SOCIAL INNOVATION IN HEALTH INITIATIVE

IMAGING THE WORLD AFRICA

CONTINENT	Africa
COUNTRY	Uganda
HEALTH FOCUS	Primary Health Care
AREAS OF INTEREST	Maternal Health, Technology
HEALTH SYSTEM FOCUS	Medical Resources

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IMAGING THE WORLD AFRICA, UGANDA

Imaging the world provides affordable ultrasound scans to pregnant women in low income settings to contribute to better birth outcomes. Since 2010, obstetric ultrasound results have helped change management in 23 percent of pregnancies with complications.

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SUGGESTED CITATION:

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ABBREVIATIONS

ANC	Antenatal Care
CPD	Continuous Professional Development
ITWA	Imaging the World Africa
NGO	Non-Government Organisation
SMS	Short Message Service
USD	United States Dollar
WHO	World Health Organization

CASE INTRODUCTION

Imaging the World Africa (ITWA) focuses on incorporating low-cost ultrasound services into remote health care facilities which routinely do not provide this service, which lack the standard infrastructure required of imaging systems, and where there is a shortage of radiologists. ITWA integrates technology, training and community participation to bring medical proficiency and high-quality imaging services to people in remote and under-served areas.

Due to low income and the absence of advanced imaging technology, rural populations are unable to access diagnostic imaging, for example for timely and quick diagnosis of pregnancy complications. This challenge increases the risk of severe morbidity and mortality among pregnant women.

The ITWA model incorporates point of care ultrasound imaging devices, task shifting, training, innovative real-time external radiological expert reviews (telemedicine), community awareness and pragmatic funding models that promote self-sufficiency. ITW developed software that compresses and transmits full ultrasound images via the internet. ITWA achieves this by training nurses/midwives to perform basic ultrasound scans and transmit the images to participating radiologists in Uganda or abroad (using their VICATT software) for real-time interpretation. An offsite team of sonographers review the images captured at remote health centres, provide a diagnosis, and relay the results back to the remote health centre.

The ultrasound program was originally introduced to identify high-risk pregnancies in Uganda in one health facility in eastern Uganda, and has since expanded to 6 other districts and 11 facilities over the last 10 years. ITWA provides a sustainable model for ultrasound imaging, making basic life-saving diagnosis accessible in the poorest regions.

1. INNOVATION PROFILE AT A GLANCE

Organisation Details

Organisation name	Imaging the World Africa
Founding year	2008
Founder name	Dr Kristen DeStigter
Founder nationality	American
Current head of organisation	Dr Matovu Alphonse
Organisational structure	Non-Government Organisation
Main value proposition	ITW is dedicated to building lifesaving medical imaging capabilities in areas where medical resources are scare. ITW provides affordable ultrasound scan solutions for women at rural health facilities, which lack standard infrastructure for imaging systems.
Organisational stage	Scale up
Size	5 staff members
Main income streams	Grant funding is from Phillips (manufacturer of the ultrasound scan machines), Grand Challenges Canada, Bill and Melinda Gates Foundation and McKesson. Additional funding from Imaging the World-USA and philanthropists in USA.
Annual expenditure	USD 25,000

Operational Details

Country/countries of operation	Uganda
Local scope	First implemented in Kamuli district, eastern Uganda; then scaled up and implemented in five other districts: Mubende, Sheema, Kanungu in central and South Western Uganda, and Amuru and Omoro in the Northern Uganda
Type of beneficiaries	• Low income mothers from rural communities who are not be able to pay for an ultrasound scan in the private sector • Low level government and private health facilities in remote areas, which do not routinely provide imaging services
Number of beneficiaries (annually)	30,000 mothers per year
Cost per client	Clients contribute US $1.5 for the service
Local engagement	• Partnerships with the district health facilities hospitals ultrasound scans and training are provided by ITWA freely; • The Association of Radiologists in Uganda works with the health facilities to interpret the ultra sound scans.

Innovative elements	1. Task shifting of ultrasound service provision from sonographers to point of care healthcare workers at lower level facilities, particularly nurses and midwives. 2. Telemedicine - Remote interpretation of ultra sound scans images by experts and routine Quality Assurance 3. Affordable ultrasound services for rural Ugandans
Scaling Considerations	• Scaling up this idea can be considered in similar settings with lack of access to ultrasonography including for pregnant women. • Need for support for task shifting so that front line health workers -midwives and clinical officers - can be trained to undertake sonography.
Sustainability Considerations	• Patients make a minimal co-payment of USD 1.5 for imaging consumables like gel, and back-up electricity. • The revenue generated allows the program to be financially self-sustaining, after free equipment and training is obtained.
Health Systems Lessons (3)	• Task shifting can create a sustainable and effective way to deliver ultrasound services in low resource settings. Trained midwives can conduct the ultrasound scans, reducing the cost of hiring a sonographer. • Integrating telemedicine (with remote interpretation of scans and real time result transmission) in low resource settings is feasible and provides an opportunity to improve access and quality of care. • Affordable and sustained ultrasound services can be provided in rural areas, as with the ITWA model.

2. CHALLENGE

Uganda is a low-income country in East Africa with an estimated population of nearly 40 million people, of whom 48% are below 15 years of age (UBOS, 2017). Eighty percent (80%) of the population live in rural areas and are dependent on subsistence farming for their livelihoods and income. The proportion of Uganda's GDP that is spent on health care is 8% (GoU, 2016).

Like other African countries, Uganda has a high maternal mortality ratio - 336 per 100,000 live births, and high under-5 mortality - 53 deaths per 1,000 live births (UDHS, 2016). The high maternal mortality is attributed to high teenage pregnancies (25% of young women have a child by the age of 18), lack of equipment and drugs in health facilities, and the absence of skilled health workers in rural areas to handle emergency obstetric complications.

The Uganda health system includes both public and private health facilities. The public health system is structured into the national and regional referral hospitals, general hospitals and, at district level, health facilities are divided into four levels (I-IV) according to services provided. Health Centre I is the lowest level in the health system and comprises a village health team or volunteers serving to link the community to their local primary health facility. Health Centre II, provides basic outpatient health care services, including preventive and curative services for a catchment area of 500 people. Health Centre III offers all of these services, together with antenatal care and vaginal delivery services. Health Centre IV is a semi- hospital; it is a point of referral from the lower health centres and offers all other services and surgery (Mukasa, 2012). Health Centre IV serves a total population of 100,000. It is estimated that 79% of the population live within

5km from a health facility which is about one-hour walking distance (Rutherford et al., 2010).

Pregnant women in Uganda seek antenatal health services from Health Centre III, but this is restricted to basic preventive services and excludes diagnostic procedures such as ultrasound scans. Ultrasound scans, supported by specialist sonographers and radiologists, are only available at higher level facilities such as hospitals, Health Centre IV and some private health facilities. These facilities are often a long distance from rural communities. Financial constraints contribute to the limited access to ultrasound services. The out of pocket cost of an ultrasound scan ranges between USD 5-13 (USAID, 2014).

The World Health Organization recommends 20 radiologists/sonographers per one million people, but Uganda has only one (1) sonographer per one million population. Most sonographers work in urban areas in Uganda, with very limited numbers serving the rural population, so limiting access to ultrasound scans for pregnant women in rural settings. (Zaba et al., 2005). Specialists are not attracted to work in rural areas because of low remuneration and poor infrastructure. To reduce maternal mortality and morbidity, affordable diagnostics tests including ultra sonography, at the point of care, are required for women in rural areas.

It is unacceptable to look on as maternal deaths occur when application of an ultra sound could help improve survival rates (Dr Matovu Alphonsus, Executive Director of ITW)

3. INNOVATION IN INTERVENTION

Imaging the World Africa (ITWA) is a Ugandan registered Non-Government Organisation (NGO) with a mission to bring medical expertise and high quality low cost health care to the most remote and underserved areas worldwide, by integrating simple ultrasound technology with training, local capacity building and community support. ITWA is dedicated to building lifesaving, medical imaging capabilities in regions where health resources are scarce, such as in rural Uganda.

ITWA begun its work in one rural health facility in Eastern Uganda in 2003, recognising the contribution that ultrasound technology at primary care level could make towards reduction in maternal mortality. Ultrasound services are currently provided at eleven peripheral health facilities at a cost that is affordable for the rural population. Obstetric ultrasound results have helped change management in 23% of pregnancies with complications, in the participating health facilities.

The ITWA solution comprises of two components: a task-shifting training programme and an e-health/telemedicine radiology service.

3.1. TASK-SHIFTING TRAINING PROGRAMME

ITW uses the innovative concept of equipping

nurses and midwives with the skills and knowledge to conduct the obstetric ultrasound scans. ITWA has developed a 6-8 week certified training programme for non-specialist health workers in rural areas provided at the Ernest Cook Ultrasound Research and Education Institute (ECUREI), a private for-profit sonography training centre in Kampala, Uganda. Selected midwives or nurses with interest in sonography undertake practical and theoretical training on how to conduct abdominal sweeps and transmit the images for interpretation. Once health professionals have successfully completed the training course, they are awarded a certificate of completion and ITWA then provides the health facilities with ultrasound machines to perform scans.

3.2. E-HEALTH/TELEMEDICINE ULTRASOUND RADIOLOGY SERVICE A PRIMARY CARE LEVEL

ITWA donates ultrasound devices (Phillips ClearVue and Lumify) and consumables in rural primary care settings that do not usually have these technologies, to enable scans to be produced, transmitted and shared electronically.

During ultra sonography, the probe is passed across the pregnant abdomen in a series of six

prescribed sweeps acquiring a series of static images, using a low-frequency transducer. The acquired images are de-identified and stored locally on a computer before being compressed and transmitted digitally. The images are sent via an internet connection and can be immediately viewed by participating radiologists. The majority are local Ugandan radiologists who volunteer to interpret the ultrasound scans. Radiologists in the USA usually view and support the interpretation of complex imaging such of breast cancer and echocardiography pilot programs. An abbreviated report of the findings is sent via SMS to the nurse/midwife's cell phone with the full report sent by email, usually within an hour. In order for this to happen, there must be a laptop, a cell-phone, internet connection, and an ultrasound machine at the point of care.

4. IMPLEMENTATION

4.1. INNOVATION IN IMPLEMENTATION

ITWA implements its programme through careful selection of participating health facilities and attracts community contributions to ensure it is sustainable to maintain for the local health facility.

Health facility selection

To start the project implementation, ITWA contacts the diocesan health offices in the case of the private not-for-profit (PNFPs) facilities and district health officials for the public facilities. These stakeholders come up with a list of facilities that they think are most in need of the service. The ITWA team conducts site visits to each of the listed facilities, and looks at their records of numbers of antenatal care (ANC) visits, deliveries, distance to the nearest referral hospital, number of staff, and estimated catchment population. The facilities are chosen depending on the volume of pregnant mothers who seek antenatal services from them. Facilities that best fit the assessment are selected for implementation. This is the first step in health facility selection.

At the second stage, ITWA approaches the health facility staff to inquire whether they are interested in providing scanning services. If the health facility staff are interested in training, they join the ITWA network of health facilities. An agreement is made between ITWA and the health facility about how to use and look after the machine and how much to charge. The health facility is prohibited from increasing the fee charged per client, with ITWA staff making occasional visits to the communities to conduct exit interviews with clients to ensure that they are paying the agreed fee for the service.

ITWA currently (2018) has 11 health facility partners in six districts in Uganda. These are located in Kanungu and Sheema in the Western Uganda, Mubende in the Central region, Kamuli in the Eastern region, and Omoro, and Amuru in the Northern Uganda (see map below).

Community contributions

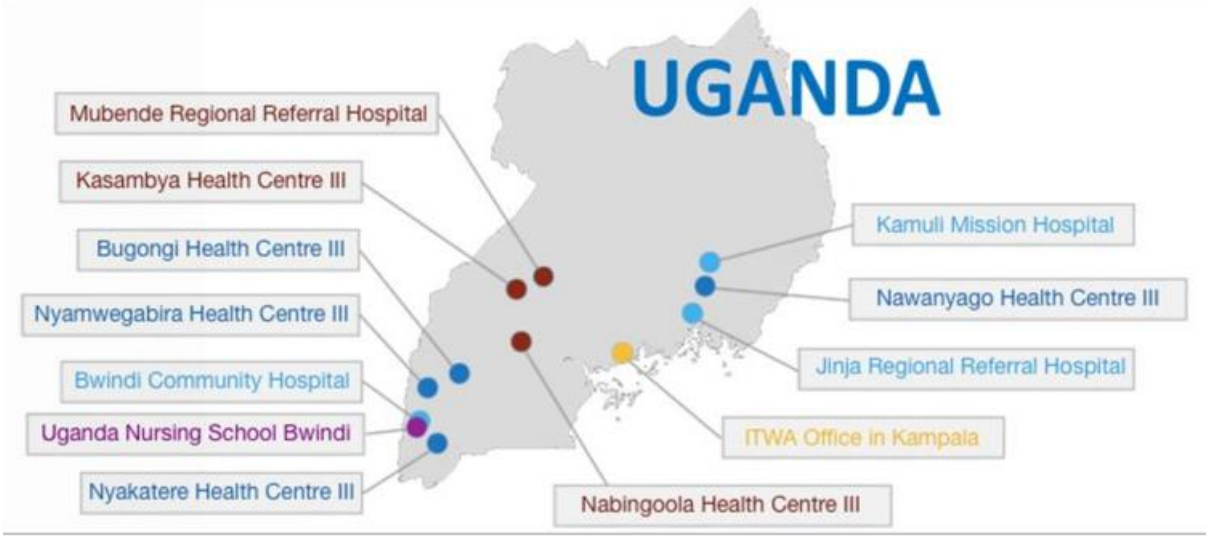
To ensure the sustainability of the service and to have the required consumables at the participating health facility, pregnant women contribute an out-of-pocket fee for an ultrasound scan. The community chairperson, the village health teams and the health facility in-charge sit together and agree on the fee that they deem affordable for the ultrasound. This fee covers the cost of the consumables for operations (power,

internet connection, gel, cleaning supplies, office supplies, security and infrastructure), and the supply chain for ultrasound technology servicing, site monitoring, and ongoing training and supervision.

Ultrasound services at each health facility must become financially viable to make the commitment by the centre and ITWA worthwhile.

On average, each mother pays USD 1.20 to the health facility to receive an ultrasound scan. In Kamuli district, revenue generation from the ultrasound scan at the Nawanyago Health Centre steadily increased from USD 420 in Financial Year 2010/11 to USD 4070 in Financial Year 2014/15.

Figure 1: ***Health facilities where ITWA implements ultrasound services***



4.2. BUSINESS MODEL

ITWA is a social enterprise, applying commercial strategies to maximize access to ultrasonography by rural populations. ITWA depends on several sources of funding to supply the ultrasound machines to rural health facilities and to conduct the training of the staff.

a) Ultrasound machines are donated by manufacturers their under Corporate Social Responsibility.
b) Volunteer sonographers interpret scans and in return, volunteers are supported to upgrade their careers in sonography through education scholarships.
c) Grant funding is obtained for supportive supervision, continuous professional development, service and maintenance of the machines.
d) Beneficiaries contribute US$1.2 per ultrasound scan

Grant funding to date has been received from Phillips, Grand Challenges Canada, Bill and Melinda Gates Foundation, and McKesson (a US-based wholesale healthcare company which provides medicines, pharmaceutical supplies, health information technology products and services). Additional funding is provided through the US-based Imaging the World organisation and individual philanthropists in the US. On average, it costs ITWA USD 25,000 annually to run the project.

4.3. ORGANISATION AND PEOPLE

ITWA is a registered NGO in Uganda working in partnership with Imaging the World USA. It was co-founded by Dr Matovu Alphonsus, a Ugandan surgeon who was working with Kamuli Mission Hospital in eastern Uganda. Dr Matovu teamed up

with Dr Kristen DeStiger, the interim chair of the Department of Radiology at the University of Vermont, US. Dr DeStiger had previously worked on the border of Kenya and Sudan where she joined colleagues in impromptu health clinics to conduct physical and radiological exams. Her experience there led her to reflect on how ultrasound scanning could be made accessible to people who needed it in the most remote areas of the world.

Dr Matovu was motivated to increase access to ultrasound when he was working with Kamuli Mission Hospital as the sole doctor. Many of his patients experienced labour and delivery complications, with some dying because of conditions like abnormal placenta lie, malpresentation of the foetus, or a ruptured uterus. Some of these conditions can be diagnosed using ultrasound scan prior or during labour to support clinical decisions. As a result, he was seeking a solution to the challenge of lack of access to obstetric imaging, and ITWA was born.

Sometimes you see a mother who has attended all the ANC visits and suddenly, they come up with a complication, ultra sound scans help us to see what the eyes will not be able to see. (Dr Matovu Alphonsus, Executive Director, ITWA)

ITWA has a team of five people working at the head office in Kampala: a program officer who oversees the program activities, a logistics officer in charge of ensuring that the machines are operational in every site, and a data officer who keeps record of the number of patients seen at the facility and their outcomes. Dr Matovu, the executive director, is in charge of the running of the organisation, and Dr Kristen DeStiger the co-founder mostly works with ITW USA that supports fundraising and identification of volunteer sonographers and radiologists who in addition to the Ugandan trainers help with training.

5. OUTPUTS AND OUTCOMES

5.1. IMPACT ON HEALTH CARE DELIVERY

ITWA has rolled out ultrasound services in 11 rural health facilities in Uganda and has skilled 150 health workers to perform obstetric ultrasound. Since 2010, 200,000 ultrasound scans have been done, with each scan generating data that aided decision making. Obstetric ultrasound results have helped change the management in 23% of pregnancies with complications.

Ultrasound sonography has been extended to include echocardiography through a cardiac ultrasound pilot program. The pilot programme identified 58 pregnant women with heart disease, who were monitored and treated at the clinic close to home. Seven women were monitored for specialized delivery, and one had her first baby after multiple late pregnancy foetal deaths.

The availability of ultrasound scans have supported pregnant mothers to receive timely care at the appropriate level of health facility, thereby reducing unnecessary delays and complications of delivery. This has led to an increase in the number of women seeking antenatal care, increased male involvement in ANC services and attendance, and improved birth plans at participating health facilities. In one participating health facility, first antenatal care (ANC) visits increased from 80 to 120 women, second ANC-visits has increased from 35 to 62, the third ANC increased from 10 to 30 while the fourth ANC attendance increased from 4 to 19 patients (Ross et al., 2013). Pregnant women are then referred to the appropriate level of health facility for delivery, depending on results from their ultra sound scan (Sengupta et al., 2013).

5.2. ORGANIZATIONAL MILESTONES

a) ITWA designed proprietary software, VICAT, and a protocol to transmit ultrasound sweeps, which maintain the cinematic feature of ultrasound, to any place where a cell-phone signal is available.

b) ITWA partnered with the Children's National Hospital and Uganda Heart Institute, Kampala, Uganda to complete their two-year NIH-funded Rheumatic Heart Disease study (Beaton, A. 2018). See link to publication: http://dx.doi.org/10.1136/heartjnl-2018-313810

5.3. COMMUNITY AND PATIENT EXPERIENCES

Since the introduction of the ultrasound scan, the community has developed a better relationship with the health facilities. Women and men have become more involved in antenatal care attendance and appreciate the importance of the visits. ANC visits have nearly doubled since 2012 (Ross et al., 2013). The community re-affirms that the major outcome has been the ability to have better prepared birth plans (for time of delivery), and having their husbands excited to see the baby. Many women who have used the ultra sound scan have become the "champions," encouraging others to go for the scan. They assert the ultrasound scan is more affordable (USD 1.5) than it is at private facilities, which charge between USD 5-6.

Anything with a cost has an implication. But to bring them to reality we charge them USD 1.5 but in hospital it's between USD 5-6. They also know it. When they come to the health centre and find out it's cheaper, then they will get the services here. (Renny Ssembatya, Data Officer, ITWA)

If I had not had this scan done here, I wouldn't have known that I should deliver from a hospital. (Mother, Nyamwegabira HC III)

This procedure helped me know the position of my twins and I was referred to the main hospital. (Mother, Nyakatale HCIII)

6. SUSTAINABILITY

For the sustainable provision of services, patients make a minimal co-payment of USD 1.5 for the service. This helps to pay for the gel, the internet connection, maintenance of the health facility, and electricity. This creates a sustainable way to generate income to run the facility. The revenue allows the programme to be financially self-sustaining since the equipment is provided by ITWA.

7. SCALABILITY

The organisation currently operates with five employees at the head office and the trained health workers in the remote sites. With more health facilities adopting the ITW model, more employees will be needed for the smooth running of activities.

ITWA started operations in one health facility in eastern Uganda, and soon expanded to 11 rural health centres (2018). In partnership with Rotary Cubs of Uganda and Chicago, ITWA intends to roll out to five more health facilities; and to 20 more facilities in the next five years.

ITWA extended its programme and ultrasound services to hard-to-reach areas in Uganda including the Bwindi forest in Kanungu district (home of the Batwa people, one of the marginalized communities in Uganda) through five years collaboration with Bwindi Community Hospital. ITWA has also extended services to the northern region. This area has faced with insecurity and political instability for many decades. The recent influx of South Sudanese refugees into the region has created further

pressure on =available health care facilities.
ITWA has also scaled its programme to Malawi. In partnership with Warm Hearts Foundation, ITWA will start implementing the ultrasound program in the district of Mangochi. Malawi has one of the highest numbers of maternal deaths in Sub Saharan Africa, and has minimal healthcare infrastructure. The partnership is aimed at ensuring that pregnancy complications can be detected early enough for birth planning and better delivery outcomes.

Successful implementation is based on adapting consistent processes to different contexts, taking into account cultural, political, access and socio-economic considerations. In addition, government must be willing to authorize task shifting from high level health to lower level cadres and to a range of interested health professionals (nurses, midwives, and clinical officers) to undertake training, and must be willing to support a quality assurance mechanism to ensure that patients receive the right diagnosis.

8. KEY LESSONS

ITWA started operations in the country with one health facility in eastern Uganda in 2008. The team never imagined that they would grow and expand to the 11 facilities they serve right now. Success is attributed to partnership with ITW USA, and to the strong leadership provided by the co-founder, Dr Kristen DeStiger and the executive director, Dr Alphonsus Matovu who believe that rural women should not suffer and die because they can't afford an ultrasound. In addition, ITW acknowledges the generous contribution of ultrasound machines from Phillips, image storage from McKesson, and the philanthropists who donate financially to ensure monitoring and supervision. ITWA also acknowledges the effort of the team that is constantly innovating to improve the services of the organisation. .

Operational lessons learned include:

a) The community initially believed that the use of ultrasound reduce a woman's life span, and there were taboos surrounding seeing the foetus while in the womb. Over the years, ultrasound has become increasingly acceptable through continuous community engagement, positive outcomes from users of the scan, and a good relationship between staff of ITW and the community. In addition to the ability to provide a much needed service to the community, team work and inclusiveness are part of the culture at ITW.
b) ITW has learnt that the closeness of the intervention to the target beneficiaries at lower level health centres ensures that the cost of transport incurred by community members to access the service is limited. This contrasts with alternatives that are usually at district/referral hospitals and private clinics in urban and suburban settings.
c) The training of frontline nurses and midwives in basic obstetric ultrasound helps cut the costs of hiring radiologists or sonographers, and ensures local ownership and sustainability.

CASE INSIGHTS

Task shifting in health is a popular concept, due to the scarcity of human resource. Task shifting now refers to the process of delegation, whereby tasks are moved, where appropriate, to less specialized health workers. The WHO estimates that the WHO African Region has a shortfall of 817,992 doctors, nurses and midwives, which means that there is a need for the current workforce among these professional categories to more than double (WHO, 2007). The shortage of radiologists and sonographers is severe.

The key insights from the ITWA solution and case study are:

1. Task shifting can create a sustainable and effective way to deliver ultrasound services to low resource settings. As shown by ITWA, trained midwives can conduct the ultrasound, reducing the cost of hiring a sonographer in a low resource and remote setting
2. The integration of telemedicine for the interpretation of ultrasound scans is feasible and provides an opportunity to improve quality of care given to patients.
3. Affordable ultrasound services can be provided in rural areas at a cost that the users are able and willing to pay. These later become self-sustaining.

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