



Maternal messaging
mHealth programmes
Empowering and enabling decision
makers to include mHealth services
into their budgets



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About the GSMA

The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress and Mobile Asia Expo.

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1. Abbreviations



CHW	Community Health Worker
CSI	Corporate Social Investment
IVR	Interactive Voice Response
LSM	Living Standard Measure
M&E	Monitoring and Evaluation
MDG	Millennium Development Goal
MNO	Mobile Network Operator
MNCH	Mother, New-born and Child Health
NDoH	National Department of Health
NPR	National Pregnancy Registry
PMTCT	Preventing mother-to-child transmission
PoPI	Protection of Personal Information
PWM	Pregnant Women and Mothers
SMS	Short Message Service
USSD	Unstructured Supplementary Service Data
WHO	World Health Organisation

2. Executive summary



Sustaining grant- or donor-funded mHealth services once funding has come to an end is a major challenge worldwide. This has largely been attributed to a lack of understanding of the true financial implications as well as a lack of empirical evidence of the effectiveness of such programmes.

From a South African perspective, this is further complicated by the fact that the mHealth ecosystem is relatively immature – there are only a small number of service providers and their services offerings generally do not compete or overlap. This makes it difficult to compare their services, costs and capabilities; as well as the outcomes that they are achieving.

While there is no single solution to manage the complexities of sustainability, programme buyers need to ensure that the most viable financing models are achieved. This involves investigating opportunities to reduce costs and exploring all avenues to unlock potential additional sources of revenue, whilst ensuring the programme reaches the maximum number of end users.

This document has been created by investigating the mHealth environment, both in South Africa and globally, in order to give a better understanding of the true cost of delivering mHealth programmes in South Africa and provide several options for making future maternal messaging mHealth programmes more sustainable, and potentially more effective.

mHealth programmes can be delivered through a number of operating models for a range of health needs. This document details three scenarios that consider different delivery channels and the costs associated with each channel. When considering the three costing scenarios (SMS/USSD channel, an SMS/USSD and data combination, and a solely data scenario), it is critical to bear in mind the complexities and challenges that will arise with each option.

Operating an mHealth programme in South Africa via a data only platform would be the most cost effective method of delivery, however, with a 69% penetration of feature phone and smartphones it would not allow the programmes to be accessed by all the potential end users. A data and SMS/USSD combination, where the service is delivered through data for PWM who utilise feature phones or smartphones, but the SMS/ USSD service will continue for those who only have access to a basic phone, also show significant savings when compared to the current delivery method, and this scenario should be further investigated.

Leveraging existing mHealth programmes and devices to assist in pre-registering and registering PWM is another area needing to be explored further, as it has the potential to reduce current programme costs significantly and improve programme effectiveness.

From a sustainability perspective, M&E is another essential element to consider when adopting a maternal mHealth programme. M&E assists in identifying areas for improvement and modification; and crucially, it also assists buyers to understand the impact of the programme and whether it is achieving its intended aims. M&E also provides health and economic metrics to justify the investment in the programme.

By having considered and tested all viable and potential options and the benefits realised with these programmes, it will be possible to begin defining actions that can drive sustainability.

“The MDGs cannot be achieved without a substantial reduction in maternal, infant and child mortality... We need to increase our efforts in order to turn these decisions into action and to make our aspirations a reality.”

- Adv. Bience P. Gawanas. Former AU Commissioner for Social Affairs (November 2011)

3. Maternal, newborn and child health in South Africa



132.9/
100 000

the global maternal mortality target is 29 deaths per 100 000... South Africa has approximately 132.9 deaths per 100 000



13 718/
clinic

South Africa currently has 13 718 people served per clinic in the public sector, which exceeds the WHO's guidelines of 10 000 per clinic

3.1. Current state of maternal, newborn and child health

Maternal, newborn and child health has been a key component in the country's healthcare agenda. Live births in South Africa are approximately 1.1 million per annum. 30% of these pregnancies occur in girls between 13 and 19 years of age.

MDG 5 aims to reduce the maternal mortality rate to 29 deaths per 100 000, however South Africa is currently not achieving this. In 2012, approximately 132.9 deaths occurred for every 100 000 live births. The highest ratio of deaths occurred in Limpopo and Mpumalanga, though high numbers are also observed in the other provinces.

It is estimated that 60% of maternal deaths in South Africa are considered to be potentially avoidable. Non-pregnancy-related infections are the major contributor to maternal deaths, followed by obstetric haemorrhage and hypertension. By addressing the various causes of mortality it may be possible to decrease maternal deaths and better achieve the targets set out by [amongst others] the Millennium Development Goals.

Although the ratio for maternal deaths is high, a number of successful initiatives have been implemented to improve mother-to-child transmission of HIV, which demonstrates that targeted programmes can have a significant impact on reducing disease. Data from the National Health Laboratory Services (NHLS) shows that mother-to-child transmission of HIV has more than halved from 8% in 2008 to 2.4% in 2013. This reduction is in line with the South African National Strategic Plan which guides efforts for 2016/2017 in reducing the transmission rate to less than 2%.

Infant (0 and 1 month) death statistics continue to be relatively high (18.8 deaths per 100 000 live births). The primary cause for this being sepsis and other infections, but others include prematurity, foetal abnormalities, intrapartum asphyxia and birth trauma. It has been suggested that these can be addressed by mothers adhering to the prescribed continuum of care which includes:

- Antenatal care attendance
- Appropriate response to poor foetal movements
- Seeking immediate medical attention during labour

The target for child (1 and 59 months) mortality is 20 deaths per 1 000 live births, as set out by the MGDs. South Africa lags behind this target with 45 deaths per 1 000 live births in 2012. The primary causes of death are acute lower respiratory infections, malnutrition and diarrhoea.

These statistics further demonstrate the need for targeted strategies to improve maternal, newborn and child health outcomes, and to achieve the targets set out by programmes such as the MGDs.

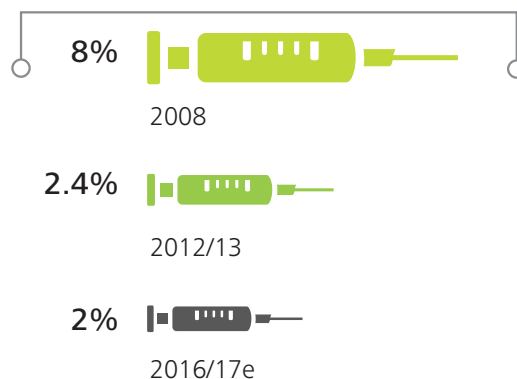
3.2. South Africa's healthcare environment

Healthcare infrastructure is potentially a major contributing factor to the high maternal and child mortality rates. The 2012 National Healthcare Facilities Baseline Audit revealed serious challenges with the quality and functionality of clinical services within the public healthcare network. South Africa currently has 13 718 people served per clinic in the public sector, which exceeds the WHO's guidelines of 10 000 per clinic. Shortages in healthcare skills (especially in rural areas) are further contributing to the challenges in delivering clinical services.

- 0.77 doctors per 1 000 population in the public sector (one of the lowest globally)
- 73% of GPs work in the private sector, servicing 20% of the population that comprise the higher LSM groups

In order for maternal, newborn and child mortality to be decreased, it is necessary to address these facility and skill challenges.

Mother-to-child transmission of HIV



3.3. Commitments to reducing maternal and child mortality

3.3.1 Key commitments

South Africa has demonstrated its commitment to reducing maternal, newborn and child mortality by adhering to various strategies, one of which is the Strategic Plan for Maternal, Newborn, Child and Women's Health and Nutrition in South Africa 2011-2016 ('Strategic Plan'). This Strategic Plan outlines actions and objectives that guide the provision of maternal, newborn and child healthcare from antenatal and postnatal care, to nutrition through breastfeeding, the provision of preventative services (immunisation), and the development of healthcare services and coverage.

Other programmes and agreements cover similar actions and objectives to those defined in the Strategic Plan; however, regardless of the Strategic Plan, the various programmes need to have targeted, scalable and sustainable actions that reach the needed communities.

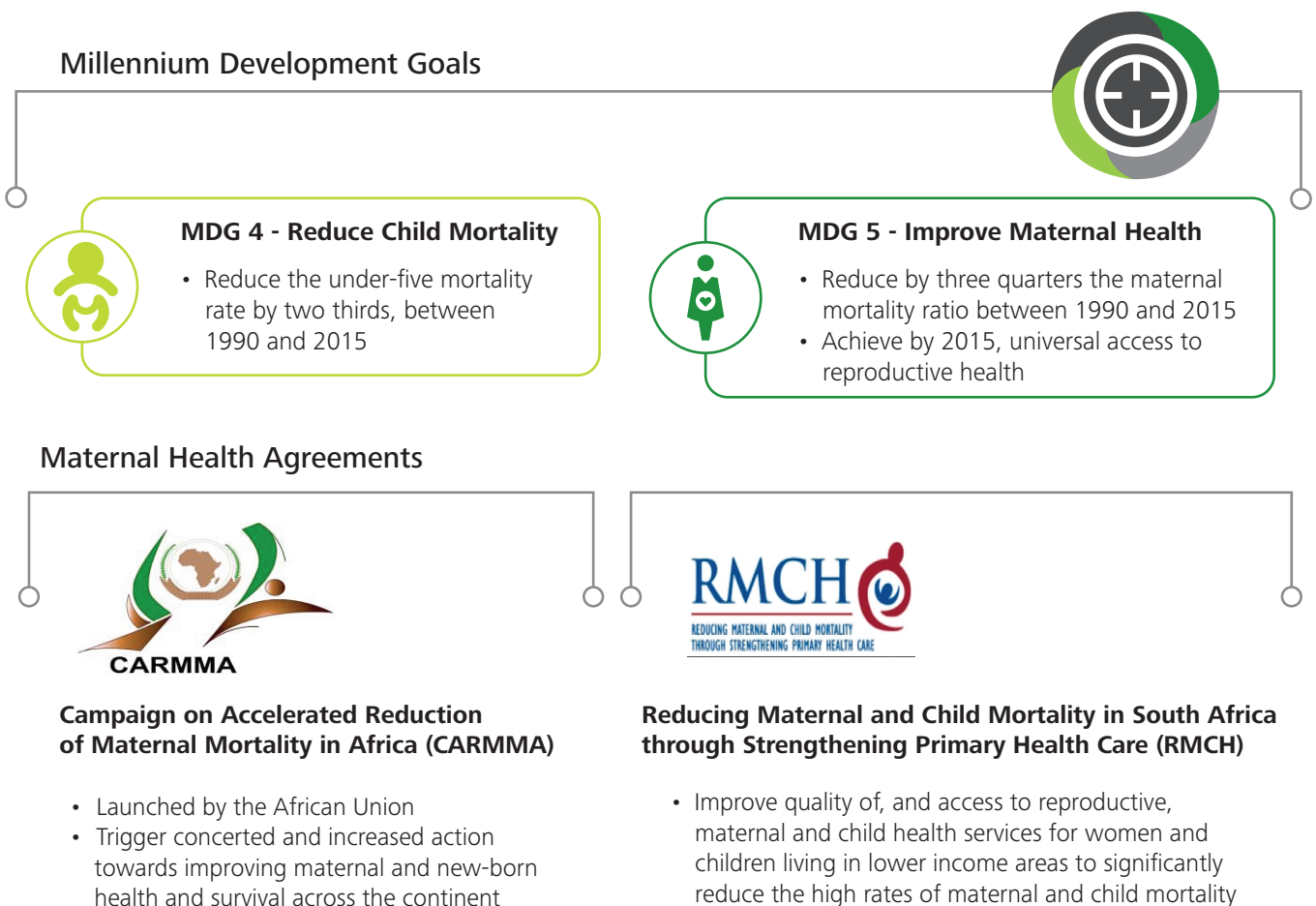
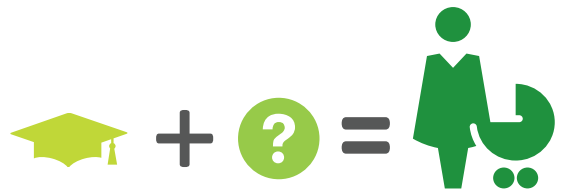


Figure 1: Commitments to achieving improved maternal, newborn and child health



3.3.2 Critical elements to achieving commitments

Critical elements for addressing the key health indicator of maternal, newborn and child health and survival include:

- Improving the proportion of women that attend antenatal care in the first trimester
- Improving the quality of antenatal care (e.g. early testing for HIV)
- Improving maternal nutritional status
- Ensuring that all eligible mothers receive all components of the PMTCT programme
- Improving the quality of intrapartum and emergency obstetric care
- Ensuring highly active antiretroviral therapy cover for HIV-positive breastfeeding mothers

mHealth may be one method that can assist in addressing these elements by educating and promoting positive health behaviours amongst the target population and therefore ensure that health-seeking behaviours occur.



targeted



scalable



sustainable



....mHealth solutions
offer the potential to
bridge health information
gaps and support health
system strengthening

4. mHealth as an enabler of healthcare delivery



4.1. mHealth as a platform to deliver healthcare services

mHealth solutions offer the potential to bridge health information gaps and support health system strengthening by addressing a spectrum of healthcare needs including:

- Promotion of health education and awareness
- Diagnosis support
- Data collection and reporting
- Management of supply chains
- Registries and electronic health records
- Electronic decision support
- Provider-to-provider communication, training and education
- Human resource management and capacitation
- Financial transactions and incentives

Players from across the mHealth ecosystem will have a role to play in designing, developing and delivering the solution, during which there are key considerations that need to be taken into account:

- The activities required to ensure positive health outcomes
- The specific content needed to assist in delivering these activities
- The adaptations necessary for the content to be delivered effectively
- The interoperability of systems and technologies between the different service providers
- The involvement of the different stakeholders across the mHealth value chain
- Privacy and security of data

Various stakeholders are involved in developing and implementing an mHealth solution. These stakeholders and the technologies and delivery mechanisms comprise the mHealth ecosystem (shown in Figure 2).



mHealth solutions offer the potential to bridge health information gaps and support health system strengthening

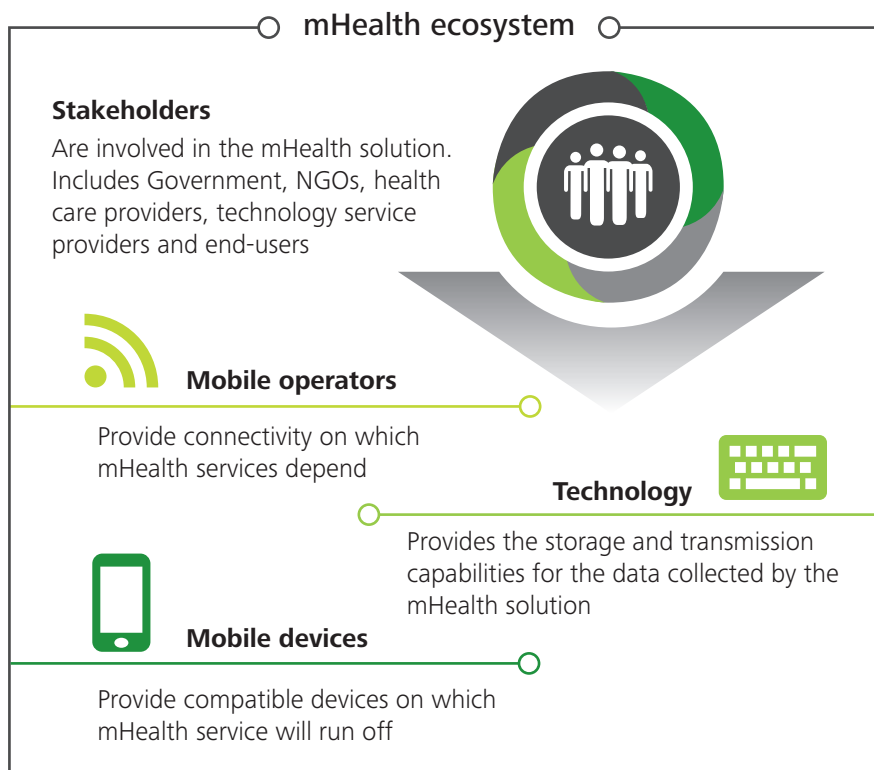


Figure 2: The mHealth ecosystem

4.2. Mobile access in South Africa

For mHealth solutions to be effective it is also necessary to ensure that the reach and accessibility of these are possible. South Africa has one of the most developed mobile markets in sub-Saharan Africa, demonstrated by the number of South Africans (over the age of 15) who personally own, rent or have use of a mobile phone increasing from 33% in 2004 to 85% in 2012. The degree of this mobile penetration increases as income levels in LSM groups six to ten increase.

Furthermore, mobile access in the target market is also strong with over 70% mobile penetration in mothers across all LSM groupings. Penetration of smart and feature phones is also estimated to increase amongst this group, and the overall South African market is expected to rise as the price of data decreases and cheaper smartphones become available. Currently there are an estimated 12 million active smartphones in the market, which equates to a penetration of 32% of the population, and this access is forecast to grow to 53% by 2017.

This increase will be impacted by:

- Affordability – competition in the smartphone market has prompted a decline in device prices which results in an increased market uptake
- Data costs – improved network infrastructure and pricing disputes between operators have resulted in the reduction of data costs. It is expected that this will continue to decrease, resulting in increased penetration
- Network coverage – it is expected that as coverage and speed of the 3G network improves, smartphone penetration will increase

Additionally, as smartphone penetration in South Africa increases, it will become necessary to explore methods of utilising these devices in delivering on maternal mHealth solutions. Crucially, mHealth programmes will need to adjust to the changing market consumption and trends in order to ensure consistent use and uptake.

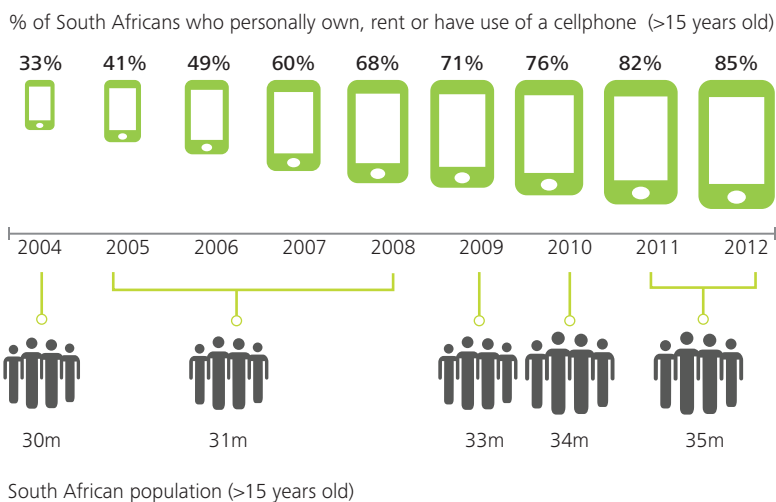


Figure 3: Mobile phone penetration in South Africa

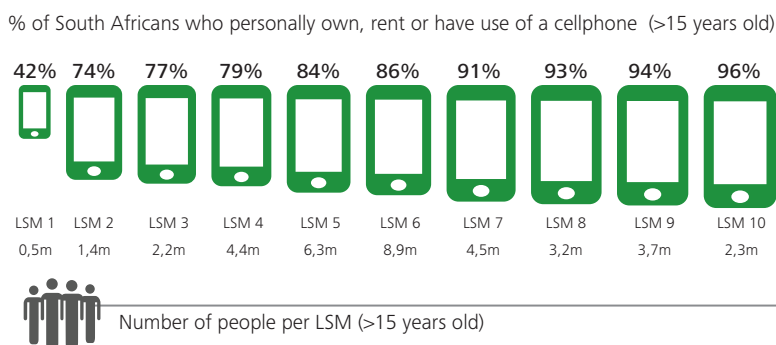
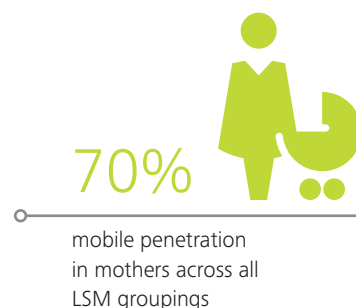


Figure 4: Mobile phone penetration in South Africa per LSM group



4.3. The mHealth technology framework

The framework for an mHealth solution consists of several interoperable components, with various stakeholders and service providers involved in the different levels as depicted below.

The technology framework is comprised of five different layers: user, the channel for delivery, the application layer, the middleware layer and database. Figure 4 illustrates this framework at a high level to depict how a programme can deliver messages to the user and how the user's data is captured and stored.

The ideal mHealth solution should be scalable, commercially viable and socially benefit the bottom of the pyramid population. Sustainability is also crucial so that the positive impact on health outcomes will be realised for as long as the programme is operational. One component in ensuring the sustainability of these programmes is the evaluation of their effectiveness, and this will become an integral part in ensuring that these solutions extend beyond first phase implementation.

User: The PWAM will interact with the service via a mobile device, ranging from a basic phone to a feature phone or smartphone.

Channel: The user will input unique data fields via a USSD channel, which can ultimately feed into a registry. The user will also receive information and reminder messages via an SMS channel.

Application: The application layer provides the services that fulfil use cases and the user interacts with the application through their mobile device. The application integrates with the middleware layer, which orchestrates transactions and data requests initiated.

Middleware: Performs the transaction process and orchestration functions. It is based on open standards.

Database: The database is the central registry/ repository where all user information is stored and managed.

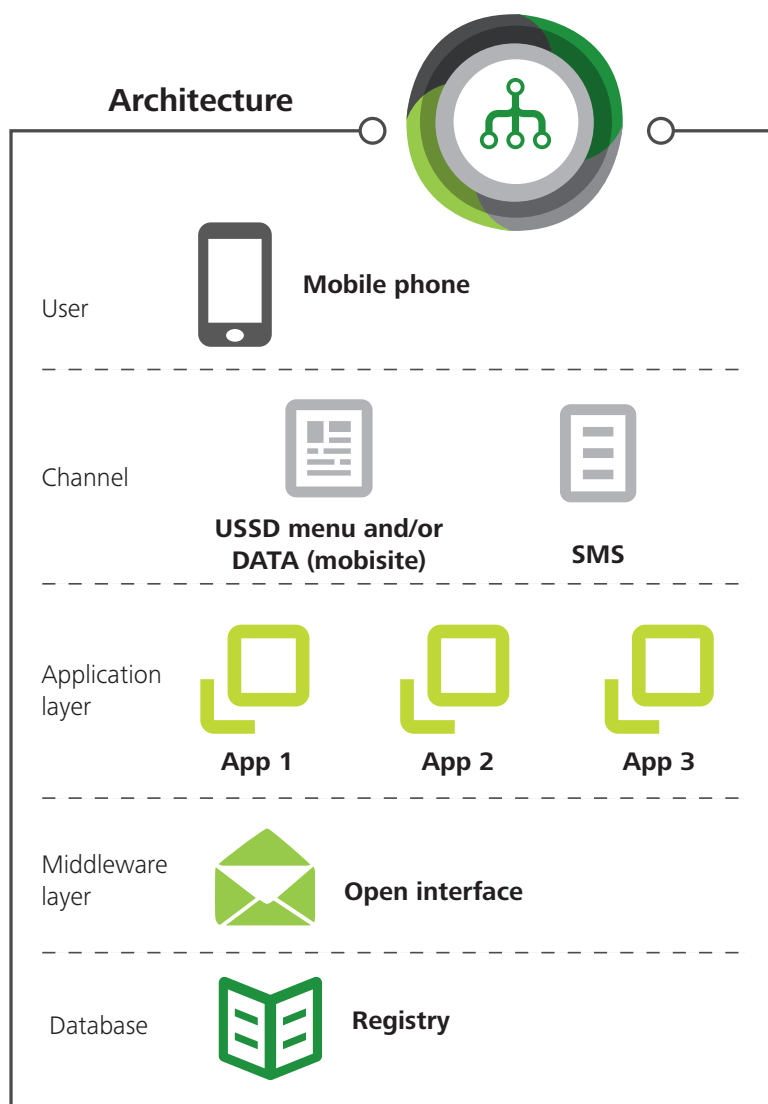


Figure 5: The mHealth technology framework

4.4. Regulations governing mHealth programmes

When implementing mHealth programmes it is necessary to consider the regulations and legislation that govern the use and security of information data. Data is a key component of mHealth programmes, and it is therefore necessary to consider the four compliance components:

- Privacy of data
- Security of data
- Ownership of data
- Usage of data

Currently there is no legislation specifically governing mHealth programmes, however, there are various Acts and Bodies that could have an influence over these programmes, both now and in the future.

These include:

Potential governance over mHealth

- Protection of Personal Information (PoPI) Act
- National Health Act
- Electronic Transactions and Communications Act
- Promotion of Access to Information Act





Extension of eHealth legislation

- Minimum Information Security Standard
- National Archives and Record Service of South Africa Act
- Free and Open Source Software Use for South African Government

Bodies

- Health Professions Council of South Africa
- Council for Scientific Research in South Africa

Table 1: Legal and regulatory considerations when implementing an mHealth solution

mHealth environment	Legislation around what it means	What must be ensured by stakeholders	Potential impact on mHealth
 Data privacy	<ul style="list-style-type: none"> • Ensure adequate protection of personal information on handset and where data is stored or transmitted • Integrity of stored data cannot be compromised deliberately or by human error 	<ul style="list-style-type: none"> • Ensure users are given information to manage their privacy • Patients and health-care workers must practice confidentiality and integrity of data • Data needs to be captured, stored and maintained in a database to ensure integrity and confidentiality of information 	<ul style="list-style-type: none"> • Users need to know: <ul style="list-style-type: none"> - which company is collecting data, - what personal information is required - what the intention is - who its going to be shared with • Patients are entitled to be informed of their conditions
 Data security	<ul style="list-style-type: none"> • Adequate measures and controls in place to track and prevent unauthorised access 	<ul style="list-style-type: none"> • Adequate measures and controls in place to safeguard information to protect it from theft, or being compromised • There are three basic elements of data security to be ensured: confidentiality, integrity and availability 	<ul style="list-style-type: none"> • Compliance with very restrictive regulations like: <ul style="list-style-type: none"> - security issues regarding authentication of user - encryption of transmitted data • Health-care programmes must process all confidential data so it is not disclosed to unauthorised individuals, whether disclosure is accidental or malicious
 Data ownership	<ul style="list-style-type: none"> • Dependent on whether partners are contracted with SA government to provide service <ul style="list-style-type: none"> - If so, then SA government owns data • Partner organisations only 'own' data that are legally obliged to retain <ul style="list-style-type: none"> - i.e. MNOs would own traffic data e.g. SMS sent 	<ul style="list-style-type: none"> • Person should be appointed to: <ul style="list-style-type: none"> - ensure integrity, availability and accuracy of data - create internal awareness of programme to ensure staff are aware of their obligations to keep data confidential 	<ul style="list-style-type: none"> • All data collected via registration and subscription systems are transferred to National Pregnancy register • Data residing on NPR and associated servers held at NDoH
 Data usage	<ul style="list-style-type: none"> • Pertains to who personal information is shared with i.e. third parties 	<ul style="list-style-type: none"> • Patients need to know how their personal information will be collected, shared and used, and to exercise choice and control over its use 	<ul style="list-style-type: none"> • Responsibility and obligation on owners of data to protect personal information • National Department of Health Pregnancy Registry and Data Controller are responsible for good privacy and security practices

Taking these potential regulations and legislations into account, the following (as shown in Table 1) should be considered when establishing and implementing mHealth programmes:

Underpinning regulations and legislation, there are interoperability standards that need to be adhered to. These standards assist in ensuring the compatibility of information systems across the public sector and are key in trying to increase the scope and scale of programmes from different service providers.

- ISO standards: Interoperability is a key component when implementing mHealth programmes and this is fundamentally dependent on the use of standards. These are referred to as ISO standards which cover various areas including health informatics and electronic health record communication. These are necessary as a way to ensure harmonisation of practices, protection of data and patient privacy, and will need to be considered when developing further programmes.

- The Minimum Information Interoperability Standards (MIOS) 33: The MIOS defines government’s technical standards for achieving interoperability and compatibility of information systems across the public sector. It is a key component in the overall e-government strategy for the country and these standards will affect and need to be applied for any programme developed and utilised in the public sector. As such, mHealth programmes that contain information and data flows into the public system will need to adhere to these.

4.5. Barriers to implementing mHealth solutions

Although mobile access can contribute to the success of mHealth programmes, a number of barriers remain. This demonstrates the need for a clearly defined business model and an mHealth solution that breaks the implementation barriers.



Figure 6: Key barriers to consider when implementing an mHealth solution

5. Maternal messaging mHealth case studies



mHealth has been regarded as a method to deliver healthcare in an efficient, innovative and user-interactive manner. An assessment of global and local maternal mHealth programmes was conducted to understand the different types of solutions, the lessons learnt, and the need for clear monitoring and evaluation studies. All of these factors can assist in driving a programme's sustainability.

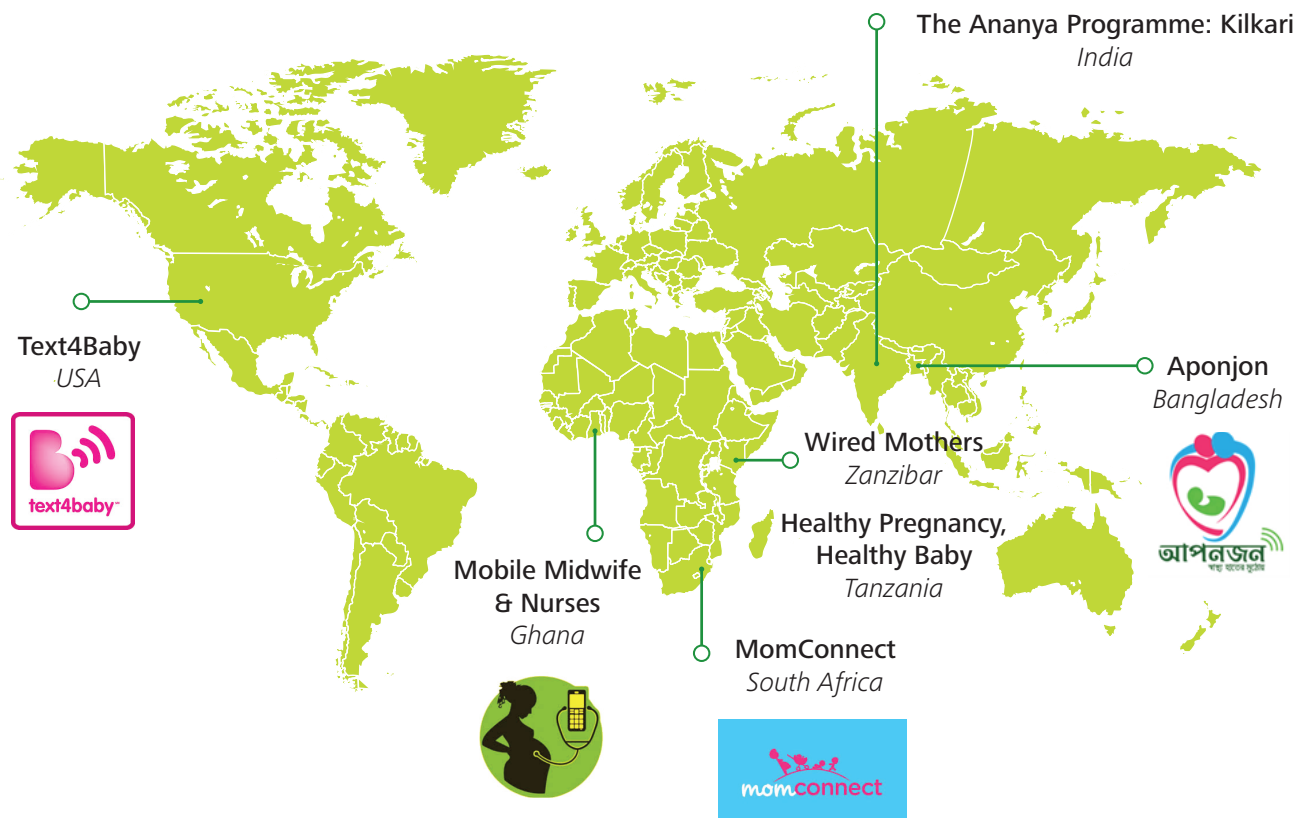


Figure 7: Global and local maternal messaging mHealth case studies



Text4Baby was launched in the United States and within three years had registered 500 000 mothers



Aponjon in Bangladesh ...free of charge for 20% of registered users that belong to lower-income levels

5.1. Global maternal mHealth programmes

5.1.1. A snapshot of solutions in developed and developing countries

Maternal mHealth programmes are being implemented in developed and developing countries as a means to provide healthcare and modify behaviours within this population group. Although there is consensus that there is value in providing these services, the true impact remains to be conclusively evaluated. Whilst some randomised controlled cluster trials have been conducted, it is necessary to expand these studies to be more quantitative on the health and economic outcomes and benefits that the programmes offer.

Text4Baby

In 2010, Text4Baby was launched in the United States and within three years had registered 500 000 mothers. The programme is comprised of over 250 educational text messages on nutrition, delivery, pregnancy health, immunisations and infant health. The service also provides links and toll-free numbers that can be utilised for additional information and is offered in either English or Spanish. Currently the Department of Defence is conducting studies to understand the value of the programme for military families and States are competing to register as many users as possible. Other programmes following the SMS delivery channel include Healthy Pregnancy, Healthy Baby in Tanzania and Wired Mothers in Zanzibar which also deliver messages to PWMs as a way to influence health seeking behaviours.

Mobile Midwife

Certain programmes take literacy levels of the target market into consideration and utilise interactive voice response (IVR)/voice messages to deliver relevant content to users in their language. One such programme using this delivery channel is Mobile Midwife though it also uses SMS channels. A unique feature of the IVR channel is that users without a personal phone can access their messages via a “toll-free” number – this is made possible by users being required to enter a unique ID for the messages to be played. Other distinctive features of this programme include:

- A client data app which allows nurses to upload patient records into a centralised database to track client care and query the database as needed
- A monthly caseload report is generated using aggregated registration data for the Ghana Health Service to permit analysis and feedback to the facilities on adherence to care protocols
- In certain districts nurses now utilise tablet devices which allow for quicker registration of users and easier data management

The service cost of the Mobile Midwife programme is US\$12 per year per registered woman; this cost includes equipment, standard immunisations, airtime and three-part anti-malaria medication. By including the cost of immunisations in the programme fee, it assists in driving adherence to care. The programme was rolled out in Nigeria with content and language adaptations, and with this scale up sustainability becomes key. The Grameen Foundation (a key implementation partner) is currently testing a sliding-scale fee structure that will allow the use of programme revenue from middle-class women to support the usage by lower-income women. It is anticipated that this model allows for the programme to become a sustainable social enterprise.

The Ananya Programme – Kilkari

The Kilkari programme in India also uses IVR channel with the aim of promoting positive health behaviours and generate demand for health services in eight districts of Bihar. The Kilkari messaging service will keep trying to reach the mother should she be unable to receive the call, and if the airtime is depleted the service will be put into suspension mode until it is topped up. The service comprises of 64 messages at a cost of 1 rupee per message, in 6 months 60 000 subscriptions were made and 1 000 villages exposed to the programme. A unique feature of this programme is that CHW are incentivised to promote the service, whereby they receive airtime for every PWM that is subscribed onto the programme.

Aponjon

Another programme worth mentioning is Aponjon in Bangladesh. The primary objective of Aponjon is to register two million mothers as well as their relatives in order to influence positive maternal and child health behaviours. The programme was launched nationally in 2012 and has had 624 330 subscriptions to date. The programme also utilizes 3 000 community workers and brand agents to assist in increasing registered users. Messages are delivered either via SMS or IVR, and the user can select the most convenient time for delivery of the messages. There is also a counselling service center where doctors deliver health information to subscribers and refer to health facilities as necessary. Messages are costed at US\$0.025 each for upper and middle income subscribers and are free of charge for 20% of registered users that belong to the lower income levels.



South Africa recently launched a maternal mHealth programme called MomConnect ...messages are offered in six languages and will include all 11 official languages in the future

With the national roll-out of the Aponjon programme certain adjustments are being made, these include:

- The development of higher-end apps for upper income users, it is hoped that this could assist in cross-subsidising the basic service for lower-income mothers
- Additional revenue is also being achieved through advertising of a government-endorsed micronutrient for children older than six months
- Funding is being restructured to ensure long-term sustainability by deriving additional funding from upper-middle income users as well as local corporate social responsibility, advertising and sponsor a mother campaign

Monitoring and evaluation (M&E) is a key component of this programme and outcomes are being tracked via a performance monitoring plan. The plan defines a framework, dashboard and feedback system that can demonstrate reach, behavior change and impact. In general, these global programmes are still in Phase 1 implementation with more consideration now being given to how they will achieve scale and be sustainable. Future success of such programmes will only be possible through clear outcome and impact assessments, which will then inform sustainability actions.

5.1.2. Maternal mHealth programme in South Africa

MomConnect

Recently South Africa also launched a maternal mHealth programme called MomConnect. The primary aim is to improve maternal, new-born and child health through the use of cell phone based technologies integrated into maternal, new-born and child health services. The programme seeks to register one million pregnant South African women in one year and promote positive health behaviours through targeted health educational messaging.

The messaging service will be for the duration of the pregnancy, up until the infant is one year old; and covers a range of topics including information on the pregnancy, nutrition, hygiene, importance of skilled care and immunisations and are offered in six languages and will be scaled to include all 11 official languages in the future.



Benefits of such a registry include:

- Organised collection, storage and retrieval of data
- Consolidated view of pregnancy statistics
- Improved management of resources
- Service delivery monitoring
- Monitoring of trends across the country

A unique component of this mHealth solution is the National Pregnancy Registry (NPR) which will underpin the MomConnect programme. The programme's mobile health applications are combined with the NPR's health information exchange technology which creates a functional platform that captures relevant demographic and clinical data from PWM that are accessing the public health system. This will allow for the women to receive targeted information and health messaging, as well as provide the health system with information to assist in improving health service delivery.

Registration for the programme is primarily based at the point of care, though pre-registration can occur via two other channels (identification by CHWs and subscription by the PWM herself) with an initial five messages being received until the mother completes registration at the health facility.

When compared to other global mHealth solutions, MomConnect is a relatively new programme and as such it is expected that there will be some learnings and adaptations in its roll out. These will ensure that the aims and objectives are reached and that sustainability is achieved. A clear M&E framework has been proposed, and this will be vital in tracking the progress of the programme in achieving its aims and objectives.

Table 2: Summary of global and local maternal mHealth programmes

	Text4Baby	Aponjon	Mobile Midwife & Nurses	MomConnect	Kilkari
Registration method	SMS	IVR or call centre	Call centre or health facility	USSD	SMS
Delivery channel	SMS	SMS & IVR	SMS & IVR	SMS	IVR
No. users (to date)	500 000	624 330	37 000	~100 000	87 876
Unique factors	<ul style="list-style-type: none"> Additional info given via toll-free number and links 	<ul style="list-style-type: none"> 24 hour counselling centre Data app being explored 	<ul style="list-style-type: none"> Sliding scale fee structure Unique user ID 	<ul style="list-style-type: none"> National pregnancy registry 	<ul style="list-style-type: none"> CHW are incentivised to be promoters
Number of messages	250	350	170	150	64



Benefits of the messaging across these programmes include:

- Promotion of health education and awareness
- Improved lifestyle choices
- Highlight warning signs
- Promotion of improved help-seeking behaviour
- Ability to disseminate information quickly and easily
- Improved maternal and child health outcomes
- Connect women with local health services
- Reinforce breastfeeding practices
- Explain the benefits of family planning
- Make new mothers aware of the best ways to care for their babies

As with the above mentioned global programmes, it is essential to have an implementable tracking mechanism that can assist in not only tracking benefits but also inform where improvements and adjustments need to be made. In this way sustainability can be driven throughout the mHealth ecosystem.

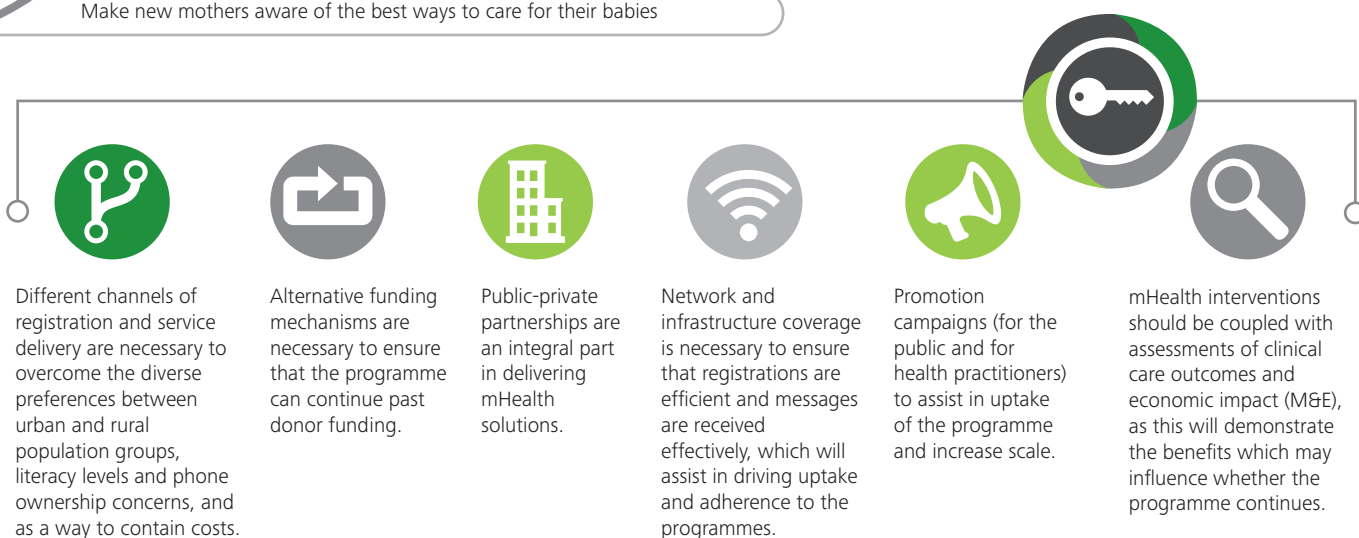


Figure 8: Key lessons for maternal messaging mHealth case studies

6. Health and economic proof points



When implementing such mHealth programmes, it is expected that they will have an impact on the health of the targeted population as well as the country's economy.

6.1. Health proof points

The continuum of care encompasses maternal, newborn and child health, and requires end-to-end healthcare services to ensure good health outcomes. mHealth programmes may assist in providing good health outcomes through promotion of the importance of following the antenatal continuum of care. Potential maternal health proof points are depicted below:

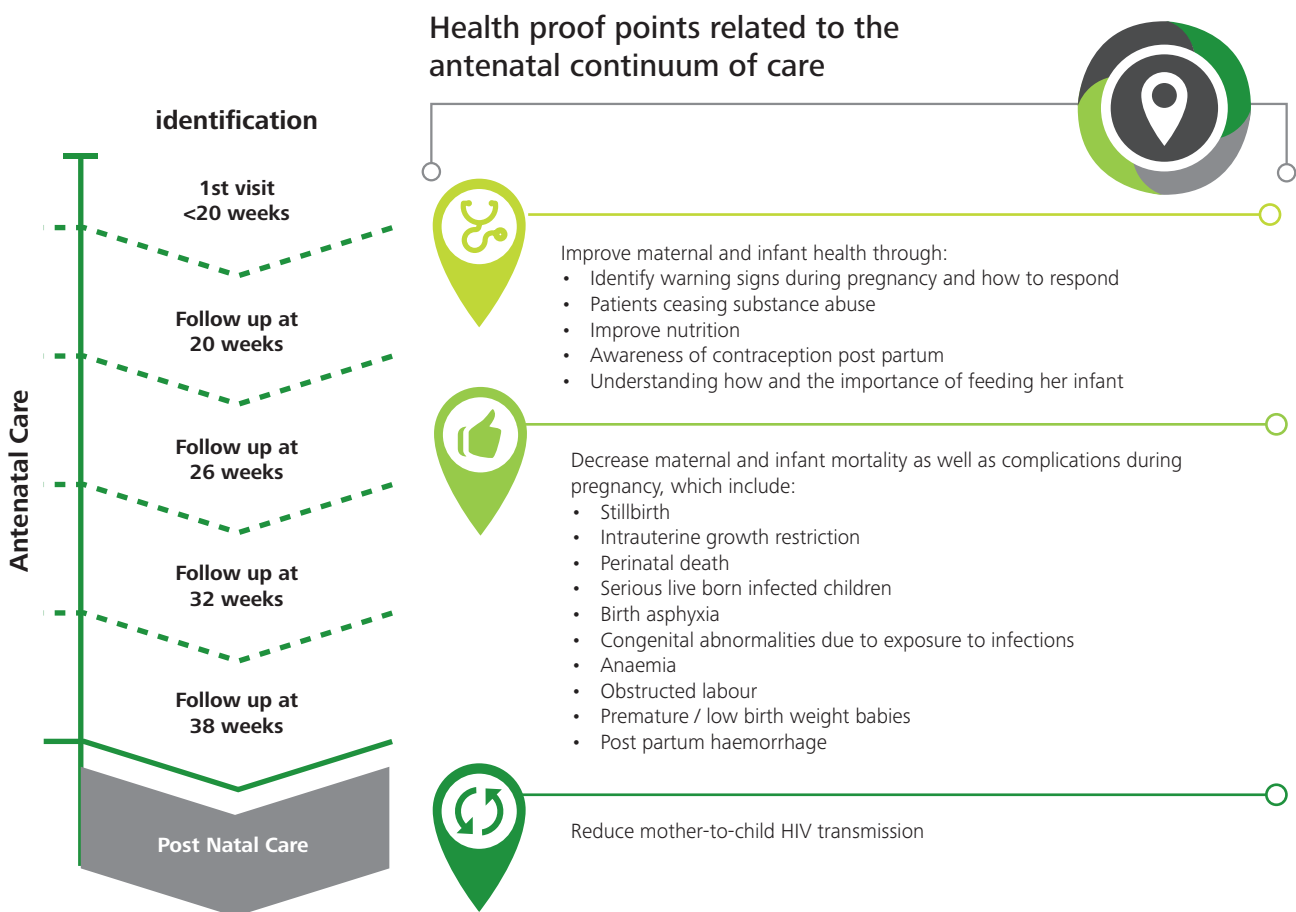


Figure 9: Potential health proof points along the maternal continuum of care

34%
vs
80%



only 34% of mothers with poor maternal healthcare knowledge receive antenatal care, while 80% of mothers with good maternal healthcare knowledge receive antenatal care

Poor knowledge of maternal healthcare is the major contributor to delays in seeking care during pregnancy and childbirth. A Japanese study shows that only 34% of mothers with poor maternal healthcare knowledge seek antenatal care, while 80% of mothers with good maternal healthcare knowledge seek antenatal care. Maternal mHealth programmes may be a channel through which to improve the knowledge of women and husbands and their uptake of antenatal care services. This may be done through educated messaging, feature phone or smartphone applications, and knowledge-sharing by CHWs.

Infant and childcare health proof points need to be analysed from birth until the end of the immunisation schedule at 18 months. The proof points may include:

- Reduction in mother-to-child HIV transmission
- Decrease in infant mortality
- Reduction in the contraction of diseases such as polio, TB, hepatitis, tetanus, diphtheria, diarrhoea, meningitis and pneumonia

Though assessments have been limited in determining the true impact of maternal mHealth programmes on the abovementioned proof points, initial studies on various global maternal mHealth programmes have shown the following:

1. A study conducted by the University of California, San Diego and California State University with Text4Baby participants found that:

- 74% learned about medical warning signs
- 65% reported that Text4Baby helped them to remember an appointment or immunisation

2. A cluster randomised controlled trial of 1 311 registered users and 1 239 controls not registered with the programme was conducted for Wired Mothers. The trial revealed:

- The intervention increased the proportion of women who attended four antenatal care visits (44% versus 31% in the control group)
- 60% of women in the intervention group versus 47% in the control group delivered with skilled attendants, though this was more significant for urban women
- The perinatal mortality rate was lower in the intervention cluster (19 per 1 000 births) than in the control cluster (36 per 1 000)

3. Aponjon's initial impact was evaluated through a survey which showed that:

- 63% of Aponjon subscribers attended at least four antenatal care visits, which was an increase of 43% from the national baseline of 20%
- 45% of Aponjon subscribers went to a facility for delivery
- 56% of new mother subscribers attended a postnatal care visit
- The immunisation rate amongst users was 100% for pentavalent immunisations

These all demonstrate the impact that mHealth solutions have on health behaviours. However, it is necessary to extend the scale and scope of these studies to fully determine the impact on health outcomes as well as the economic impact.

6.2. Economic proof points

Improvements in healthcare outcomes can potentially have a positive effect on the performance of the economy. According to Jeffrey D Sachs from the Harvard Institute, there is a correlation between health and economic performance. The economic impact would potentially be on:

- Labour productivity
 - Being ill results in days of work lost and poor productivity
 - Each child who dies before their fifth birthday represents a loss of 1 300 to 1 800 hours of parental work time
- Savings and capital investment
 - Ill individuals cost the nation further expenses
 - Investments in education and other forms of human capital are at risk of being misplaced and not benefited by individuals who do not survive
- Foreign trade
 - Communicable diseases increase the costs of inter- and intra-national migration, investment, commerce and trade

There are indicators that can be used to track the impact of mHealth on the economy, as illustrated in Figure 10.

In order to verify and both quantitatively and qualitatively prove the abovementioned health and economic proof points, it is necessary to monitor and evaluate mHealth programmes through a clearly defined and implementable framework.

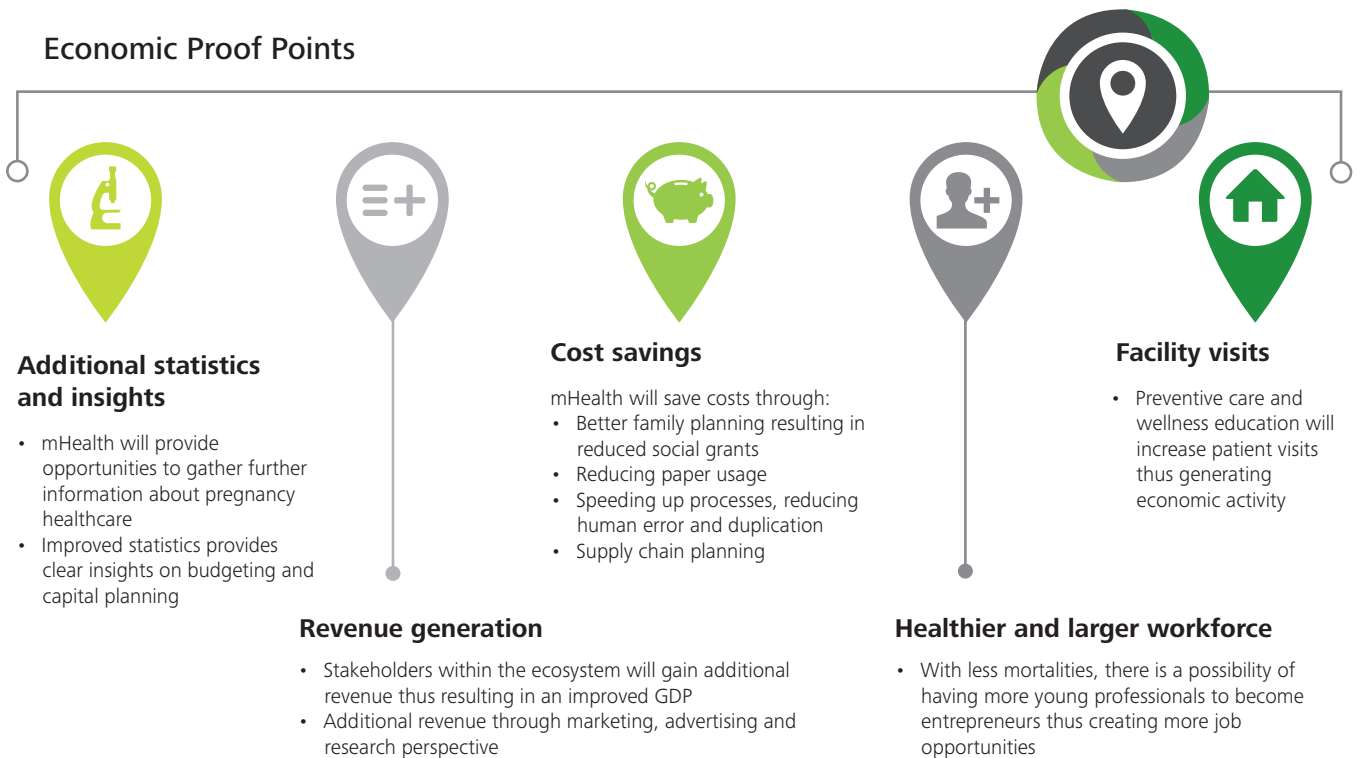


Figure 10: Economic indicators that may be impacted by a maternal mHealth programme

7. Maternal mHealth programme costing



The sustainability of maternal mHealth programmes can be dependent on how the programmes are funded beyond the donor period. This makes it critical to understand the current costs associated with these types programmes (specifically how much it will take to run such programmes beyond the donor period), and to understand if there are any alternative delivery methods that could reduce or minimise the costs.

7.1. Cost breakdown

While there is no single solution to manage the complexities of sustainability, buyers of a maternal mHealth programme need to ensure that the most sustainable financing models are achieved. This involves investigating opportunities to reduce costs. The bulk of costs occur at the channel layer. As such, the costing model has been broken down into three different scenarios that demonstrate the different possibilities of structuring the programme and the costs associated with each. The scenarios include:

Scenario 1: USSD and SMS

Deliver the programme utilising USSD for registration of users through the collection of data fields, and SMS to deliver content to the user for the duration of the programme.

Scenario 2: Data and USSD/SMS combination

Deliver the programme using data for the population group that owns a feature phone or smartphone, but maintain the USSD/SMS component for lower LSM groups (with the penetration being 69%) that only have access to a basic phone .

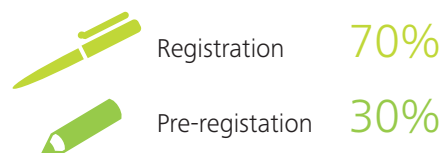
Scenario 3: Solely data usage

Assume that all users have access to a feature phone or smartphone and can download all the necessary applications.

7.1.1. Likely uptake rate of the programme

The first component in cost calculation for the three scenarios is to understand the likely uptake rate of a programme. This assumption was based on the maximum uptake rate of other global mHealth programmes (e.g. Aponjon and Kilkari). From this it was estimated that the uptake for year 1 would be 350 000 PWM, and that this would increase to 650 000 PWM in year 2 and 1 000 000 PWM by year 3.

Once the uptake rate had been determined, the second component of the cost calculation was to understand how users would join the programme. The two possible options modelled are through pre-registration, either through themselves or by a clinical healthcare worker or registration at a healthcare facility. The split of users across the options would be:



It was assumed that there will be a high conversion rate of PWM from pre-registration to full registration, and that this conversion rate would increase year on year (from 80% in year 1 to 100% by year 3). This increased conversion was based on the fact that the perceived benefits of this programme would be better understood by communities over time, and that nurses and CHWs would become more experienced and therefore continue to drive the programme and promote PWM adherence to the process.



consider different delivery mechanisms to minimise costs while maximising reach

Table 3: Uptake and conversion rates of users

	Forecasted total users	Registered	Pre-registration	Conversion rate of pre-registration	Pre-registration conversion	Total users
Year 1	350 000	245 000	105 000	80%	84 000	329 000
Year 2	650 000	455 000	195 000	90%	175 500	630 500
Year 3	1 000 000	700 000	300 000	100%	300 000	1 000 000

Total users= Registered users + Pre-registration conversion

7.1.2. Breakdown of the layer costs

The scenario costs were calculated based on the number of users (as per Table 3), and the costs associated with the interoperable components/layers:

- Channel costs (MNO costs)
- Application costs
- Middleware and database layer costs

1. Mobile network operator costs/channel costs

To demonstrate the maximum costs for running such a programme, it was assumed that:

- All pregnant women who are fully registered will enter the programme at eight weeks of pregnancy and will remain on the programme until their child is 12 months old. In this instance, a total of 1.3 USSD sessions are used (includes 1 session to register and a fraction of the total number of complaints, compliments and frequently asked questions expected, but excludes wastage) and two messages received per week for the duration of the programme.
- Pre-registered PWM would utilise 1 USSD session and receive a maximum of 5 messages prior to progressing to being registered with the programme.
- Pregnant women will also have the opportunity to opt out of the service, each utilising a single USSD session. It is assumed that those who opt out of the programme are negligible and the cost of the USSD session for this has not been factored into the model.

USSD wastage

USSD wastage occurs due to timeouts during the process of capturing the information, as well as due to possible network problems.

An average wastage factor of 4 was used when developing the cost model. This means that it takes an average of 4.0 USSD sessions to complete a registration or pre-registration. This is despite the fact that data fields are saved until the next session.

Pricing

An average cost for both SMS and USSD was calculated based on the current rates charged by the WASP aggregators. The price of the data component was an average cost based on the current rates charged by the MNO.


2. Application costs


Application costs are applicable to maintain a programme's communication/messaging platform. Production costs were taken into account for year 1, and running/maintenance costs were included for the duration of the programme. Production costs include requirements gathering, training material, messaging content production, admin interface production, dashboard production, and helpdesk functionality production.

The running costs are divided into three distinct areas:


- Software
- Maintenance and support
- Other

Software







It is assumed that the programme will be built on a free open source platform, and where USSD is utilised, that an interface platform will be used to establish USSD connectivity with the user.



It is assumed that the programme will be built on a free open source platform, and where USSD is utilised, that an interface platform will be used to establish USSD connectivity with the user. These costs are dependent on the monthly account fee and the number of interactions a user will have when using USSD sessions.

- When a user responds to a USSD prompt it counts as one interaction, and when the hosting party reacts to that prompt then it acts as another interaction.
- For every step a user takes in the USSD process, it counts as two interactions.

18

Based on this, it was assumed that each PWM would have a total of 18 interactions while on the programme.

The application development cost to collect the necessary fields for registration and pre-registration using data was included in the model. A number of application layer mHealth providers have the ability to develop an application (or have already developed an application) for this to occur.

Maintenance and support

Maintenance and support are necessary to ensure upgrades/development of the systems, that no bugs interfere with performance, and effective integration between operating systems. To ensure effective support it is necessary to have development, engineering and technical support employees. Their hours have been forecasted per month.

Other

Other costs involve administration, monitoring and evaluation, and project management costs. Consideration also needs to be given for the cost of maintaining a mobisite if a pure data route is taken. These costs are similar to the maintenance and support costs of the pure USSD approach.

3. Middleware and database costs

The middleware and database costs are divided across three areas and there are no software costs for these layers. The middleware and database costs will consist of:

- Hardware
- Maintenance and support
- Other

Hardware

The hardware set-up costs are one-off and, depending on the needs of the user and changing technology environment, will have a lifespan/efficiency of two to three years before additional/replacement servers will be required.

Maintenance and support

Maintenance and support will be necessary one year after start up. The initial set-up costs are assumed to be inclusive of any maintenance and support needed. After the first year it will be necessary to have maintenance via support developers, engineers and technicians. The assumption is overcompensated for with six employees. This would change depending on the budget of the sponsor/buyer. Other maintenance and support costs, if necessary, will be for high-level specialised architects/consultants to review and expand systems. This is optional depending on the user case.

Other

Other costs include the one-off cost of professional services (i.e system integration), administration and training costs. Both administration and training costs are only necessary from year 2 of implementation because the initial set-up cost for the first year will not require any administration or training.





Scenario 1
USSD and SMS

7.2. Costing scenarios

7.2.1. Scenario 1: USSD and SMS

In this scenario PWM are registered and pre-registered through a USSD channel, and messages are delivered through an SMS channel for the duration of the programme.

Table 4: Programme costs of a USSD/SMS programme scenario

Number of users	Costing areas	Scenario 1	
 Year 1 350 000 users		 Total R 12.3 million	
	Channel	USSD	R3.2 million
		SMS	R4.9 million
		Data	
	Application & Middleware and Database		R4.3 million
 Year 2 650 000		 Total R 23.0 million	
	Channel	USSD	R6.6 million
		SMS	R10.0 million
		Data	
	Application & Middleware and Database		R6.4 million
 Year 3 1 000 000		 Total R 35.8 million	
	Channel	USSD	R11.2 million
		SMS	R17.2 million
		Data	
	Application & Middleware and database		R7.4 million

Note: The average wastage factor used in this scenario is 4.

Please see Annexure 10.1 for a programme price comparison with different average wastage factors.



Scenario 2
Data and USSD/SMS
combination

7.2.2. Scenario 2: Data and USSD/SMS combination

South Africa has one of the most developed mobile markets in sub-Saharan Africa, with over 69% of the population owning a feature phone or smartphone. Additionally, the penetration of smartphones is expected to continue to rise as the price of data decreases and cheaper smartphones become available.

In scenario 2 the programme is delivered using a data platform for the population group that owns a feature phone or smartphone, but maintains the USSD/SMS component for lower LSM groups that only have access to a basic phone.

Table 5: Programme costs of a data and USSD/SMS combination scenario

Number of users	Costing areas	Scenario 2	
 Year 1 350 000 users		 Total R 9.3 million	
	Channel	USSD	R1.0 million
		SMS	R1.5 million
		Data	R0.3 million
	Application & Middleware and Database		R6.5 million
 Year 2 650 000		 Total R 12.4 million	
	Channel	USSD	R1.5 million
		SMS	R2.3 million
		Data	R0.7 million
	Application & Middleware and Database		R8.0 million
 Year 3 1 000 000		 Total R 15.5 million	
	Channel	USSD	R2.0 million
		SMS	R3.1 million
		Data	R1.2 million
	Application & Middleware and database		R9.1 million

Note: The average wastage factor used in this scenario is 4

To consider: In order to deliver the service using data, an application needs to be deployed to the PWM phone. This will allow messages to be pushed to the PWM handset, which can be done through programs such as Mxit or other data-driven services. The downloading of this application will incur a data cost, which has not been included in the model.



Scenario 3
Solely data usage

7.2.3. Scenario 3: Solely data usage

Although from a cost perspective data certainly appears to be the most attractive scenario, it is not the most practical at this stage if the aim of the programme is to reach the entire population. This is primarily due to the fact that 31% of the population does not have access to the necessary feature phone or smartphone, which leaves out an important part of this population group.

Smartphone penetration is, however, expected to continue to rise as the price of data decreases and cheaper smartphones become available, which makes this a potential opportunity in the future.

Scenario 3 assumes that all users have access to a feature phone or smartphone.

Table 6: Programme costs of data scenario

Number of users	Costing areas	Scenario 3	
 Year 1 350 000 users		 Total R 6.0 million	
	Channel	USSD	
		SMS	
		Data	R0.5 million
	Application & Middleware and Database	R5.5 million	
 Year 2 650 000		 Total R 8.6 million	
	Channel	USSD	
		SMS	
		Data	R1.0 million
	Application & Middleware and Database	R7.6 million	
 Year 3 1 000 000		 Total R 10.3 million	
	Channel	USSD	
		SMS	
		Data	R1.6 million
	Application & Middleware and database	R8.7 million	

To consider: In order to deliver the service an application needs to be deployed to the PWM phone. This will allow messages to be pushed to the PWM handset, which can be done through programs such as Mxit or other data-driven services. The downloading of this application will incur a data cost, which has not been included in the model.

Note: See Annexure 10.2 for a pricing comparison sheet of the three costing scenarios.

8. Considerations for sustainability



Taking all of this into account, it is necessary to develop sustainability measures so that maternal mHealth programmes extend beyond the donor funding first phase and that benefits can be realised. User experience will be fundamental in ensuring buy-in from PWM and health practitioners which in turn drives sustainability. Currently, the mHealth market in South Africa is relatively immature. As such, the opportunity exists to utilise global lessons as well as to consolidate diverse efforts to deliver effective and efficient programmes.

8.1. Cost efficiencies

One method of ensuring the sustainability of a programme is to ensure that cost efficiencies are achieved. Overall, this will permit funding to be maximised. These cost efficiencies may be done in the following ways:

- Determine the most effective delivery channel that will achieve cost savings but also reach the maximum amount of the target population. Cost analysis shows that data is the most cost-efficient channel; however, due to limited feature phone or smartphone penetration, a combination of data and USSD/SMS will ensure funding maximisation. The channel options should be reviewed as penetration of feature phones and smartphones changes in the target population.
- Leverage other programmes and the devices already being utilised for these. These will assist in ensuring reach, dividing airtime and maintenance amongst the different project owners. Additionally it will also allow for the leveraging of existing funding and decrease the amount that needs to be spent on training.
- Develop training modules that can be driven without on-the-ground staff. This will assist in cost containment and ensure that the rotation of staff members will not affect PWM registrations.
- Ensure an open market process when employing service providers. This will naturally bring about competition, which will in turn reduce the overall programme costs.
- Achieve interoperability between the technology platforms as this will allow service providers to plug into the existing delivery mechanisms, which permits for seamless integration and therefore cost savings.

8.2. Monitoring and evaluation

M&E is essential to track the progress of an mHealth programme and to determine whether it is achieving its aims and objectives. A framework should be implemented that is inclusive of all the different aspects of the programme and the outcomes associated with each, as this will provide the evidence necessary to demonstrate the programme's success and whether further investment should be sustained. Some components that should be included in such a framework include:

- Uptake of programme
 - Number of registered users in a specific time period
 - Channels through which user programme awareness is being achieved
 - Extent of promotion by health practitioners
- Trained health practitioners
 - Number of trained practitioners
 - Successes and areas for development in the training process
- Strengths and weaknesses of the registration process
- Impact on users
 - Increase in MNCH knowledge
 - Improvement in health-seeking behaviours (antenatal care visits, skilled delivery, adherence to immunisation schedule)
 - Mortality rates

Some actions that can be taken in relation to M&E as a way to achieve sustainability include:

- Increase the data fields of an mHealth programme, which will assist in easier reporting of health outcomes in the M&E framework. Complexities in evaluation may arise if the programme has an inherent limitation in the amount or number of data fields that are being collected. Therefore, it is crucial that reliable data is collected and produced. This will aid in showing the effectiveness of programmes in achieving the goals they set out to achieve, as well as guide the development, modification and improvements required on the programmes.
- Once an M&E framework has been implemented, ensure that reports on benefits, lessons learnt and necessary adjustments are made to the relevant stakeholders. This will assist in guaranteeing that support for the programme is maintained and furthered.



ensure that cost efficiencies are achieved



develop training modules that can be driven without on-the-ground staff



implement M&E to track the progress of an mHealth programme and to determine whether it is achieving its aims and objectives

M&E will show the value and ultimately the cost savings achieved through the implementation of such a programme. By proving healthcare and economic benefits, it will be possible to justify the need for additional funding as well as gain buy-in from the various stakeholders for the programme.

8.3. Alternative revenue streams

The costs associated with a maternal mHealth programme are continuous. Though there are actions that can be taken to contain these, it is also necessary to explore alternative streams of revenue as this will also assist in ensuring that all funding is maximised. These streams include:

- Advertising either the MNO delivering the message or products relevant to the messaging and target group. Depending on the delivery channel ultimately used (SMS or data), the impact of advertising may be more limited but this could be an important mechanism to potentially generate revenue or funding.
- Monetising assets (data) through aggregating and anonymising data that can be utilised by various organisations. Until such time as the PoPI Act has been finalised and it is clear as to how data can be utilised, the ability to monetise data will be limited. It is, however, an important consideration for the future, especially as more data fields are collected.
- Implement a sliding scale payment structure whereby higher LSM groups pay for the service as a whole or for premium content. These revenues can then be used to fund the programme for PWM in lower LSM groups.



advertising



monetising



sliding scale

8.4. Scale

The ultimate aim of a maternal mHealth programme is to reach and impact the maximum number of people in the target group, which can be achieved through scale. To drive scale it is necessary to drive buy-in at the health practitioner level, as they will be the first point of reference to drive adherence at the community level. This buy-in can be achieved through clear benefit reporting, incentives, or the inclusion of registrations into KPIs.

Scale will not be effective in decreasing costs if the SMS/USSD method of delivering services is utilised. As the number of users increases, the costs increase exponentially. Cost efficiencies through scale will only be effective if a maternal mHealth programme were to operate via a data or SMS/USSD and data combination, as the incremental costs would be significantly less. The impact of scale on costs is represented in figure 11 below.

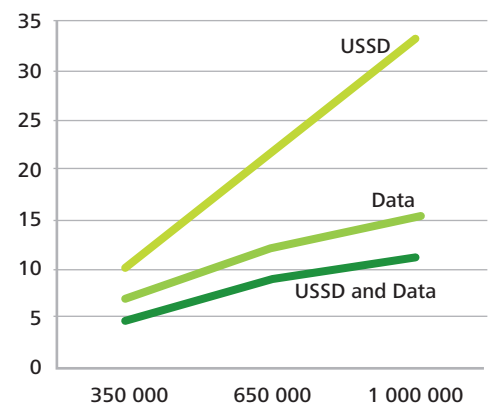


Figure 11: Channel costs compared to the number of users on the programme

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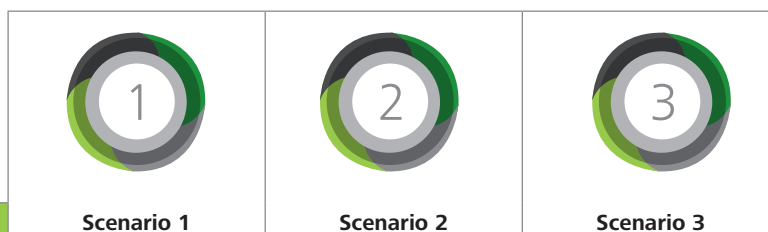
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10. Annexures

10.1. Scenario costing comparison



Number of users	Costing areas		Scenario 1	Scenario 2	Scenario 3
350 000	Channel	USSD	R3.2 million	R1.0 million	
		SMS	R4.9 million	R1.5 million	
		Data		R0.3 million	R0.5 million
	Application & Middleware and Database		R4.3 million	R6.5 million	R5.5 million
	Total		R12.3 million	R9.3 million	R6.0 million
650 000	Channel	USSD	R6.6 million	R1.5 million	
		SMS	R10.0 million	R2.3 million	
		Data		R0.7 million	R1.1 million
	Application & Middleware and Database		R6.4 million	R8.0 million	R7.6 million
	Total		R23.0 million	R12.4 million	R8.6 million
1 000 000	Channel	USSD	R11.2 million	R2.0 million	
		SMS	R17.2 million	R3.1 million	
		Data		R1.2 million	R1.6 million
	Application & Middleware and Database		R7.4 million	R9.1 million	R8.7 million
	Total		R35.8 million	R15.5 million	R10.3 million

10.2. Scenario 1: Wastage factor comparison

Number of users	Costing areas	Wastage factor of 2	Wastage factor of 4	Wastage factor of 6
350 000	Channel USSD	R1.7 million	R3.2 million	R4.8 million
	SMS	R4.9 million	R4.9 million	R4.9 million
	Data			
	Application & Middleware and Database	R4.3 million	R4.3 million	R4.3 million
	Total	R10.8 million	R12.3 million	R13.9 million
650 000	Channel USSD	R3.4 million	R6.6 million	R9.8 million
	SMS	R10.0 million	R10.0 million	R10.0 million
	Data			
	Application & Middleware and Database	R6.4 million	R6.4 million	R6.4 million
	Total	R19.9 million	R23.0 million	R26.3 million
1 000 000	Channel USSD	R5.9 million	R11.2 million	R16.8 million
	SMS	R17.2 million	R17.2 million	R17.2 million
	Data			
	Application & Middleware and Database	R7.4 million	R7.4 million	R7.4 million
	Total	R30.5 million	R35.8 million	R41.4 million

This report is an output of a project funded by UK Aid from the Department for International Development (DFID), managed through Mott MacDonald, for the benefit of developing countries. The views expressed do not necessarily reflect those of DFID or Mott MacDonald

