ongoing burden of death and disability.

The objective of this five-year program, implemented by Touch Foundation during the 5-year Medtronic Foundation grant period (2015-2020), was to design and test a blueprint for an RHD identification and referral program that could be implemented at lower level facilities, thus bringing specialist care closer to the community (Figure 1).
PROGRAM APPROACH: NEEDS ASSESSMENT, TESTING, AND SET-UP OF A SCALABLE APPROACH

To ensure a consistent and coordinated global approach, Touch Foundation and other international partners in the Medtronic Funded RHD Action group developed an RHD approach provided support to communities, enabling screening closer to patients’ communities while simultaneously contributing to educating community and schools (Pyramid: People and Communities). Moreover, the program delivered essential technologies to support RHD identification and referral, including echocardiography, while also supporting strep throat diagnosis and management (Pyramid: Essential Technologies). Additionally, Touch promoted a health systems approach and a focus on reproductive health, embedding the RHD project into our existing maternal health program, M-Mama (Pyramid: Systems and Services). The implementation approach included three key steps, as outlined in Figure 3.

In Phase 1, a needs assessment was conducted to provide an effective baseline view of the Tanzanian RHD context. This included collaboration with the Tanzania National Institute for Medical Research (NIMR) to administer a structured, community-level assessment on Group A Streptococcus (GAS), Acute Rheumatic Fever (ARF), and RHD awareness, education, and health-seeking behaviors, as well as the provision of core screening and treatment services. Touch Foundation used the outcomes and learnings from Phase 1 to develop and test a number of specific activities aimed at addressing the most

Figure 2
challenging gaps in the Tanzanian health care system. Phase 2 included upskilling non-specialist healthcare workers (HCWs), beta-testing an RHD patient registry, and identifying medical devices that could enable NCD screening at lower-level facilities. It was also supported by a screening program to understand Lake Zone RHD prevalence.

In Phase 3, the program leveraged the learnings of the testing phase to design a scalable and cost-effective RHD identification and referral program. Built around a structured, 8-week training program for non-specialist HCWs, and supported by critical portable echocardiographic and ultrasound technologies, the program proposed to embed RHD screening services within previously established healthcare routines at lower-level facilities (Ante- and Post-Natal Care clinics (ANC/PNC)). Not only does this approach allow for routine screening of large patient numbers closer to home, it also does not require significant resources after the initial set up and training investments.
**Conduct Baseline Needs Assessment**

**OVERVIEW**

Touch worked with the Tanzania National Institute of Medical Research (NIMR), national and international RHD stakeholders including Medtronic, and RhEACH to design and develop tools to assess the RHD control needs within the RHD continuum of care, from a patient's perspective. Touch incorporated a health system strengthening perspective in the implementation plan, leveraging relationships formed through other ongoing Lake Zone programs.

Touch Foundation, along with the BMC Department of Community Health and NIMR, utilized a site selection tool to assess whether establishing an RHD identification and referral program would be appropriate for the Sengerema district health system.

In addition to this, we employed other procedures – such as direct observations, interviews, and qualitative analysis of local conditions – to conduct a baseline assessment of Sengerema District. This was split between a population assessment (survey of 347 households with 2401 participants) to map socio-economic data, as well as a health facility assessment survey of 17 health facilities (1 hospital, 5 health centres and 11 dispensaries) to understand RHD service provision.

**ASSESSMENT FINDINGS**

The findings across each area are further described below, using – where possible – quotes from community members, patients, and HCWs to illustrate the realities of the Tanzanian context.

**I. LOW AWARENESS OF AND ABILITY TO DIAGNOSE AND TREAT GAS, ARF AND RHD AMONG LOWER-LEVEL HCWS**

We identified several challenges that hinder the early diagnosis of RHD and other NCDs by lower-level HCWs, mostly related to equipment availability, awareness, and training.

**Limited knowledge on RHD symptoms:**

Among the HCWs interviewed, there was a clear lack of knowledge concerning strep throat, ARF, and RHD. None of the facilities visited reported to have a staff member who has attended in-service training on streptococcal sore throat, ARF, or RHD management. In addition, many symptoms of strep throat and ARF overlap with other diseases, especially malaria, which is among the most commonly diagnosed diseases in the country. As a result, RHD diagnosis at a very early stage in the local health facilities is unlikely.

**Unavailability of treatment guidelines**

Only 13% of HCWs interviewed reported to have the Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC) guideline for disease diagnosis (dated 2007). However, none of the facilities visited had specific treatment guidelines or treatment flow charts for sore throat, ARF, or RHD.

“I don’t have it, I just use the knowledge I got at the college to treat these patients.” [...]  

“I haven’t done any follow-up to know whether there is such a guideline.”

[Clinical Officer – Health Centre (HC)]

**Low Specialist Numbers Impede Hotspot Identification**

In the absence of skilled lower-level HCWs familiar with identification of GAS, ARF, or RHD, an additional burden falls on specialist physicians further up on the referral pathway.

However, in 2019, the Tanzanian healthcare system
counted only approximately 20 cardiology specialists. This amounts to .035 specialists per 100,000 people (US: 10 per 100,000 people).

Identifying RHD hot spots and providing early referral and treatment through specialist-led screenings therefore presents a significant logistical challenge and balancing act for the health system. To provide rural screening services, specialists must travel from their base in zonal hubs to lower-level facilities in the region, creating a trade-off between critical care provision at zonal hospitals and early identification of patients requiring referral services. Moreover, the sheer undersupply of specialists means that comprehensive, nationwide screening services are not possible.

**Lack of diagnostic equipment**

One common challenge to disease diagnosis mentioned by health workers interviewed is the unavailability of diagnostic equipment. Lower-level facilities generally lack equipment for diagnosis of infectious disease such as strep throat. None of the health facilities visited in the study had the capacity to diagnose strep throat, ARF, or RHD.

“[...] As a dispensary we don’t have the capacity to diagnose [sore throat]. [...] We just guess maybe it could be just a normal infection and we give them antibiotic.”

[Nurse– Dispensary]

Patients also complained that since the health workers had no equipment to diagnose diseases, the health workers used physical examinations which the patients believed gave false diagnoses. Suspicions that health workers are not able to diagnose diseases led some community members to seek alternative avenues for treatment.

“You can be tested at the health facility and no disease can be revealed. You now decide to go to the traditional healers.”

[Female patient – rural]

**No Systematic Tracking of GAS, ARF or RHD in National Health Information Management Systems**

At present, both Rheumatic Heart Disease and Rheumatic Fever are lumped together under the cardiac disease category when coded into Tanzania’s Health Information Management system. This reduces visibility of actual disease burden for these conditions and prevents national-level analysis of RHD/ARF hotspots.

**II. LOW AWARENESS OF GAS, ARF, AND RHD AMONG POPULATION**

RHD identification and treatment was missing among the district health priorities and so not planned for, mainly because the disease burden was not known.

We observed low awareness about RHD at all levels across both health and education sectors. Risk factors for development of RHD such as upper respiratory tract infections (URTIs) were reported to be present among school children, however they were not reported with any perceived threats associated with them. Moreover, the school assessment did not reveal any education-linked activities intended to prevent RHD or increase awareness.

However, participants (patients and clinicians) engaged through the program were enthusiastic to learn more about RHD and showed interest in further understanding how to incorporate it in school health programs (SHP) by involving existing structures for SHP implementation.

**III. LOW RATES OF SEEKING HEALTH FACILITY SERVICES FOR EVALUATION AND TREATMENT OF STREP THROAT AND OTHER HEALTH CONDITIONS**

An initial finding of the research was that community members in Sengerema District only seek out health facilities as a means of treatment for general illness in one-third of all cases. As shown in Figure 4, use of traditional healers remains widespread (~25%), and more than a third of patients prefer not to seek any treatment at all, often relying on advice from family elders.
We identified a number of factors that impact healthcare seeking behaviors among the study group. Key factors preventing community members from utilizing health services at public health facilities included distance to the health facility, health facilities' lack of drugs, health facilities' lack of diagnostic equipment, and the perceived negative attitude of health workers, including corruption. These are summarized in Figure 5 and outlined below:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Total n=352 (%)</th>
<th>Sore throat (Currently) n=134 (%)</th>
<th>Sore throat (last 12 months) n=218 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where treatment was sought</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health facilities</td>
<td>120 (34.1)</td>
<td>39 (32.5)</td>
<td>81 (67.5)</td>
</tr>
<tr>
<td>Traditional Healers</td>
<td>86 (24.4)</td>
<td>39 (45.4)</td>
<td>47 (54.7)</td>
</tr>
<tr>
<td>Treatment was not sought</td>
<td>132 (37.5)</td>
<td>47 (35.6)</td>
<td>85 (64.4)</td>
</tr>
<tr>
<td>Others</td>
<td>14 (4.0)</td>
<td>9 (64.3)</td>
<td>5 (35.7)</td>
</tr>
<tr>
<td>Medicine taken for sore throat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health facility medicine</td>
<td>96 (27.3)</td>
<td>30 (31.3)</td>
<td>66 (68.8)</td>
</tr>
<tr>
<td>Medicine bought in a pharmacy</td>
<td>158 (44.9)</td>
<td>58 (36.7)</td>
<td>100 (63.3)</td>
</tr>
<tr>
<td>Local herbs</td>
<td>87 (24.7)</td>
<td>39 (44.8)</td>
<td>48 (55.2)</td>
</tr>
<tr>
<td>None</td>
<td>10 (2.8)</td>
<td>7 (70.0)</td>
<td>3 (30.0)</td>
</tr>
<tr>
<td>Others</td>
<td>1 (0.3)</td>
<td>0 (-)</td>
<td>1 (100.0)</td>
</tr>
</tbody>
</table>

**Figure 5**

**Distance to the health facility**

Participants – especially those who were met and interviewed at the health facilities – considered the distance between the community and health facilities to hinder utilization of health facility medical services.

"[...] People who live in the villages far from hospital [...] prefer to treat themselves with local medicine..."
[herbs] or […] may go to the traditional healers […]”

[Male patient with sore throat condition– Health Centre]

**Shortage or erratic supply of drugs**

Both health care providers and community members mentioned a shortage of drugs in the health facilities. Shortage of essential medicines and frequent stockouts encourage patients to seek medicines from the drug store for self-treatment, instead of consulting health facilities, and health facilities may be forced to refer patients to drug stores.

*Currently we are out of stock for almost all drugs; the only medicine we have is Panadol and Magnesium. [...] When we are out of stock for a long period [...], this poses a great challenge to us [...]. We have reached a point where we listen to the patient complaints and if the sore throat is not serious [...] then I advise the patient to go and buy those drugs [elsewhere].*

[Health care provider–Dispensary]

**Quality of services at public health facilities**

Participants were dissatisfied with the quality of services offered by public health facilities, namely with issues such as long wait times and health workers’ attitudes. The overwhelming majority of the participants mentioned negative attitudes of health workers, including corruption, as being the predominant barrier to seeking health services from public health facilities.

*If you don't have money you can wait until evening even if you arrived in the morning. In these government hospitals, health services are very much associated with bribes and corruption. If a patient does not have five to ten thousand shillings to bribe the nurse, he/she will take long to have the services.*

[Patient]

“[…] Even if they are all around at the hospital, they will still tell you that they are tired … They will tell you ‘go and buy some medicine or wait [for us] to finish taking our tea […]’, even if you have a serious patient with you”

[Patient]

**Severity of the disease**

Some of the study participants indicated that the hospital is mostly utilized when patients perceive their disease to be more severe or fatal. This implied that the hospitals are utilized as the disease severity progresses or at later stages of the disease.

*“Before I go to the hospital I first see if I can use any medication... I usually go to the drug shop where I can take just a normal medicine like Panadol for cooling down the fever. But later when it gets worse [...] I make a decision to come to the dispensary.”*

[Patient with sore throat condition – Dispensary]

**Conclusion**

In line with the program mission to test and recommend interventions based on research done on the Tanzanian context, the learnings from the community assessment resulted in the focus on four specific activities for the next program phase, as outlined in Table 1:
<table>
<thead>
<tr>
<th>Community &amp; Health System Assessment Learning</th>
<th>Specific Activities to be Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of RHD prevalence data meant that RHD identification and treatment was not a district health priority</td>
<td>I. Conduct a prevalence assessment in Sengerema District</td>
</tr>
<tr>
<td>Lower-level HCWs were not aware of GAS, ARF, or RHD symptoms and could not screen and/or refer patients effectively</td>
<td>II. Provide training to lower-level HCWs to improve RHD awareness and screening capacity</td>
</tr>
<tr>
<td>RHD patient data is not included in Tanzania’s national health information management system (MTUHA)</td>
<td>III. Beta-test an RHD registry that could underpin the set-up of an RHD identification and referral program</td>
</tr>
<tr>
<td>Lower-level facilities are ill-equipped to identify GAS, ARF, or RHD. Lack of equipment acts as a barrier to health system uptake by the community</td>
<td>IV. Identify and establish critical technologies that will improve identification and increase trust in local facilities, in order to increase uptake of healthcare</td>
</tr>
</tbody>
</table>

*Table 1*
Testing Activities –
Prevalence Assessment, 
HCW Training, 
RHD Registry and 
Technology

OVERVIEW

Phase 2 of the program focused on testing activities that were designed in response to assessment outcomes and learnings. Aside from establishing key prevalence information, the goal was also to further understand the usability and scalability of HCW training activities and related technological interventions.

In order to ensure long-term sustainability, the program team worked with local and national authorities, including both clinical and health management teams from BMC, NIMR, and CUHAS, to co-develop a training solution. This included aligning with national research processes and working to obtain approvals for training, research, and reporting clearances, with conversations with relevant stakeholders throughout the training implementation. In addition, the team obtained clearances for an innovative portable ultrasound device, which was used in the training.

ACTIVITIES

I. CONDUCT A PREVALENCE ASSESSMENT IN SENGEREEMA DISTRICT

Given the prevalence of results from neighboring country Uganda*, the program delivered a screening program while starting the training of HCWs. The locality chosen for this was Sengerema District (population ~400,000), a district where Touch has long-standing relationships and has delivered health systems strengthening programs for many years. For instance, Sengerema was also one of the implementation sites for Touch’s M-Mama emergency maternal transportation program. Our experience there provided us with the ability to leverage existing stakeholder relationships and thus build a more sustainable program.

Working closely with two Bugando Medical Centre (BMC) specialists, Touch facilitated the set-up of regular specialist-led outreach clinics at Sengerema Council Designated Hospital (SCDH) and local schools. As part of screenings conducted within outreach clinics and through additional appointments, 5,000 people from Sengerema District were screened for RHD, including 2,000 pregnant women and approximately 3,000 school children. During screening of pregnant women for RHD, the specialists also provided free obstetric ultrasound scans (not a normal part of ANC care in Tanzania), which enabled referral for high risk pregnancies prior to the development of an emergency. In addition to the ultrasound and echocardiography screening, screening for strep throat was performed in order to determine prevalence of strep A.

Of those children screened for whom there was a complete dataset, only 12 (0.47%) had a previous history of RHD, only 1/3 of those with a history of RHD were currently taking penicillin and only 1 of the 12 had had surgical correction. The assessment revealed an extremely low prevalence of RHD in the patient population, amounting to an RHD case in just 0.4% of school age children screened and 1.1% in pregnant women screened.

Thirty two percent of the children reported having a sore throat and of those, some 63.7% reported having 2 or more cases of sore throat in that previous year. Consistent with previous assessments, only 44% sought medical treatment for the sore throat. The prevalence of a positive strep test was 5.5% which is consistent with an earlier study funded by Medtronic that was conducted in a different geographic area of Tanzania.

There were 580 women who underwent obstetric ultrasound with 4.0% having an abnormality.

Challenges/Lessons Learned:

Large scale screening in a campaign presents different challenges than when it is more formally embedded in normal healthcare provision. Data collection in this large-scale screening circumstance requires many more people to be on hand in order to ensure timely and complete patient visits and data recording. Having a digital application that can store data “offline” when there is limited internet connectivity is key. The digital application that we
used allowed the program to store data and then “upload” it when in internet range. One challenge to note with data collection on a large scale was that it was difficult for data collectors to correct data entry mistakes. This lack of ease often resulted in a loss of time as the record had to be restarted from the beginning.

Similarly, while mass screening of school age children can be done, it also requires having parents present when the screening is done to provide consent and serve as a proxy provider of patient history. There were challenges where the students would be at school but then screening had to be delayed until the parents arrived and if no parent was available, that child was unable to be screened. As noted above, having the screening embedded in normal health-care visits ensures that parents are present at the same time. Additionally, in this environment where many people may not have birth certificates, ages reported by parents may not be a true reflection of chronological age.

Impact on Demonstration Project Design

Based on work done by others in Uganda in similar geographies, the low prevalence of RHD in the school age population was not expected. We then decided to look for RHD “hotspots” in a different geography but still embedded within separate ongoing programs.

II. PROVIDE TRAINING TO LOWER-LEVEL HCWS TO IMPROVE RHD AWARENESS AND ABILITY TO SCREEN

One critical finding from the needs assessment was the low capability among HCWs at more rural facilities in identification, treatment, and referral for RHD. In response, Touch worked with its partners to identify 13 HCWs based at lower-level facilities to receive training on these elements. Five HCWs from SCDH, as well as eight nurses from the Private Nurses and Midwives Association Tanzania (PRINMAT) participated in the training. MeduProf-S, an independent healthcare education company, in conjunction with specialists from Bugando Medical Centre (BMC), facilitated the training. The two week training focused on RHD, ARF, and strep identification and screening, and included both didactic and hands on training with respect to ultrasound science, anatomy and physiology, and screening protocols for obstetric abnormalities and RHD.

Additionally, a 12-month online training license was provided to all HCWs who participated in the training through partnership with MeduProf-S, adding ultrasound training that focused specifically on left-heart screenings. This provided trainees with continued access to extra training exercises for use as a refresher and review.

The objective was to provide HCWs with the skillset needed to assess patients for symptoms, physical exam, and echocardiographic findings of GAS, ARF, or RHD at their facilities, improving early identification of at-risk patients, leading to more effective and timely referral.

Challenge/Lessons Learned:

One challenge related to the use of online training. While online training has been heralded as a way to reach healthcare workers in more remote areas and to enhance their in-person and hands on training, it relies on good internet connectivity and access to computers. While a computer lab and internet was available at SCDH for the trainees, the internet connectivity was still a challenge and reduced the impact of training.

More critically, a key programmatic challenge that became evident during the Phase 2 training was related to obtaining requisite training approvals to allow unsupervised screenings by HCWs. As outlined previously, at the outset of program design and throughout early implementation, the team held productive conversations with both regional and national stakeholders around formalizing the capabilities of non-specialist radiographers, including enabling the provision of ultrasound and echocardiography screening, which previously fell only into the scope of work of specialists and radiographers. We submitted our curriculum and plans to stakeholders and obtained provisional approval from the Board of Radiology level. This allowed the program to start training HCWs. However, an abrupt change in MOH leadership resulted in a breakdown of conversations and approval was not granted for unsupervised screenings by HCWs.

Moreover, the conversations with clinical and health management stakeholders revealed a number of
concerns that prevented granting of final approval. These included:

1. **Fear of having false negatives** – one key concern voiced by stakeholders was that HCWs trained as part of the program had no prior formal education on use of ultrasounds (i.e. were not specialists). Neither the 5 HCWs nor the 8 nurses trained as part of our program had received any meaningful training on cardiac ultrasound as part of their medical education. Moreover, because ultrasound usage was not a core job responsibility in their current scopes of work, stakeholders were concerned about the quality of care.

2. **Confusing screening with diagnostics** – whilst it was made very clear that HCW roles in the patient care pathway would be limited to simple screening provision (non-diagnostic), stakeholders at all levels struggled with the distinction and concerns lingered that HCWs would have to carry out activities that would require more specialist training (e.g. diagnosis).

3. **Political context and risk-aversion** – the program was delivered in a time of increased political risk-aversion, which also translated to a desire by local and regional health authorities to ensure alignment with pre-existing protocols and ways of working. As a result, there was extremely low appetite to deliver any approaches that deviated from the status quo (e.g. lower-level HCWs carrying out added responsibilities).

The challenges encountered during this program period – which persisted to varying extents until the end of the program – illustrated the importance of a conducive environment to establishing and operationalizing an RHD identification and referral program.

**Impact on Demonstration Project Design:**

In response to the learnings above and following conversations with MOH and BMC stakeholders, we established a set of criteria for any HCWs enrolled in upcoming training programs. This included a stipulation that HCWs must have either previously received formal ultrasound/echocardiography training and/or must have practical experience carrying out screening activities. In addition, training time was expanded from 2 to 8 weeks. To allow for objective assessments of the trainees’ capabilities, we added an end-of-program assessment to the design, mandating the unsupported screening of ~30 patients by the HCWs with immediate screening follow-up of those same patients by a specialist. We then confirmed alignment between the newly trained HCWs’ results and the gold standard set by a specialist.

**III. Beta-Test an RHD Registry That Could Underpin the Set-Up of an RHD Identification and Referral Program**

A further outcome of the initial needs assessment highlighted the lack of structured documentation around RHD during routine clinical appointments, and the resulting lack of aggregate data at the national level on RHD prevalence and regional trends.

As a result, the program began working with the Pan-African Society of Cardiology (PASCAR), which had supported the development of an RHD eRegister, to support data collection during screening. The tablet-based application collected simple screening details including demographic and socioeconomic data, clinical history, and exam findings as well as ECHO results.

**Challenge/Lessons Learned:**

Unfortunately, use of the application presented the team with a number of challenges. In particular, while data entry was straightforward, a number of challenges existed in exporting screening data in a usable format for further analysis. PASCAR responded to feedback and undertook considerable effort to reconfigure the program to resolve these challenges, however given the need for regular manual workarounds to achieve full functionality, the application was deemed to not be fit for purpose as a supporting technology for large scale screening efforts.

**Impact on Demonstration Project Design:**

In response to the difficulties faced during the beta-test, the team engaged in conversations with technology developer D-tree International, a digital health NGO that designs and supports digital health
applications in low- and middle-income country (LMIC) settings. D-tree had previously partnered with Touch Foundation to design a flagship emergency referral and transportation system to improve access to emergency care for pregnant and postpartum women and newborns.

The solution, further detailed in Section 3 below, included a data collection application linked to a live dashboard, allowing real-time visualization of screening data.

After identifying the Lumify as the device best suited for the Tanzanian context, the RHD team began building a relationship with Philips, starting the process of procuring these devices for use in Tanzania.

**Challenges/Lessons Learned**

Philips Lumify has never been used in Tanzania. As a result, Touch, acting as device importer, obtained Tanzania Food and Drug Authority (TFDA) regulatory approval to use the devices in the country.

**Impact on Demonstration Project Design:**

Given the Lumify device matched all the needs established in the requirements gathering stage, it presented a cost-effective, durable, and innovative solution to improve screening capabilities at lower level facilities. Whilst the device requires purchase of tablet to allow use, the combined investment is still less than other portable ultrasound machines.

As a result, all trainings for the Demonstration Project were performed using the Lumify; the program ultimately decided to donate one Lumify to each of the 3 key facilities with trained HCWs upon conclusion.

**IV. IDENTIFY CRITICAL TECHNOLOGIES THAT WILL IMPROVE DETECTION**

The community needs assessment further pointed to the need for improving access to critical screening technologies within lower-level facilities. Through conversations with the BMC specialist, a list of key requirements for a diagnostic/screening device was established. One device, the Philips Lumify handheld ultrasound, matched the requirements best (see Table 2).

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
<th>Lumify Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low electricity dependence</td>
<td>Many lower level facilities experience volatile electricity supply or are dependent on solar power, which may not adequately supply the health facility with power</td>
<td>Device does not need to be plugged into external power outlet; uses USB power when connected to tablet</td>
</tr>
<tr>
<td>Durable &amp; robust</td>
<td>Facilities in rural areas lack access to technicians able to repair devices easily</td>
<td>Device made of high-quality materials; only 2 components (transducer + cable)</td>
</tr>
<tr>
<td>Light and portable</td>
<td>Lower level facilities required a device that could be portable to different rooms</td>
<td>Transducer weight is only ~500g and can be easily used in multiple wards in the health facility</td>
</tr>
<tr>
<td>Multi-purpose</td>
<td>Many lower level facilities lack resources and equipment, therefore device with multiple screening capabilities would be ideal</td>
<td>Device is 5-in-1 ultrasound transducer that connects to a tablet or smartphone, using an app to view and navigate through diagnosis</td>
</tr>
</tbody>
</table>
Design A Blueprint for A Scalable Identification and Referral Program (Demonstration Project)

BUSINESS CASE FOR EARLY, SYSTEMATIC NCD IDENTIFICATION

As outlined previously, the objective of the program was to design a blueprint (“Demonstration Project”) for scalable identification and referral of RHD cases, which could both leverage existing health systems resources (i.e. be fully embedded in the health system) and be cost effective to implement.

Given the low RHD burden in Sengerema, Touch moved the Demonstration Project to Shinyanga Region (Population ~1.7m projected 2017) to identify “hotspots” of the disease. Like Sengerema, Shinyanga region borders Mwanza region and has seen the implementation of a number of previous and ongoing Touch projects (e.g. M-Mama, Healthy Heart Africa). As a result, the program team was also able to draw on an extensive network of stakeholder relationships to increase implementation buy-in and effectiveness.

One central component of the Demonstration Project was to develop an ultrasound and echocardiography training program that can be led by local specialists to upskill existing, non-specialist healthcare workers (HCWs) at lower-level facilities on simple, cardiac ultrasound screening procedures. Given the challenge in obtaining approval for lower-level HCWs to conduct these screenings in Phase 2, health cadres chosen for the Demonstration Project – while still based at the lower-level facilities – had previous experience using ultrasounds as part of their healthcare provision routines, or had been trained on echocardiography/ultrasound in their clinical education.

The focused training was delivered through a structured, 8-week training program, which was divided between an initial 2-week classroom-based theoretical component hosted at BMC and Shinyanga Regional Referral Hospital (SRRH), followed by 6 weeks of practical screening initiatives at Kambarage Health Centre (KHC) and Kahama District Hospital (KDH) supervised by BMC specialists. As part of the training, all HCWs were exposed to different types of ultrasound equipment, including Philips Lumify. Once competent, HCWs would be assessed on their ability to implement what they learned.

The goal of this approach was to significantly improve access and health outcomes for those patients most at-risk of RHD complications by:

I. PROVIDING A NATURAL ENTRY POINT INTO THE HEALTH SYSTEM FOR PREGNANT WOMEN (A HIGH-RISK GROUP)

II. ENABLING HOT-SPOT IDENTIFICATION, BY FACILITATING LARGE SCREENING NUMBERS ACROSS MULTIPLE GEOGRAPHIES

III. IMPROVING FINANCIAL ACCESSIBILITY TO SPECIALIST SERVICES BY SHORTENING THE DIAGNOSTIC AND REFERRAL PATHWAY

IV. SOLVING COST INEFFICIENCIES CAUSED BY LACK OF LOWER-LEVEL SCREENING CAPABILITIES

Each benefit of the approach is further detailed below:

I. PROVIDING A NATURAL ENTRY POINT FOR RHD RISK GROUP INTO THE HEALTHCARE SYSTEM FOR PREGNANT WOMEN

Pregnant women are a risk group for complications associated with RHD such as heart failure.

Despite advances in family planning and widespread availability, women in the Lake Zone of Tanzania have a higher number of pregnancies (fertility rate @ 6.5) than the national rate (fertility rate @ 5.2)⁵. The physiology of pregnancy leads to an increase in blood volume and a dilutional anemia which may be exaggerated due to nutritional iron deficiency.

Both of these put an extra burden on a normal heart that is usually able to adapt. However, if a pregnant woman also then has RHD, the woman’s heart will not be able to respond appropriately to the physiology of pregnancy. This may result in loss of life for the fetus and for the woman. One study from Dar Es Salaam National Tertiary Referral Hospital, identified RHD as a cause of death in 17% of pregnant women with cardiac disease⁶.
In addition to the epidemiological factors that make pregnant women a high-risk group for RHD complications, this patient group was chosen as a focus group for the Demonstration Project because of the added factors below:

- **Established, Tailored Healthcare Offering**: Antenatal Care (ANC) and Postnatal Care (PNC) clinics are well-established healthcare routines across the facility pyramid (offered at Health Centres, District, Regional, and zonal hospitals), and therefore provide a natural and necessary entry point into the health system for pregnant women.

- **Reduced Barrier to Care**: Pregnant women are exempt from healthcare costs, which should reduce financial barriers to seeking medical diagnosis and treatment in the event of illness. However, supplemental costs – particularly for transport to larger regional health facilities following referral – continue to limit accessibility to care.

The sections below outline how the systematic and embedded screening approach proposed by the Demonstration Project can further support healthcare service provision for this at-risk group.

**II. ENABLING HOT-SPOT IDENTIFICATION, BY FACILITATING LARGE SCREENING NUMBERS ACROSS MULTIPLE GEOGRAPHIES**

As outlined previously, low national coverage of clinical specialists in the Tanzanian health system is a persistent challenge. The Lake Zone is no exception, currently only counting a single specialist cardiologist – located at the zonal hospital, BMC. Access to screening, diagnosis, and treatment for cardiac NCDs, including RHD, is therefore limited to weekly clinics led by the specialist. The clinic sees up to 40 patients per week – ~2,000 per year. The patient numbers seen in the lone specialist clinic are not sufficient to sustainably identify regional RHD hotspots across Lake Zone (population: ~17 million). More importantly, given BMC’s position at the end of the referral spectrum, these specialist clinics cannot guarantee early identification and timely treatment of at-risk patients.

The Demonstration Project approach addresses this challenge by embedding simple screenings within ANC and PNC clinics already established at lower-level facilities. This approach not only moves the point of diagnosis closer to the rural populations, but also engages a significant population segment already using these services.

For instance, health facilities in Shinyanga where the Demonstration Project took place – Kambarage Health Centre (KHC) and Kahama District Hospital (KDH) – see a combined average of ~3,300 ANC/PNC patients monthly.

Embedding non-specialist-led cardiac screening at these facilities would therefore allow for the routine screening of up to 40,000 women annually, as compared to ~2,000 seen by a BMC specialist.

A systematic approach to training non-specialists to carry out ANC/PNC based screening services could therefore yield significant screening results immediately and lead to early identification and referral without the need for additional interventions. In this way, multiple geographies can screen for hot spots concurrently, whilst supporting timely referral for potentially critical cases or patients with identified cardiac abnormalities.

**III. IMPROVING FINANCIAL ACCESSIBILITY TO SPECIALIST SERVICES BY SHORTENING THE REFERRAL PATHWAY**

An additional challenge addressed by the Demonstration Project approach involves combating financial barriers to accessing health services, especially for low-income populations.

The average household income around the Tanzanian Lake Zone is 160,000 TZS ($70 USD) per month. In light of this, the health system exempts a number of patient groups from the costs of diagnosis, treatment, follow-up, and medications. These include:

- Children under 5 years
- Pregnant women
- Patients with certain chronic diseases (e.g. Diabetes, Hypertension, HIV, TB & Leprosy, Epilepsy, Psychosis)
- Elderly patients (>65 years)
While these programs are far-reaching and clearly serve to improve access to the health system, income and high out-of-pocket expenses continue to be a decisive factor in determining a patient’s access to health services, particularly for rural populations. Facility visits for routine or emergency treatments can lead to significant travel costs for patients travelling from rural settings (i.e. transport/accommodation, distance, road quality, and appointment timings). These are likely to rise as patients pass through levels of the referral system, given the added distances between rural patients and the regional or zonal facilities that serve them.

The graphic in Figure 6 outlines the example of pregnant women attending a regular ANC clinic at one of the District Hospitals engaged through the program. In the standard referral set-up, an underlying NCD would only be identified if the patient was referred effectively through the system.

As screening for RHD and other NCDs is only currently possible under specialist care at zonal facilities, the patient is unlikely to pass through the health system (i.e. be referred to a higher-level facility instead of being discharged) until symptoms of the underlying condition are more apparent, and potentially severe. Moreover, as evidenced by the graphic, the transportation cost associated with following the referral pathway may amount to a quarter of a monthly income. This, in addition to the lack of information about potentially serious underlying cardiac abnormalities, may lead to the patient dropping off the referral pathway as a result of inability to pay for transport.

**Case in Point.** Through Touch Foundation’s M-Mama Emergency Transportation System, it was discovered that a number of pregnant women who initially accessed care at lower-level health care facilities and who were then referred to higher-level facilities, were unable to complete the referral. For example, Stela, a 19-year-old woman pregnant with her first child, was initially referred to Shinyanga District Hospital because all first time pregnancies are considered high-risk. Unable to come up with the money to travel to the District Hospital, Stela went back to the lower-level dispensary when she went into labor. After

*pregnant mothers are exempt from treatment costs*
being examined, she was found to have eclampsia, and was transported through the Emergency Transport System to Shinyanga district hospital, at no cost to Stela, where she had a C-section. She stated, “Since I did not have the money to travel on my own, I think me, or the baby would have lost our lives.”

The Demonstration Project set-up, however, allows for identification of screening abnormalities within the routine ANC clinics that pregnant women are likely to attend. As a result, patients leave the clinic with additional information around their heart health, and, in the case an abnormality is identified during screening, are able to be confidently and immediately referred to the zonal facility for specialist follow-up, diagnosis, and treatment. Therefore – by embedding screening in established health system services – the Demonstration Project set-up raises the efficiency of the referral process, reduces time to treatment, and supports the early identification or critical conditions. Whilst the current referral system would cost 35% of average monthly household income, streamlined referral provision, as proposed under the Demonstration Project, could reduce this cost by 50%.

IV. SOLVING COST INEFFICIENCIES CAUSED BY LACK OF LOWER-LEVEL SCREENING CAPABILITIES

Engaging lower-level healthcare workers in screening is a more cost-effective option for the health system, both in terms of system costs involved in the treatment life cycle and when compared to the investment required to train specialists.

Factor 1: Referral Inefficiencies are Costs to System

Under the current Tanzanian health system, pregnant women, children, and people over the age of 65 are exempt from treatment and referral costs. If underlying conditions are not identified early (e.g. because there is no screening capability/capacity at lower levels of referral spectrum), efficient referral to a zonal specialist for follow-up is not possible. As a result, the patient will continue to traverse the referral pyramid as a net cost to the system (each facility visited incurs costs/no revenue generated). Additionally, undiagnosed underlying health conditions may worsen over time (no diagnosis available until zonal level reached), resulting in higher follow-up treatment costs for the patient and worse outcomes.

Factor 2: Lower cost of training HCWs vs “building a specialist” for hot-spot identification

Specialist cardiologists are highly qualified, meaning training is time-intensive and costly, taking 2 years in addition to Master of Medicine (MMED) and medical school training (3 and 5 years, respectively). Further study to reach specialist status at Muhimbili University of Health and Allied Sciences (MUHAS) in Dar es Salaam costs around TZS 21.5 m (~ $10,000 USD) per annum. Over the course of a 2-year degree, and including supplemental costs such as materials and accommodation expenses, producing a super-specialist could therefore cost up to TZS 46m (~ $20,000 USD).

In comparison, assuming a total of 8 trainees per cohort, the 8-week HCW training program cost ~TZS 2.5m ($1,090 USD) per trainee. Given the indicative performance results of HCWs who underwent the program (see Section 4), around 17 HCWs could be trained for every 1 specialist cardiologist produced.

Whilst lower-level HCW training clearly does not replace the need for specialists to tackle severe cardiac conditions, focusing on lower-level cadres to increase the coverage of early NCD screening will be more cost effective and timely than training a specialist.

PRACTICAL IMPLEMENTATION AND TECHNOLOGIES FOR SUSTAINABILITY

The Demonstration Project design provides the blueprint for a scalable, cost effective RHD identification and referral program.

The following sections outline the practical set-up of the approach: training and assessment, an overview of the technologies and advocacy initiatives implemented by the program to improve sustainability, indicative results of HCW assessments, as well as challenges and lessons learned.

I. SELECTION OF HCWS

Ultrasound screening training is included in the technical education of a number of Tanzania’s me-
Medical cadres. In order to reduce the barriers to skills uptake, HCWs enrolled in the Demonstration Project belonged to a cadre with previous training or practical experience in administering ultrasound screenings. More specifically, HCWs were eligible to participate in the training if they were:

- Able to demonstrate previous experience in carrying out ultrasound/echo screening and/or had received training on ultrasound/echo screening
- Working at a lower-level facility (Regional Referral Hospital, District Hospital, or Health Centre)
- Recommended by senior facility stakeholders as a result of their performance at those facilities and their commitment towards improving NCD care provision in rural Tanzania

In selecting participants, it was evident that all shared a passion for delivering quality healthcare services to their communities. The focus piece in this report highlights the experiences of one of the female trainees, Mercy, a sonographer recommended to the program by the Medical Officer in Charge (MOIC) of Kambarage Health Centre (KHC) in Shinyanga town.

**IMPLEMENTING A NON-SPECIALIST SCREENING SYSTEM CAN SAVE LIVES**

Mercy, a trainee in the RHD Demonstration Project, has been working as a sonographer at Kambarage Health Centre (KHC) for 3 years. She is the only sonographer at the Health Centre and was recommended to the program by KHC’s Medical Officer in Charge. Being pregnant with her first child, Mercy understands the importance of her prenatal care.

Her passion for her work stems from her own experiences. As part of another Touch Foundation program supported by AstraZeneca, Healthy Heart Africa, Mercy was screened and found to be hypertensive early on in her pregnancy. She was able to receive the proper treatment, and she and her unborn child remained safe. She feels strongly about providing services that will lead to early detection and care for others too.

“It is important to screen women and children for Rheumatic Heart Disease because then we are able to know in the early stages and get treatment earlier.”

There are very few cardiologists who can do these screenings, especially in rural areas. Many of these services are only available at the larger zonal referral hospitals. Through the RHD project,

Mercy was trained along with other healthcare workers to screen pregnant women and children during routine ante-natal visits at the clinic. She now has the knowledge, equipment, and confidence to contribute to identification of issues in pregnant women, supporting early detection and referring those patients before their conditions become severe.

“If more healthcare workers could be trained and upskilled like I have, it will have a big impact. It can improve the services and we can increase care for people living in remote areas and refer them in the first stages of an issue.”

The RHD demonstration project training has shown first-hand that providing non-specialist healthcare workers with the training and equipment to implement an early screening system can save lives.

“We met a pregnant mama yesterday, she used to come to the clinic because she had high blood pressure. We found out she has a problem with her heart. We were able to give her a referral to the regional hospital to get treatment. This is a good thing for us!”
II. 8-WEEK TRAINING PROGRAM

In response to the stakeholder feedback on the training carried out with Sengerema-based HCWs, a number of changes were made to improve the rigor and depth of learning during the Demonstration Project training.

The training program followed the principles of adult learning. As shown in Figure 7, it consisted of in-person didactic lectures and learning taught by sonography, cardiology, and obstetrics experts. Didactic learning was then augmented by hands on learning about the echocardiography machines and practice in screening of pregnant women for RHD as well obstetric abnormalities in concert with the experts.

III. SUPPORTIVE TECHNOLOGIES

From its experience in the Tanzanian health system context, Touch understands the important role technologies play within the healthcare infrastructure. As outlined previously, Touch was part of a group of partners who beta-tested the PASCAR RHD registry as part of Phase 2. Unfortunately, the application was not stable and was difficult to extract data from, thus requiring numerous manual workarounds, and we ultimately could not use it to effectively track enrolled patients across programmatic screening activities.

Using the learning from the PASCAR application testing, and to further streamline the Demonstration Project set-up, the team set-up a front-end and back-end technology-enabled data collection and analysis process. Touch collaborated with technology implementers D-tree International to build a tablet-based screening application to complement the Demonstration Project process. The technological components and their role in a typical ANC/PNC visit are illustrated in Figure 8, and further detailed below.
App-based data collection (STEP 1-3)

The core element of the solution is an app-based data collection tool, which acts as a repository for patient data and screening results. The tool can be installed on multiple, facility-based tablets at the same time and updates automatically when connected to a wireless network.

The application has three objectives:

1. **Enroll patients into directory:** Capture core personal data and household indicators. The patient file stored on the device can be anonymized for sharing or analysis and is marked with a unique ID linked to the patient’s national registration card. In this way, patient data can be updated at future visits. (see STEP 1)

2. **Capture screening data:** Facilitate the capture of left-heart and/or obstetric ultrasound screening results. This is linked to online dashboard. (See STEP 2)

3. **Upload to Dashboard:** The collected patient information and screening result feeds into the program-wide data dashboard. Once the tablet is connected to the internet, and patient data entry is completed, the results are immediately uploaded onto a central server and update the dashboard. (See STEP 3)

Integrated dashboard for data visualization (STEP 4)

Touch champions the use of data visualization across its programs, including in the M-Mama program (showing transport statistics for program-facilitated emergency transportation for pregnant and postpartum women and neonates) and the Healthy Heart Africa (HHA) (illustrating the hypertension prevalence rates across testing sites). Given the challenges with application beta tested in Phase 2, Touch worked with D-tree to add data collected in the HHA program to the existing M-Mama program application.

This allowed for synergy and leveraging existing platforms as well as the ability to view data across M-Mama as well as HHA and RHD programs that are embedded in M-Mama. This led to a dashboard which provides a live display of aggregate facility screening data to visualize screening results and allow for immediate data analysis. The integrated dashboard functionality allows every user to analyze RHD prevalence or cardiac abnormality data using various filters (geography, screening location, socio-economic factors, etc.), enabling a first step of analysis online and without the need for advanced statistical software packages.

<table>
<thead>
<tr>
<th>Touch RHD Screening</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>100</strong></td>
<td>Number of Pregnant Women screened</td>
</tr>
<tr>
<td><strong>0</strong></td>
<td>Number of Pregnant Women with Borderline or Positive RHD</td>
</tr>
<tr>
<td><strong>0%</strong></td>
<td>0% of Pregnant Women with Borderline or Positive RHD</td>
</tr>
<tr>
<td><strong>41</strong></td>
<td>Number of Pregnant Women with Echo Abnormality</td>
</tr>
<tr>
<td><strong>41%</strong></td>
<td>41% of Pregnant Women with Echo Abnormality</td>
</tr>
<tr>
<td><strong>41</strong></td>
<td>Number of Pregnant Women with USS Abnormality</td>
</tr>
<tr>
<td><strong>41%</strong></td>
<td>41% of Pregnant Women with USS Abnormality</td>
</tr>
</tbody>
</table>

If made accessible to critical Health System Stakeholders, including Medical Officers in Charge (MOICs), District and Regional Medical Officers (DMOs/RMOs), NGOs, or senior Ministry of Health (MOH) decision makers, the dashboard could support data-driven decision making.

For instance, an RMO may be interested in using the dashboard’s clear overview to review RHD prevalence across regional geographies, or to monitor patient loads and screening numbers at regional facilities. This could provide the basis for more targeted data capture in these hotspots, or for re-allocation or addition of trained healthcare personnel to busier facilities.

Portable Ultrasound with tele-med capabilities

Touch Foundation was successful in introducing a new, innovative technology to Tanzania for the first time. As mentioned previously, Touch’s RHD team worked to obtain TFDA approval for use of the Philips Lumify portable ultrasound machine in Tanzania.

In line with Touch’s app-based data collection approach, the Philips Lumify portable ultrasound device also relies on app-based technology to deliver multi-
purpose screening capabilities. Aside from cardiac, these also include obstetric, respiratory, and gastroenterology screening options.

In addition to increasing facility capacity to screen and identify abnormalities in RHD, the introduction of this device provides the opportunity for diagnostic capacity in other areas, benefiting the hospital immensely at a low cost.

Furthermore, the Lumify offers telemedicine capabilities, potentially connecting HCWs and specialists via video call, thereby allowing real-time diagnosis. The screening exam footage collected through the app can also be saved on the device and sent to specialists at higher level facilities at a later time for input or clarification.

This opens a number of potential opportunities for improved collaboration and remote supervision. The ability for lower-level HCWs to send screening images to a specialist can both reduce timelines to diagnosis and improve quality of care, by validating or commenting on initial screening findings. Moreover, this increased exchange is also likely to provide regional specialists with improved visibility on the screening performance and accuracy of HCWs. As a result, conversations around screenings could pave the way for targeted upskill, and/or refresher trainings proposed by specialists, and allow HCWs to receive additional inputs and learnings from more experienced clinicians regularly.

**IV. POLICY AND ADVOCACY ACTIVITIES:**

Given that this demonstration project included training for lower level healthcare workers and that the skills they were being given were not in their current scope of work, advocacy for this project needed to be carried out at multiple levels on a national, regional and local scale. Stakeholder mapping conducted in the program design phase identified the following stakeholders in Tanzania:

- Tanzania Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC)
  - Radiology division
  - Curative services division
- NCD division
- Nursing education division
- Tanzania school health program
- Tanzania National Institute of Medical Research (NIMR)
- Muhimbili University of Health and Allied Sciences (MUHAS)
- Catholic University of Health and Allied Sciences (CUHAS)
- Bugando Medical Centre (BMC)
- Regional government and health teams, medical offices in Mwanza and Shinyanga regions
- District government, health teams, medical offices and communities in Sengerema and Shinyanga

At the national level, introductory and then update meetings were held with the Permanent Secretary and Chief Medical Officer at the MOHCDGEC. Then, the various divisions within the MOHCDGEC were engaged to determine where best to house the program (NCD or curative services) with the final decision being within NCD division. This then allowed for regular updates to be given to the head of NCD division. Then, we engaged, along with Medu-Prof S, the radiology division at MOHCDGEC, to seek approval for the curriculum, where Medu-Prof has had a long-standing relationship and with MUHAS radiology school to assess current ECHO training in country.

CUHAS, BMC Dept. Of Community Health and Research and NIMR became research and implementing partners after multiple discussions and provided ethical clearance for the project as well as community engagement, assessment and training. Regional and district medical offices provided permission for the project to proceed after obtaining ethical clearance.

On an international level, Touch Foundation is a member of RHD Action, a global movement to reduce the burden of RHD in vulnerable populat-
ons. We participated in launch events in Mauritius and at UNGA week in New York, USA, multiple Panafrican Society Cardiology (PASCAR) meetings and events in South Africa, Ethiopia, Egypt and elsewhere providing knowledge dissemination and developing partnerships. As a member organization, we partnered with other members from Uganda, US and SA to develop a baseline assessment of barriers to RHD care in Tanzania and Uganda. In addition, we partnered on the development of the TIPS Handbook and also, the WHO passage of a global resolution on ARF and RHD in 2018 in Geneva, Switzerland.

V. INITIATIVES FOR SUSTAINABILITY

Embedding RHD in a larger NCD portfolio

In order to ensure that screening for RHD was linked to a broader NCD initiative, we embarked upon a partnership with the Tanzania MOHCDGEC and AstraZeneca via their Healthy Heart Africa Program, to embed NCD screenings for diabetes and hypertension into ANC clinic visits along with RHD screening. To date, along with the 2,600 pregnant women who have been screened for RHD, we have helped screen over 30,500 pregnant women for diabetes and hypertension during antenatal clinic visits. The Healthy Heart Africa program targets screening 50,000 individuals for these conditions.

Additionally, we organized NCD fairs and outreach clinics to raise community awareness. Further details can be found by visiting https://www.astrazeneca.com/sustainability/access-to-healthcare/healthy-heart-africa.html

Engineering Training

Touch Foundation leveraged relationships formed through its Healthcare Technology Management (HTM) program to combat challenges of medical equipment downtime, which are common in low-resource environments. In line with BMC’s role as a tertiary super-specialty health facility in the Lake Zone, the BMC technicians also service a network of facilities across the Lake Zone, which includes those engaged throughout the RHD program. Refresher training on ultrasound repair and maintenance was provided to the engineers through funding from Medtronic as well as Touch’s HTM program.

As a result of the training and wider HTM program, engineers at BMC are now better prepared to ensure that ultrasound devices in the region are up and running at all times. This will improve the ability of lower level facilities to provide ongoing identification and referral of NCDs without being impacted by down-time of critical medical devices. All engineers who underwent ultrasound repair training are enrolled in a 4-year development and upskilling project as part of Touch’s HTM program, which runs until late 2021.
RESULTS, CHALLENGES AND LESSONS LEARNED
Results, Challenges and Lessons Learned

The following section outlines the result of the assessment of a sub-set of the trained HCWs, as well as general challenges and lessons learned, which may inform follow-on programs in Tanzania and beyond.

**INDICATIVE ASSESSMENT RESULTS: HCW SCREENING CAPABILITIES**

A key part of the Demonstration Project approach was completing an objective assessment of the performance of the trained HCWs. This involved each HCW completing a left-heart ultrasound examination on their own and noting down results and findings on an exam sheet. The cardiac specialist then immediately screened the same patient, noting their findings. Following this, a comparative agreement statistic was calculated to measure the alignment between HCW screening results and the gold standard set by the specialist.

As a result of the global COVID-19 pandemic, the Demonstration Project assessment phase was curtailed; only 3 (of 9) trainees underwent more than 50% of their assessment. Each of the three HCWs completed 19 supervised echocardiographic screening exams for RHD, immediately after which a cardiology expert performed a screening exam. The indicative agreement result based on 60% assessment completion are outlined in Figure 10.

![Figure 10](image)

<table>
<thead>
<tr>
<th>Trainee Number</th>
<th>Agreement with Gold Standard (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (19/32 screenings completed)</td>
<td>84%</td>
</tr>
<tr>
<td>2 (19/32 screenings completed)</td>
<td>100%</td>
</tr>
<tr>
<td>3 (19/32 screenings completed)</td>
<td>100%</td>
</tr>
</tbody>
</table>

For trainee 1, 2 of the 3 results where there was disagreement involved the identification of pericardial effusion by the expert that the trainee did not identify. Similarly, that student also identified a pericardial effusion when the expert did not.

In general, the specialist who reviewed the screening results emphasized the strong performance of the candidates conducting the screening. The trainees showed an ability not only to identify the presence of abnormalities, but also achieved close alignment in taking specific measurements during examinations that could be accurately replicated by the specialist.

The indicative data, combined with the feedback from the trainers/specialists, supports the view that lower-level cadres are able to learn simple screening techniques and replicate these at high conformity with a gold standard, thereby maintaining the required standard of care. Further assessment is however required to further strengthen and confirm these results.

**CHALLENGES, LESSONS LEARNED**

**Challenge 1: Government appetite for transfer of responsibility to lower level cadres is low**

Regulatory requirements and changes in MOHCDGEC leadership presented a challenge in obtaining permission for non-specialist HCWs (e.g., nurses, physicians) to carry out screenings. This resulted in the program’s pivot towards training HCWs with previous experience of carrying out ultrasounds as part of clinical routines. Despite promising initial discussions, MOH leadership did not provide clearances to allow enrolled HCWs to carry out unsupervised screenings before the end of the program.
As outlined previously, a number of factors contributed to the difficulty in obtaining requisite approvals. These included:

- **Fear of false negatives** – concerns about care and screening quality if utilizing non-specialist HCWs
- **Confusing screening with diagnostics** – concerns that HCWs would provide specialist-level services (diagnosis) rather than pure identification and referral (screening) services
- **Political context and risk-aversion** – low senior stakeholder appetite for delivering an approach that proposed increased responsibility for lower-level cadres
- **MOH leadership changes** – unexpected change in MOH leadership that caused a breakdown in national-level conversations

In addition to the above, the COVID-19 pandemic coincided with the assessment phase of the Demonstration Project, meaning that we did not have complete data to demonstrate HCW screening performance for further support stakeholder discussions.

**Lesson learned** – a key priority for follow-on programs will need to be continued advocacy around the transfer of screening responsibilities to lower-level cadres and facilities. This could entail improved alignment with senior MOH officials, regional administrative bodies, and research/ethical clearance committees and leveraging the business case learnings and approaches outlined in Section 3 above.

**CHALLENGE 2: SCALABILITY AND SUSTAINABILITY OF THIS SOLUTION IN A LOW-PREVALENCE COUNTRY**

While the core structural components (training, HCW selection; supporting technologies) underpinning the Demonstration Project were evaluated and a small-scale set-up was established within the project timeframe, the team did not have the opportunity to implement and test the solution on a wider scale.

Further work is required to scale up the training to a significant number of HCWs, in order to more clearly assess the capabilities within certain cadres.

Moreover, the small-scale set-up and lack of clearance for HCWs to actively carry out unsupervised screenings meant the team was not able to monitor whether unsupervised HCWs would indeed embed screenings into health routines effectively. One solution would be to support the HCWs in setting up a process for them to do so in their individual health facilities.

**Lesson learned** – In addition to an increase in the number of HCWs receiving training and assessment, it will be critical for follow-on program to map current HCW routines, and to establish clear processes for how screening skillsets are embedded in daily activities. Establishing a clear monitoring and data collection framework at each lower-level facility would ensure the ability to track HCW activity data and populate the registry/dashboard app for use by decision makers, RHD partners, etc.

**CHALLENGE 3: RETAINING PATIENTS IN CARE**

While the proposed approach can set-up wider, systematic identification of patients in need of care, the challenge of retaining these individuals in care, following specialist diagnosis and enrolment in treatment, remains.

For instance, whilst all 11 individuals (9 schoolchildren; 2 pregnant women) identified with RHD during Sengerema screenings attended a full consultation with the zonal specialists, there was low attendance at follow-up clinics for monthly treatment. Of the nine school children identified in the outreach screenings, only three attended at minimum one follow-up clinic, with only one patient attending regular monthly follow-ups. Neither of the two pregnant women identified as borderline cases attended scheduled clinic appointments.

**Lessons learned** - Further work is therefore needed to support the health system at large in reducing barriers to treatment. This could include:

- Improving and expanding uptake of the health insurance system, including introducing reimbursing travel expenses
• Subsidizing transport by setting up funds at referral facilities (especially those with diagnostic or treatment capabilities)

• Providing visibility on patient diagnosis/treatment needs at lower level facilities by improving healthcare information management systems

• Training lower level HCWs to administer monthly RHD treatments and ensuring rural antibiotic supply

**CHALLENGE 4: BARRIERS TO UPTAKE OF HEALTH FACILITIES**

By embedding RHD screening within established healthcare services, the Demonstration Project approach seeks to capture at-risk populations in the healthcare offerings that they trust and with which they are familiar.

However, this approach is unable to imminently address cultural factors that act as barriers to the utilization of health facilities. As outlined in the discussion of Phase 1 at the top of this report, community members still only routinely seek care at health facilities in one out of three instances of illness. Among others, barriers to seeking care at health facilities included community members’ the negative views around HCWs’ attitude, corruption, lack of supply of medication that prevents patients from building trust in facilities, as well as ongoing beliefs around the relative efficacy of traditional healers at the start/end of a treatment journey.

Lessons learned - Follow-on programs should leverage the outcomes of the community-level assessment to build a holistic approach to supporting and empowering people living with RHD. Initiatives to improve community trust (and thereby increase uptake) of lower-level facilities could include:

• Campaigns to inform communities, particularly risk-groups, about GAS, RHD, and related conditions

• Specific activities to reduce peoples’ reliance on traditional healers, including improved medication availability at lower-level facilities, expanded uptake of the health insurance system, including introduction of reimbursement of travel expenses

• Operational efficiency and patient pathway activities to improve the patient experience at lower-level facilities (e.g. to shorten wait-times, improve customer service, etc.)
FUNDING AND SUSTAINABILITY
Funding and Sustainability

The program was funded through kind support of Medtronic Foundation.

Grant amount: $1.25m (2015-2020)

LEVERAGED FUNDERS

- **Vodafone Foundation** has been a key resource and program partner for Touch’s M-Mama program since 2013. M-Mama leverages Vodafone’s mobile payment system, M-Pesa, to pay community drivers, and multi-million USD investment in activities like maternal health infrastructure development and HCW training. The RHD program leveraged relationships built through our M-Mama program.

- **AstraZeneca** is a global pharmaceutical company. They support our Healthy Heart Africa program (2018-2021) to address hypertension conditions related to pregnancy as well as hypertension and other NCDs in healthcare workers. The RHD program identified and acted upon synergies, such as opportunities to reach overlapping patient populations.
IMPLEMENTATION
PARTNERS
Implementation Partners

Overview of key implementation partners

- **Alere** is the number one global provider of rapid, point of care tests. They provided 2,000 strep-A testing strips to the program.

- **Bugando Medical Centre (BMC)** is the super-specialty referral hospital for the entire Lake Zone of Tanzania which includes Sengerema and Buchosa Districts, as well as Shinyanga Region. BMC, one of the four largest hospitals in Tanzania, is a 900-bed zonal and teaching hospital serving 17 million people. Touch has been partners with BMC since 2004, when Touch Foundation was founded to address the health workforce crisis in Tanzania. BMC dedicated two ultrasound specialists to lead HCWs to certification and produced a referral protocol. BMC specialists were ultimately responsible for diagnosing and treating patients referred as a result of screenings conducted by trained HCWs.

- **Catholic University of Health and Allied Sciences (CUHAS)** provides training, research, and consultancy services to medical professionals. CUHAS provided experts from the ethical clearance team to give advice and guidance on the ethical clearance needed to screen and collect data during the Sengerema prevalence assessment.

- **Comprehensive Community-Based Rehabilitation in Tanzania (CCBRT)** is a Tanzanian health organization that works to prevent disability, provide affordable medical and rehabilitative services, and aid the empowerment of people with disabilities and their facilities. CCBRT kindly made a specialist (Dr. Anke Zuechner) available to the program to carry out RHD training and screening in Shinyanga region.

- **D-tree International** is a digital health NGO using technology to impact health systems. For the M-Mama Program, D-tree developed the emergency transport system application and real-time dashboard. D-tree supported in updating the digital RHD data collection tool.

Specifically, in Year 5, D-tree supported in the deployment and training related to the RHD data collection tool and dashboard.

- **Kahama District Hospital (KDH) and Kambarage Health Center (KHC)** are key implementation partners across several Touch Foundation programs including the Mobilizing Maternal Health, and Healthy Heart Africa programs. Healthcare workers from KDH and KHC participated in the RHD training and demonstration project.

- **MeduProf-S** is engaged in the acquisition and implementation of complex international education projects focusing predominantly on emerging countries and countries in transition. Meduprof-S provided a 12-month training course to HCW on ultrasound, focusing on left-heart screens and antenatal screens.

- **National and Local Government** continue to be key partners in all of Touch’s programs and we continue to deepen our relationships with these bodies through regular meetings and consultation. Touch Foundation works closely with the MOH provides guidance and accessibility to health facilities at all levels. The TFDA provided us with the approval to introduce innovative technologies (Lumify) to Tanzania for the first time.

- **The National Institute for Medical Research (NIMR)** is the largest public health research institution in Tanzania with its headquarters in Dar es Salaam and centers throughout the country, including Mwanza. NIMR conducts high quality research in collaboration with a range of leading international institutions such as the London School of Hygiene and Tropical Medicine. NIMR has been a core partner in achieving the certification of HCWs in Year 5, as well as in the production of research publications.

- **Pan-African Society of Cardiology (PASCAR)** is an organization of physicians from across Africa involved in prevention and treatment of cardiovascular disease and is concerned by the lack of progress in the diagnosis and effective treatment of cardiovascular disease across Africa. They provided the RHD registry application that we used to capture patient data during screening.
• **Private Nurses and Midwives Association Tanzania (PRINMAT)** is a non-governmental, non-profit making organization comprising of registered Nurses and Midwives who provide reproductive health services at small community maternity homes which are registered by Tanzania Nurses and Midwives council through the district. PRINMAT provided 8 HCWs from 4 clinics, for training in ultrasound and RHD, and contributed to the screening of 5,000 people.

• **Reach** is a collaborative organization that partners with stakeholders to provide technical support and policy translation to amplify rheumatic heart disease control efforts locally, regionally and globally. Reach assisted with the design and development of tools to assess the RHD control needs within the RHD continuum of care, from a patient's perspective. Reach collaborated with implementation partner, NIMR, to utilize a site selection tool to assess the Sengerema district health system for appropriateness for the establishment of an RHD identification and referral program.

• **RHD Action (RHDA)** is a coalition to combat the burden Rheumatic Heart Disease by elevating RHD on the global agenda through advocacy, technical tools and rigor, and scientific evidence. Touch Foundation maintained a close relationship with the RHDA community throughout the project, including collaboration to develop an application of Rheumatic Heart Disease identification and referral program site selection.

• **Sengerema Council Designated Hospital (SCDH)** is a 316-bed rural hospital that provides healthcare services to over 100,000 in- and out-patients per year. SDDH is a Catholic faith-based hospital built in 1959 that has been designated by the government to provide all services including medicine, pediatrics, surgery, and OB/GYN. HCWs from Sengerema were involved in training and RHD prevalence assessment, in which 5000 women and children were screened for RHD.