EXECUTIVE SUMMARY

The project, Safer Deliveries, is being implemented by D-tree International with generous support from the Bill & Melinda Gates Foundation’s Grand Challenges Explorations Phase II. The overarching goal of this project is to reduce maternal and newborn mortality by increasing facility deliveries and access to skilled care during pregnancy, childbirth, and the immediate postnatal period. This is done by reducing the three most common delays that contribute to pregnancy-related mortality, including: (1) the decision to seek care; (2) reaching skilled care; and (3) the provision of adequate care at the health facility. This project addresses each of these three delays through the use of cell phone technology by traditional birth attendants (TBAs) and community health workers (CHWs).

The pilot of the Safer Deliveries project was actively implemented from November 2010 to April 2012, with continued follow-up for those mothers already enrolled through the end of the 2012. D-tree used an open source mobile health (mHealth) application to reduce the informational, logistical, and financial barriers to in-facility births and post-partum care. The project trained 24 TBAs from the pilot areas of the North A and Micheweni districts of Zanzibar in the use of the mHealth application. Of the 938 total deliveries, 71% were in health facilities during the pilot compared to the overall DHS rate of 33.6% in these areas.

Through the Grand Challenges Explorations Phase II, D-tree is building on the successes of the first phase to improve, enhance, and scale up the project. Phase II provides the opportunity to demonstrate that this integrated mHealth intervention can significantly increase the numbers of women who deliver in a facility with skilled care, providing proof-of-principle for the original idea of the pilot both at scale and in a different cultural setting. The objectives of phase II include:

1. Expanding project to cover all deliveries in rural Zanzibar.
2. Identifying the most significant factors causing increase in clinic deliveries.
3. Enhancing the post-delivery checklist.

The integrated approach includes phone-based applications which reside on a simple Nokia phone used by the field worker which:

- Provide decision support to CHWs to develop a birth plan for the woman based on medical and obstetrical history, as well as screen women (and their babies) for complications from pregnancy up to a week after delivery;
- Counsel the women and families on the importance of facility-based deliveries as well as healthy behaviors and recognition of danger signs;
- Record permissions from husband and family members agreeing to a facility based delivery (as is culturally expected in Zanzibar);
- Use mobile banking to arrange and pay for transportation to the health facility when the woman is in labor or in case of complications; and
- Instigate text or voice communication to notify a health facility that a woman is in transit.

We are supporting 223 CHWs in six districts, including 110 shehias/wards. These areas were identified by district health management teams as having particularly low facility delivery rates and significant transport challenges as compared to the rest of Zanzibar. This report focuses on progress related to objectives 1-3 above from October 2012 to February 2014. Overall, our facility delivery rates thus far is 77% compared to the national average of 49.2%. Even more striking is our facility delivery rate in Pemba (which has been our focus area)—82% compared to only 32% according to the most recent Demographic and Health Survey (2010). By the end of the Phase II award we expect to demonstrate that the use of a mobile phone by CHWs in Zanzibar can significantly increase the numbers of women who deliver in a health facility under trained supervision and that the use of this technology is feasible and effective when covering a population of approximately 1.2 million people.
ACTIVITIES

(a) Review and revision of phone-based algorithms and community referral system for mothers and newborns.

At the start of phase II, we reviewed and revised the initial version of the application based on government guidelines, convening experts and Ministry of Health (MOH) decision-makers to agree on key risk factors, danger signs and actions during critical periods of pregnancy, labor and delivery and the postnatal period. Further revisions of the application were made based on discussion with practitioners and feedback from both new and existing users.

The most significant changes to the mHealth algorithm were enhancements to the birth planning process, the community-based referral system and the screening protocols for both mother and baby (particularly in the postnatal period per objective 4 above). For birth planning, the registration process recommends a specific facility the woman should plan to give birth at based on medical and obstetrical history, current pregnancy and health status, and skilled health worker advice (rather than just “health facility” or “hospital”). In addition, the intervention includes additional antenatal and postnatal home visits that include screening of women (and newborns) for danger signs and referring them as needed. The screening form now includes sections for pregnancy, labor/delivery, immediately after delivery (in case of home deliveries), and one or more days after delivery, with danger signs tailored appropriately for each section. Danger signs can now amend the birth plan of the woman during pregnancy (see figure 1) and will trigger a referral to a specific facility based on both severity and geographic location. In terms of the referral system, when a CHW makes a referral there is now a choice of various forms of transport, including boats and private cars—all with specific predetermined routes, prices, and drivers that are registered within the phone. They can then initiate calling drivers and facilities to arrange the referral and finally pay the drivers directly through mobile banking – without ever handling cash. (See appendix I for more screenshots of the application.)

(b) Site and TBA/CHW expansion. In collaboration with the MOH at the district and central levels, Phase II was started up first in the two districts where the pilot was implemented (Micheweni and North A) and rolled out from there one district at a time. The schedule was based on stakeholder agreement on need—including high rates of home deliveries and cultural/transport challenges. The four districts of Pemba (the north island) were prioritized for this reason (see inset).

As of February 2014, we have covered 110 shehias (wards) in six out of nine districts (excluding urban), covering almost half of the rural population of Zanzibar (see appendix II for coverage details).

Importantly, the need to ensure our field workers were literate brought us to broaden recruitment from just TBAs to include the following cadres: (1) those who assist TBAs (“TBA helpers”); (2) community volunteers who work as part of the health system to support community outreach called community based distributors (CBDs), and community health workers (CHWs) who have received additional health, maternal and child health training and conduct formalized outreach with the support of Jhpiego. For the sake of simplicity in this report we will refer to this mixed cadre simply as “CHWs”. In each district, we proceed through the following process:

1. **Introductory meeting with DHMT**, including prioritization of areas and selection of CHWs. District Reproductive and Child Health Coordinators (RCHC) administer literacy tests and finalize list of participants. They also research rates for transport and supply recommendations. Finally they identify health workers at the local primary health care units (PHCUs) to act as supervisors.

2. **Sensitization at the community level** including community leaders (called shehas), TBAs not in the program (e.g., because of literacy issues), health workers, and CHWs in the program. The project purpose and progress are presented to participants including the overarching goal of helping and
encouraging women to get to facilities for antenatal care, postnatal care, and most importantly, delivery. Concerns and challenges from the community are addressed in this forum and questions are answered. Most critical here is buy-in from non-project TBAs who will be administering home deliveries and shehas.

3. **Negotiation and agreement of rates with drivers** from each community (shehia) for every route taken – to local primary health center, to secondary and tertiary level facilities.

4. **Comprehensive training of CHWs**, including a one-day maternal and newborn health training focusing on recognizing and referring for risk factors and danger signs (facilitated by District RCHC) and basic first aid; a one-day introduction to the phone; application and form review (including role play); and Ezypesa training.

5. **Three weeks of assignment and follow-up with a demo user on the phone**, practicing the registration, screening, referral, and follow-up process through group sessions facilitated by D-tree staff and facility supervisors as well as home assignments for extra practice. Users are assessed for progress and readiness and on the final week they register the relevant routes, health facility contacts, and drivers to prepare to “go live”.

(c) **Expansion and strengthening of mobile money distribution and monitoring system.** This has been a critical component to scaling up the project. The timely transfer of money leads to smooth transactions and fast turnaround of payments so that women in labor and women and babies having complications can reach care without delay. While in the pilot and the early months of Phase II we could handle manual tracking of money going out and being spent, it became apparent that this could not be sustained beyond a certain limited number of CHWs. All money is sent through a corporate mobile money account (Zantel’s Ezypesa) out to the field workers’ individual mobile accounts. When CHWs make a referral, they fill a referral form which tells them how much to send to whom; then they send money directly to the drivers after transport is provided through Ezypesa. In order to track money out in the field without having full visibility into the individual accounts, we developed a comprehensive tracking system that combines information from the application (the referral and route data) and the corporate mobile money account (transactions sent and balances) to track the balances of the CHWs and recognize when they need money. The system also highlights suspicious activity (duplicates, women transferred repeatedly, incorrect fares, etc.). Finally, it provides activity and costing information overall and by CHW (see appendix III). Referrals are audited regularly through monthly reports from Zantel on individual CHW numbers as well as verifications with facility sign-in books or facility staff.

(e) **Stakeholder Awareness.** The Zanzibar MOH, district health management teams (DHMTs), and health facility staff were regularly informed about project progress through phone calls and visits. A dashboard reflecting most important real-time data has been created (https://maternalznz.d-tree.org/) and soon will be shared with both district and central level government so that they can get real time data. Government support at the district, regional, and national levels has increased substantially during this phase, as the project is reaching many more communities. As the Director of Preventative Services stated in a presentation to the Zanzibar Development Partners Group, “D-tree gives the best example of an effective targeted program.” In addition, D-tree had the honor of presenting progress and results at the Annual Reproductive and Child Health Review—the only NGO to do so. We are partnering with Health Improvement Project Zanzibar (HIPZ) in the North A district to strengthen the ambulance system from secondary to tertiary levels, and have developed an agreement whereby we can cover fuel costs for women registered in the program in case of shortages. We are coordinating efforts with a new MOH project centered on usage of SMS which will start up this year funded by the mHealth Alliance and Innovation Working Group, called “Wired Mothers,”—for example through the exchange of pregnancy data to ensure full coverage of pregnant women in the areas we work and co-development of consistent messages for the antenatal and postnatal period. We are working with Wired Mothers to integrate our data into the existing Health Management Information System (HMIS) and strengthen emergency transport within the formal health system so that the transport provided by this project becomes increasingly a “safety net” for
families. We are also looking into co-funding concepts both with the MOH’s basket fund and with Zantel, our mobile money partner, through a savings wallet concept whereby pregnant women would be incentivized to save for needs during pregnancy and delivery through a mobile money account. The government now starting to recognize that without the support this project provides, families, including community outreach, referral, transport, and escort, this simply will not be possible.

(f) Program implementation: The first training was conducted December 2012, with the Central district “going live” registering, screening, and referring women in February 2013. From there, we added approximately a district per month through June 2013. In July 2013 we took a 3 month roll-out break to create and test the tracking system, with the next new district starting in October 2013. The most recent district added was an expansion of central district in February 2014. We are now functioning with 223 CHWs in 110 out of 331 shehias (wards) in six districts, reaching a total of 45% of the rural population of Zanzibar (see appendix II for coverage). Remaining districts include North B, West, and South districts. Numbers of new women registered, referrals, deliveries (and follow-ups after delivery) continue to climb each month (see figure 3).

As detailed below in results, CHWs registered a total of 9,306 women. An additional 44 refused consent to participate so did not complete the registration process. They conducted 17,473 screenings—7,850 during pregnancy, 3,398 during labor, and 6,225 after delivery. CHWs conduct at least two screening visits during pregnancy (including one at registration) and two after delivery which are timed at the most risk postnatal period – days 3 and 7. If any danger signs are detected, CHWs refer to the appropriate facility based on instruction from the application. There were 7,642 referrals made in this reporting period—5,357 (70%) for labor and delivery, 1,750 (23%) due to complications during pregnancy, and 535 (7%) due to complications after delivery. As illustrated in figure 4, many more women are screened than are referred, with the exception of the labor period, since the project prioritizes immediate referral and thus the CHWs may not always stop and fill a referral form.

The data from the CHWs are transmitted from the phones via General Packet Radio Service (GPRS) to a cloud based server. The data are stored on the server, cleaned, and used for supervision (e.g., completion of visits as per agreed schedule) as well as to monitor indicators such as maternal outcomes, birth outcomes, and delivery locations. Costs were assessed through our online tracking system, with CHWs becoming increasingly active even as their numbers grew throughout 2013. Average transport cost sits around $14 per woman, while the average number of referrals per CHW has been increasing steadily, reaching around 8.6 per month in February 2014 (see appendix III for costing analysis).

INTERMEDIATE RESULTS

(a) Facility Delivery Rates have increased
During implementation of the project up to February 15, 2014, 9,306 mothers were registered, with the largest numbers coming from Micheweni and Wete districts of Pemba (approximately 25% each). As of February 15,
2014, 5,806 had given birth, of which 77% did so at a facility. The breakdown of these 77% can be seen in figure 5. This rate is can be compared to the numbers of women delivering in a health facility in the most recent DHS survey for these areas, where facility delivery rates range between 25% (Pemba North) and 41% (Pemba South) depending on the area (see box on page 2).

We looked at those who had given birth at home for their last delivery—those individuals we consider the most “at-risk” of home delivery. Of those 5,767 who reporting location of their previous delivery, 55% (1,742) had this previous delivery at a facility, while 1,393 had given birth at home. Of those 1,393 who reported having given birth at home on their prior delivery, 29.7% of them gave birth at home again (during this project); if you add those that had the current delivery on the way, this percentage goes up to 33.5% “non-facility” deliveries. In other words, we “changed” the habits of 66.5% women who arguably make up the most difficult group—as they successfully gave birth at a health facility this time. In lieu of an evaluation with a randomized design, this should point to the project’s significant effect on facility delivery rates. Interestingly, almost 40% of those who delivered “on the way” for their current (project) birth (n=136) delivered at home previously, showing this is the most ambivalent group who in turn are calling CHWs the latest.

(b) Births at PHCUs have increased

The HMIS reports, “the proportion of deliveries conducted at the tertiary hospital remains alarmingly high” in Zanzibar—with 37% of women giving birth at Mnazi Moja (referral hospital) alone, 59% at district, PHCC hospitals (including the one public maternity hospital), and only 4% from PHCUs (HMIS Bulletin 2011). The MOH is committed to increasing the proportion of births assisted at the primary health care level in order to reserve the higher level facilities for more serious or at-risk cases. We are contributing substantially to this effort through creating tailored birth plans for each woman based on these risk factors. The result of these efforts can be seen in figure 5, where an astounding 34% of women who have given birth through this project have given birth at the primary level. That is 44% of total facility deliveries.

In all intervention areas, health facilities of all levels have reported significant increases numbers of women attending for delivery. Consistent with our findings on place of delivery, many of the PHCUs saw particularly large increases. Figure 6 shows raw numbers (on average) of deliveries being performed at relevant PHCUs. Matemwe (North A) was an unpopular location for giving birth, averaging only 2 births per month, but the D-tree project increased this activity. Similarly, both Konde and Makangale PHCUs (Micheweni) saw increases of approximately 200%.

(c) Geographical differences in delivery habits and socio-cultural contributors to home delivery highlighted

Not surprisingly, we found slight geographical differences in levels of facility delivery both by district and by shehia, though in every area the rates of facility delivery were significantly higher than both HMIS and DHS reports. Consistent with DHS data, the highest rates of facility delivery can be found in Central district (86%) compared to the DHS rates of 63.2% (Unguja South). In Pemba South, where DHS facility delivery rates are lowest (only 24.4%), the project reached 73.8% and 77.4% in Wete and Micheweni, respectively. These two areas also had the highest level of activity in the project (together constituting half of total registrations) which skewed our overall rate to be
77% rather than over 80%. Also worth pointing out here is that Wete constitutes half of all deliveries which occurred “on the way” (135 or 2.3% of women total), which is likely a sign perhaps of late reporting, but also large and difficult distances (often over water) to reach delivery facilities.

Interestingly, we found two different stories in Pemba South (which has 41.5% facility rate according to DHS). Mkoani saw our lowest rates (71%) while Chake Chake turned out to be the second highest overall (an impressive 85%). Mkoani is an area not only with significant transport challenges (like Wete, many villages only accessible by boat), but also highly traditional beliefs and common superstitions. There was a period of two weeks in early 2014 where several women spontaneously fell sick and some died after seemingly normal deliveries at the hospital. Immediately the communities attributed this to witchcraft and women started refusing to go to Mkoani Hospital. This was compounded by some non-literate TBAs in the area feeling threatened by the project and spreading false rumors. We have also seen challenges in other areas as well. In one shehia in North A for example, husbands often refuse or delay going to the health facility, despite having provided permission beforehand. These families end up treating the project as a sort of “plan B” in case something goes terribly wrong at home—insisting the mother wait through labor to go, even if transport is outside the door. Thus, an important complement to this “mHealth” intervention has been targeting community outreach. In Mkoani, we met with DHMT staff, hospital staff, project and non-project TBAs, and shehas (community leaders) to strategize how to dispel the rumors and continue to increase demand for facility delivery. Soon after, the situation normalized. In Kijini, we similarly held meetings with the community leaders and plan to support the DHMT on targeting male involvement.

(d) Better Understood Risk Profiles of Pregnant Mothers

During the registration process, a “birth plan” is created for each pregnant woman, we collect information about previous pregnancies/deliveries, medical/obstetrical history, as well as the current pregnancy. Women registered ranged in age from 13 to 52, with an average age of 27 years. 132 women registered were under the age of 18; 12 women were 35 or older on their first pregnancy—both risk factors for pregnancy. Women were, on average, registered at around 5.8 months gravida, already in their second trimester. Approximately 92% of women had already attended ANC clinic by the time they were registered, as one of the major strategies for finding pregnant women is ANC books at the clinics. The Zanzibar HMIS bulletin reports that less than 20% of women attend ANC by 16 weeks of pregnancy, which explains why we see women registering late for this project as well.

7,148 of the 9,306 (77%) registered had delivered previously, with the average number of previous deliveries at 3.7 and a maximum of 15 deliveries. 7,438 women had been pregnant before, with the average number of pregnancies at 5 and the maximum at 19. In the planning process, MOH decision-makers agreed that women who have had more than one miscarriage, abortion, or stillbirth previously should be considered high risk. Only 1% of women fit this criteria, but almost 30% had just one of these. Of those with prior deliveries, the most common risk factor identified was a history of prolonged labor (28% of 7148 women), followed by postpartum hemorrhage (11%). Almost 2% had had a previous vacuum delivery while just over 4% had a previous c-section. Approximately 33% of women had one or more of these problems in previous pregnancies. In terms of general health history, a striking 23% of women had a history of high blood pressure—a very dangerous risk factor in pregnancy—but only 1.6% had a history of cardiac disease. Between 2 and 3% of women registered had been told their baby was large, in a breeched position, or they were going to have twins.

In terms of birth planning based on risk factors, women were split fairly evenly between the three levels of health facility—primary units with delivery capabilities (DC), cottage hospitals (PHCC), and district hospitals (HOSP) (see figure 8).

In terms of danger signs and morbidities, 26% of mothers screened after delivery had one or more danger signs, the most common being excessive bleeding (11.6%) followed by fever (2.9%), severe stomach pain (2.7%), and exhaustion.
26 women suffered from breast mastitis and 9 from breast cracking. 15% of babies screened suffered from one or more danger signs, the most common of which was delayed bowel movements, followed by lack of crying, and prematurity (each having only 1-2% prevalence in babies screened). Danger signs during pregnancy were much more commonly identified, with 30% of the 4,100 individual women screened during pregnancy having at least one danger sign and 334 of these having two or more danger signs. The most common danger sign detected was severe stomach pain (6.5%), followed by severe headache (5.9%) and bleeding (5.7%). 5.2% women screened during pregnancy were identified as having high blood pressure.

(e) Increased self-efficacy and capability of frontline health workers

Though the thorough investigation into “what works” (proposal objective 2) has not yet be conducted, in September 2013, we interviewed 11 CHWs, eight mothers and seven health facility staff to hear their experiences of working within the Safer Deliveries program in Zanzibar. All CHWs reported that the use of the phone enhanced communication and information sharing between CHW, mother and staff working at the facility. They also claimed it improved their own organization and workload management, as well as confidentiality of information. Mothers themselves mentioned feeling reassured their information would be safely stored on the device.

CHWs and health workers conveyed a sense of raised awareness and positive community support for the program. A consequence of this awareness raising has been a change not at the community level, but also in how the CHW are perceived by the health worker and even how they perceive themselves.

And finally, there was an overwhelming consensus from participants that the program should continue and be expanded across all communities. One public health nurses says: I hope this service continues to serve all pregnant women in Zanzibar, it has had a huge impact on not only the survival of the mother and her child, but also has driven up standards of care.

(f) Lives Have Been Saved

Case 1: Anemia in pregnancy and need for a caesarean section

Hawa is 27 years old from Gando, Wete. She agreed to register for the project because her second child was born at home and she had a bad experience. Also she saw others registered, going the facility, and giving birth. “Because we didn’t have money at that time, drivers used to refuse to come when you call them because they afraid not to be paid because most of our families are poor.”

Seven months into the pregnancy she had a problem where she fell down and lost consciousness. Her family called Naima (CHW) who sent a car to the hospital. It turned out she had severe anemia. The doctor administered her a blood transfusion and also iron tablets. “Thanks to D tree because if the project was not there the family would have use traditional grasses to make me awake.”

When labor came on, the CHW referred her to the local PHCU, but after a few hours it was clear she had obstructed labor. “I was not able to breathe and I was so weak so I was not able to push.” Unbeknownst to her, she was actually pregnant with twins. She was referred to the hospital for a c-section and delivered two healthy baby boys (pictured here at 3 months of age).

Case 2: Jaundice after delivery

Rahma is a 33 year old mother of five living in Dunga, Central district. Having had her previous four children at home, this was Rahma’s first experience of a facility delivery:

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What was so nice was that Atka escorted me to hospital in the car, she gave the nurses at Mweumbuladu all my information and history and made sure I was ok before she left. It made me feel much calmer. When I got home, Atka came to see me and she noticed that that Khamis [my baby] was yellow. She asked me more questions and then she said I needed to go back to hospital as the baby was sick.

Atka, the CHW, called a car which came immediately and took her to the hospital in town. She stayed in the hospital five days as the child was treated for jaundice. She states, “I don’t think I would have seen a problem with Khamis if Atka were not there that day. So I am very grateful that she considered the health of me and more importantly my baby.”

(g) Project outputs
- Emergency referral systems established using local transport in 110 shehias
- 223 CHWs and 51 supervisors (PHCU facility staff members) in 6 districts trained, deployed, supported
- 17,473 screenings conducted during pregnancy, labor, or after delivery.
- 9,306 registrations made
- 11,264 postpartum visits made
- 7,642 referrals made
- Open source software phone based tools adapted and enhanced
- Partnership with Etisalat/Zantel to support extended network of mobile money pay points and improve account visibility and reporting supported
- Online real-time tracking system for distribution and monitoring of funds to CHW accounts established and maintained (http://ezy.d-tree.org/)
- Online dashboard highlighting key indicators created (https://maternalznz.d-tree.org/)

CHALLENGES and how they were addressed

Internal challenges
- **Home births:** As detailed in section (c) of the results, there are pockets of areas where husbands in particular remain resistant to facility delivery (e.g., Kijini, North A) and other areas that are prone to waves of rumors and superstitions ranging from conspiracy theories to witchcraft (e.g., Mkoani). Even outside of these pockets, women often call CHWs late in their labor, as evident from the high numbers of “on the way” deliveries. **Response:** We continue to integrate community outreach efforts into implementation, collaborating with the DHMT to resolve issues as they arise and sensitize community members, with a focus on male involvement as well as engaging non-literate TBAs.

- **Late registration:** In addition to women calling late, they also attend ANC late and register into our project late, as much of our recruitment comes from ANC registration books at the facilities. **Response:** Emphasis to CHWs on the importance of locating mothers early and encouraging ANC attendance. We are also encouraging finding women other ways (e.g., through word of mouth), which is feasible since CHWs live in the communities themselves and are often respected members. Additionally, D-tree encourages CHWs to attend regular community meetings whereby information is exchanged about newly pregnant mothers from sheha leaders. CHWs create their own “mapping” of the area and are supported to conduct home visits to introduce the program to those women.

- **Forecasting transport costs:** Since so many women were referred outside of labor/delivery, it has been difficult to estimate when registered women would need referral and how much money would be needed in the CHW’s EzyPesa accounts. Hence, we realized as the project grew it is not feasible to transfer money only monthly. **Response:** Our new tracking system displays the amount of monies spent within a 5 week period per CHW (known as the “burn rate”) therefore, we can tailor transfers based on level of activity rather than expected date of deliveries. This reduces the likelihood of CHWs running out of money at any given time and not being able to refer when necessary.

- **Tracking money:** With so many distributions, it was a significant challenge to track money once it was distributed. We lack real-time visibility into individual Ezypesa accounts. Using the referral forms from the database was challenging because it had to be used manually and sometimes CHWs
fail to complete forms. **Response:** We created an online tracking system that uses referral forms, Ezypesa corporate transfers, and manual entries to ensure accurate record-keeping. We dedicate staff time to calling CHWs and reconciling verbally when needed. We use Zantel reports to audit accounts when there are discrepancies and are working with them to develop their system so it is possible to get this information in real time.

- **Remote supervision:** Since our team did not grow at the same rate of the project, there were challenges providing close supervision, especially within a limited budget. **Response:** We conduct supervisory meetings for three weeks after training to ensure CHWs are ready to start and then only quarterly at most based on need. We use data-driven supervision where we can track if forms are being filled correctly, providing feedback largely by phone and accompanying CHWs on visits only on a random basis. We use champions and supervisor to provide support in the communities where CHWs work. If this fails (e.g., for phone troubleshooting) CHWs can travel to town to see our field implementers.

- **Finding and negotiating transport:** Finding and then negotiating transport at fair prices can be difficult, especially in places where there are few vehicle owners. Even if the “normal” price is known, these drivers may want to profit off an NGO presence. We are implementing on some very rural islands so locating safe transport can also be a challenge. **Response:** Negotiate one-on-one instead of in a group. Empower the DHMT staff to suggest prices and participate in negotiation. Visit sites to find boat owners, bus owners, and other drivers who might not be immediately known.

**External Challenges**

- **Mobile money system issues:** Periodically in the project Zantel’s EzyPesa system faced serious difficulties either with the mobile accounts or the corporate accounts or both. The mobile system was down for a several days at one point. The company switched to an entirely new online corporate account system—a two week period during which we had no online access to our account at all. **Response:** Work closely with Zantel so we are kept abreast of system changes and so they are more responsive when problems or issues occur. Triangulate transactions from various reports to be sure the accurate amount is recognized. Communicate with CHWs and drivers so that they understand when there are problems and are patient with payments.

- **Electricity and connectivity:** Many parts of Zanzibar still do not have consistent electricity and hence CHWs may have to travel to charge their phones (at a cost) and will at times be unreachable when women call. They may also delay in sending forms. **Response:** We procured low-cost solar chargers from India which help relieve this burden. We track some forms (largely referral forms) manually and troubleshoot network problems for the CHWs by switching out sim cards for other providers.

- **Shortages and hidden costs at health facilities:** Due to higher volumes of deliveries at the cottage and regional hospitals, they had more frequent stock-outs of basic delivery supplies, such as gloves, plastic birthing sheets, and syringes. Though facility birth was in Zanzibar was declared “free” by the president, they are often charged for supplies or services. There are other costs that must be considered, including food at the facility and return transport. **Response:** An advice prompt was included in the protocol for CHWs to remind families to save money for other costs associated with deliveries, so that the families could arrive with the necessary supplies and be prepared for the return trip. When women are being charged for things they should not be, we report this information to the DHMTs so they can address the issue at the particular facility.

- **Increased deliveries, increased workload:** One inevitable result of raising facility deliveries is creating more work for facility staff. Given Zanzibar’s existing human resource challenges (particularly for the more highly trained medical personnel) this is a significant challenge. **Response:** Work with partners such as the MOH (reproductive health program and performance based financing), Jhpiego, UNFPA, and HIPZ who focus on the “supply” side to improve care, supply chain, and human resource distribution at the facilities. Advocate widely about issues as they arise.

- **Treatment by health workers:** Related to the previous challenge, we face some instances of what is perceived as mistreatment by health staff. This intimidates women and of course adversely affect the care they receive. **Response:** Address any specific issues as they arise with hospital and district management. Ensure CHWs develop their own relationships so when they escort women they are well-accepted and can be their advocates. Ensure CHWs call before going to a facility.
CONCLUSIONS AND NEXT STEPS

As evident in the sections above, D-tree has made significant progress in scaling up this mHealth intervention in Zanzibar. Implementation of phase II is timely because of the increasing interest of the MOH in mHealth, growing commitment to maternal health, and building pressure as Millennium Development Goals 4 and 5, in addition to national indicators are not yet in reach. We are successfully implementing a project that utilizing a decision support tool used by CHWs in communities to register women early in their pregnancies, facilitate plans for facility delivery, and provide counseling and referral as needed throughout the pregnancy and the postnatal period. Through one phone, we provided a trusted community resource (the CHW) with improved knowledge and awareness of risk factors and danger signs in pregnancy and linked her to a network of both trained health staff and reliable drivers, making it possible to reach—so far—a facility delivery rate of approximately 77%, close to the MOH target of 80% by 2015 (MDG and RCH strategic plan). At the district level health workers are collaborating on the ground, selecting participants, attending and facilitating trainings, and providing community intervention as needed. CHWs are enthusiastic about the skills they gained to play a more effective role in their villages. Further, community-level demand is high, with families seeking out the CHWs in their respective villages.

The focus of the second year of the project will be on sustaining services, improving internal systems, evaluating the project, and ensuring sustainability. Though we will continue scale-up to some degree, this will take a more “filling the gaps” approach than hitting every area, due to funding and time constraints. In terms of internal systems, we are continuing to improve the financial tracking system to make it more manageable and thus more transferable to partners and the MOH. We are designing an evaluation that will involve community sampling methods to strengthen our results by providing some comparison group. In addition to this quantitative approach, we will complete a thorough qualitative investigation to better understand which aspects of the project work best and why.

We are investigating resources and opportunities for sustaining this project or some version of it, as it has already proven so well-accepted, and well-liked—and most importantly, effective. We have already coordinated with Jhpiego on their pilot CHW program and when and if this scales up, this mHealth intervention will likely be included. We are also in discussion with Zantel to enhance our public-private partnership and develop this project to include a “savings wallet” component, where mothers can put away money for delivery and postnatal care through mobile money and earn interest as they go. The MOH is incredibly supportive of seeking additional funding to sustain the project and including aspects of the project with existing funding as possible. Districts and the central MOH plan to put transport into their plans of action, so at least some of aspects might be covered from other resources. They are also committed to improving the ambulance system which is currently inconsistent at best—at least for emergency referrals—so that the transport component of this project can become more of a safety net than a primary resource. Zanzibar culture is fiercely loyal to its communities, particularly more remote areas do not often accept outside influence with ease. However, developing positive relationships within these social groups has contributed substantially to the success of the project. As a result, communities now feel a sense of duty-bound to those women, and have expressed a wish for the project to continue long into the future.