GSMA

Case Study
Kilkari: a maternal and child health service in India
Lessons learned and best practices for deployment at scale

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

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Points of contact:

Sara Chamberlain - Digital Director, BBC Media Action, India
sara.chamberlain@in.bbcmediaaction.org

Daniele Tricarico - Senior Insights Manager mHealth & mAgri, GSMA
daniele.tricarico@gsma.com

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BBC Media Action's communication projects are rooted in local people's experiences and understanding. Our extensive research programme provides insight into the lives of our audiences to ensure that our projects reflect their needs and circumstances. We use our data to monitor how effectively our programmes engage people and stimulate change; lessons learned are then built into future projects. To share our findings and learning as widely as possible, we publish policy and research reports and briefings to inform communication for development practitioners and policy-makers.

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Executive summary

Kilkari is a mobile health (mHealth) service launched by the Government of India and designed by BBC Media Action to help nearly 10 million new and expecting mothers make healthier choices and lead longer, healthier lives. Kilkari (a baby's gurgle in Hindi) delivers free, weekly, time appropriate audio messages about pregnancy, child birth and child care via Interactive Voice Response (IVR). Messaging begins in the second trimester of pregnancy and continues until the child is one-year-old.

In the 12 months since launch, Kilkari has successfully reached 2 million subscribers and is now reaching 750,000 subscribers every week. Since its first inception, the service has evolved from being a traditional cross operator service, with a standard value added service (VAS) revenue share business model, to a toll-free service, with call costs covered by the Government of India. This evolution has allowed for a greater opportunity to scale Kilkari, in turn maximizing the potential to generate positive social impact through behavioral change in the user base.

Key insights

An in depth analysis of the launch and scale up of Kilkari brings to light key lessons learned and best practices for the deployment of successful mHealth services at scale. This case study presents learnings around mHealth mobile channels, business models, marketing strategy and technology deployment.

Mobile channel

- Ubiquitous Interactive Voice Response (IVR) technology is still the killer channel to deliver Mobile for Development (M4D) value added services (VAS) in an environment where the majority of rural women are still using brick or basic feature phones.

- Audio content is significantly more powerful than text content in the Indian states where close to 50 per cent of women are illiterate. Kilkari, as an audio rather than text-based service, overcomes the literacy challenge, providing easily accessible guidance and support.

Business Model

- A B2B enterprise agreement with a single mobile network operator (MNO), where call costs are covered by government, is more financially rewarding for a MNO than a VAS priced for the base of the pyramid.

- Standard VAS business models, based on revenue share, do not generate sufficient income to make preventative health education services sustainable for the base of the pyramid.

- Subscription billing is logistically challenging in an environment where up to 50 per cent of the user-base has zero balance on their phone at any given time.

- To reach rural women at the base of the pyramid with preventative maternal and child health education, services need to be free as cost is a significant barrier to take up.

Marketing

- Partnerships with local and national governments can be powerfully leveraged to deliver immediate scale with very little investment in marketing by using data in government Health Management Information Systems.

- Standard VAS marketing channels, such as top up shop promotions, are not effective when promoting a mHealth service for rural women in India, because these points of retail are not conducive to conversations around maternal health, and the majority of rural women do not visit them.

- Signing up users is most effective through the deployment of below-the-line (BTL) marketing, such as community health workers acting as agents, running activation campaigns at popular street performances, and leveraging SMS and OBD for targeted digital marketing.

Technology

- In order to support a mHealth service for the base of the pyramid at scale, it is fundamental not to underestimate the effort required to support, monitor and report on the service.

- Open source software can be challenging to develop and support at scale, but reduces the total cost of ownership and makes procurement less of a barrier to government adoption.

- Mobile technology solution providers and/or aggregators that offer fully managed solutions as a core business proposition are well placed to support mHealth services at scale when compared to large multinational software and hardware vendors that make the majority of their revenue on license sales.

Country overview

Despite increased investment and programmatic efforts in recent years, India's maternal, infant, and child mortality rates remain below that of the Sustainable Development Goals (SDG) targets.[1] Rural populations and the urban poor suffer disproportionately.

In the state of Bihar, where BBC Media Action's Kilkari mobile health (mHealth) services was designed, developed and tested in 2013, the maternal mortality rate at MMR 219 is much higher than the national average at MMR 178 (see table 1). Bihar is one of the Empowered Action Group (EAG) states, which due to their poor health indicators, have been prioritised by the Government of India for remedial action.

There is an urgent need to increase uptake of antenatal services, attended delivery, essential new born care and post-natal care practices in order to decrease infant and maternal mortality rates. In order to achieve this, it is critical to influence both the drivers of and barriers to the adoption of positive reproductive, maternal, neonatal and child health behaviours by families and communities, shift negative social norms and improve risk perceptions to persuade families to adopt healthy reproductive, maternal, neonatal and child health behaviours more effectively.

TABLE 1

India key health stats by state

	State	Female Population[2]	Health worker penetration[3]	Maternal mortality rate[4] (per 100,000 live births)	Infant mortality rate[5] (per 1000 live births)	Total fertility rate[6] (per 1,000 women)	Crude birth rate[7] (per 1000 population)
India	All states	648 million	940,346	178	40	2.4	21.4
Empowered Action Group States (EAG)	Jharkhand	16,057,819	41,623	219	37	2.8	24.6
	Bihar	49,821,295	92,264	219	42	3.5	27.6
	Uttar Pradesh	95,331,831	150,721	392	50	3.3	27.2

1. SDG global targets: By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births and reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

2. Source: Census 2011

3. Source: Maternal Child Tracking System, Government of India (2015): Total ASHAs registered as per the maternal child tracking system

4. Source: SRS 2012

5. Source - SRS 2013

6. Source – SRS 2012

7. Source - SRS 2013

Introducing Kilkari

In January 2016, the Government of India launched a nation-wide mobile health program designed by BBC Media Action to help nearly 10 million new and expecting mothers make healthier choices and lead longer, healthier lives. Kilkari (a baby's gurgle in Hindi) delivers free, weekly, time-appropriate audio messages about pregnancy, child birth, and child care directly to families' mobile phones from the second trimester of pregnancy until the child is one-year-old. Kilkari seeks to increase the capacity of pregnant women, new mothers and their families to adopt healthier behaviours, through increasing their knowledge, shifting attitudes and building self-efficacy. The objective is to improve family health – including family planning, reproductive, maternal, neonatal and child health, nutrition, sanitation and hygiene - by generating demand for healthy practices.

Target market

In the first phase of its roll out, Kilkari is targeting pregnant women, new mothers and their families in the Empowered Action Group (EAG) states of Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand and Uttar Pradesh. Based on an analysis of individual and household decision-making processes and the determinants of and barriers to behaviour change, the Kilkari content is designed to engage both new and expecting mothers and fathers:

- **New and expecting mothers:** As the primary caregivers for the child, impacting mothers' lives could lead to both healthier children and healthier mothers. However, new and expecting mothers often have virtually no power, control or role in decision-making within the family. Kilkari aims to empower mothers to take better care of themselves and their children, and to make mothers inquisitive and active participants in bringing about positive change.

- **Fathers:** The husbands of new and expecting mothers usually have primary control over household finances and, along with the mother-in-law and father-in-law, take the majority of household decisions. However, in rural communities in the EAG states, the majority of fathers are not presently involved in issues related to preventive health or maternal and child health, as they believe it is not their domain. Child rearing and health are both seen as the woman's domain. Kilkari addresses fathers as well as mothers to make men feel responsible and smart, increase their participation in issues of family health and enable them to make healthy choices for the family.

Value proposition

The scale of opportunity

In trying to solve the public health challenges of our times, technology can offer compelling solutions. The penetration of mobile phones in India means the scale of the opportunity is significant. Currently, mobile penetration (the number of active SIM cards as a proportion of the population) in Bihar is 55 per cent.[8] However, BBC Media Action research has shown that many more people have access to mobile phones than own them in rural areas, and that mobile phone ownership is higher among those of child bearing age. For instance, 68 per cent of men and 32 per cent of women in rural Bihar own their own mobile phone, but more than 80 per cent of both sexes have access to a shared household mobile phone.[9] The high level of mobile phone penetration presents an unprecedented opportunity to directly reach families – particularly those living in media dark rural areas, with life-saving health information.

Cost is a huge barrier to women's usage of mobile phones, which is why many rural women in India only use their phones to receive calls. According to the GSMA, cost is the greatest reported barrier to women and men using mobile phones in India, particularly in rural areas.[10] The Government of India has made Kilkari free to new and expecting mothers to overcome this barrier, and to try to ensure the widest possible access to health information.

In the 12 months since launch, Kilkari has successfully reached 2 million subscribers and is now reaching 750,000 subscribers every week. Kilkari subscribers have answered more than 29 million calls since launch, listening to more than 28 million minutes of content. 42 per cent of Kilkari subscribers are listening to 75 per cent to 100 per cent of each Kilkari call.

Enabling accessibility via all mobile phones

According to the 2011 Census of India,[11] only 53 per cent of women in Bihar are literate. Similar literacy rates prevail in the EAG states. Given that a significant percentage of the female population cannot read, it can be a challenging task for the public health system to educate new and expecting mothers about life-saving maternal, neonatal, child and reproductive health behaviours. Kilkari, as an audio rather than text-based service, overcomes this challenge, providing easily accessible guidance and support.

There is a great deal of excitement about smartphone growth in India. However, according to GSMA Intelligence, smartphones accounted for around 20 per cent of total mobile connections (active SIM cards in smartphone devices) in the Indian market as of mid-2015.[12] In absolute terms, there were 185 million smartphone connections as of mid-2015, which would equal close to 15 per cent penetration of unique smartphone owners in the Indian population. Based on this data, approximately 85 per cent of

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8. Telecommunications Regulatory Authority of India, Press Release, 30 June 2016
9. BBC Media Action market research, carried out in Bihar in 2012
10. GSMA Intelligence, The Mobile Economy India 2013, http://gsmamobileeconomyindia.com
11. http://censusindia.gov.in/2011-prov-results/data_files/mp/07Literacy.pdf
12. GSMA Intelligence, The Mobile Economy India 2015, http://gsmamobileeconomyindia.com

the Indian population is still using feature phones or, in the case of many rural women in the EAG states, brick phones.[13] Kilkari, which can make outbound pre-recorded phone calls to any mobile handset in India using any SIM card, is thus a compelling solution for the majority of the population that cannot take advantage of smartphone apps or the mobile internet.

The evolution of Kilkari

Kilkari was originally designed, developed, tested and launched in 2013 across six mobile networks in the north eastern state of Bihar with support from the Bill & Melinda Gates Foundation as part of the 'Ananya Program'. Ananya is a program funded by the Bill & Melinda Gates Foundation with the goal of accelerating improvement of health outcomes in India. The program works in partnership with the State Government of Bihar and ten other implementing organizations including BBC Media Action, which leads the Shaping Demand and Practices Project. BBC Media Action's role in Ananya is to communicate life-saving information and shape healthy behaviours that tackle the main causes of maternal, new born and child deaths, such as safe delivery of babies, preventive post-natal care and nutrition. To do this, BBC Media Action has developed a comprehensive range of communication interventions, including mobile health services for families and Community Health Workers, which have become central components of the program.

The Kilkari concept was based on a mHealth service called 'Mobile Midwife', which was originally piloted by the Grameen Foundation in Ghana, with support from the Bill & Melinda Gates Foundation. Mobile Midwife was itself a reinterpretation for a low-resource setting of 'BabyCenter', a Johnson & Johnson company Internet service for new and expecting mothers, which began in the United States. According to BabyCentre, 8 in 10 new and expectant mothers in the United States use BabyCenter each month.[14]

Kilkari is powered by the same application that powered Mobile Midwife - the Mobile Technology for Community Health (MOTECH) platform. MOTECH provides the contacts database for Kilkari, as well as the rules engine that creates subscriptions, generates a schedule of messaging for each subscriber, and triggers automated outbound calls to the subscriber.

MOTECH was originally developed in 2009 through a collaboration between the Grameen Foundation, the Ghana Health Service and Columbia University's Mailman School of Public Health, with support from the Bill & Melinda Gates Foundation. It has subsequently been deployed in many countries around the world, including India.

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13. According to a recent dip stick survey done by BBC Media Action in Bihar, 73 per cent of frontline health workers were still using brick phones in mid-2016.
14. http://www.babycenter.com/about

Strengthening health systems in India

Kilkari's primary target group is pregnant women and mothers of children under two years of age. However, in order to reach those women, it is also necessary to work with the people who most influence their health and decisions, such as husbands, mothers-in-law and community health workers. One of the main challenges to achieving universal health coverage is that there are insufficient numbers of health workers at all levels of the healthcare system. Furthermore, of the health workers that are available, many do not have the knowledge, skills, or confidence to provide comprehensive care. Consequently, the training requirements to achieve universal health coverage in India are staggering.

Community health workers face a number of constraints in providing support to families including having limited time to build their own skills on a regular, ongoing basis. Some may be remote from centres of learning and lack the financial means to travel to them while others may have family obligations that prevent them from accessing formal training programs. Most have financial constraints and a large workload which places significant demands on their time. Face-to-face in-service training requires health workers to leave their posts, and travel to a central location for an extended period, which can be expensive and inconvenient.

To meet this need, BBC Media Action designed Mobile Academy, a free reproductive, maternal, neonatal and child health audio training course for community health workers in India, which can be accessed from any mobile phone and on any network, just by making a simple voice call. The scale up of Mobile Academy by the Government of India represents a significant investment in refreshing the health knowledge and strengthening the interpersonal communication skills of community health workers. It is expected that improved quality of engagement between community health workers and their clientele should increase the uptake of healthier behaviours by pregnant women, mothers of children under the age of two and their families, as has been seen in Bihar, where the service was launched in 2012 under the Bill & Melinda Gates Foundation's Ananya program.

Mobile Academy and Kilkari are designed to work as a package. After a community health worker has refreshed her knowledge of life-saving preventative health behaviours via Mobile Academy, and learned how to communicate the benefits of these behaviours more effectively to families, she goes out into the community to counsel families. Kilkari compliments Mobile Academy by reinforcing the messages communicated by Community Health Worker; communicating directly with new and expecting mothers and their families to increase the uptake of healthier behaviours.
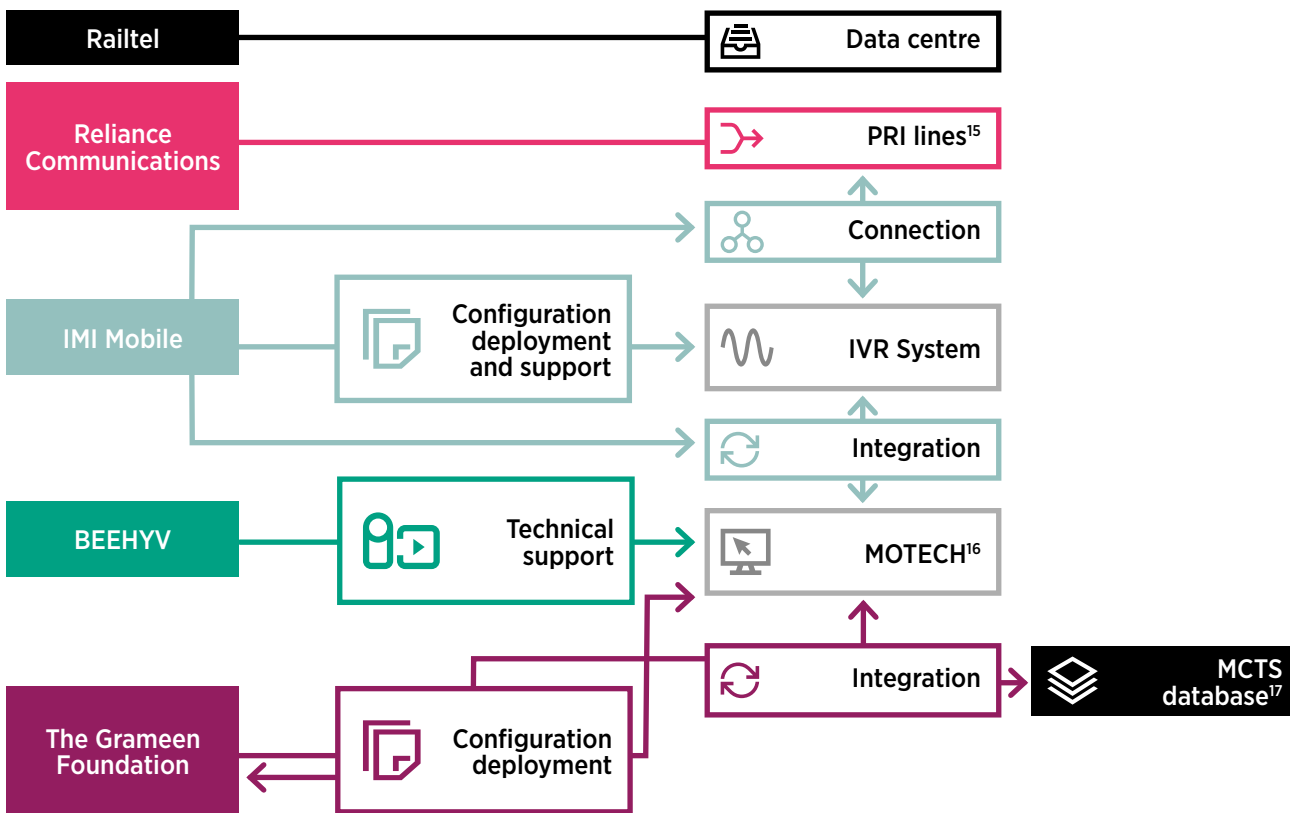
Business model and partnerships

Main stakeholders

The national version of Kilkari was launched by the Government of India as part of the Digital India Mission, in collaboration with BBC Media Action, and with the support of the Bill & Melinda Gates Foundation, USAID and the Barr Foundation. BBC Media Action led a consortium of technical stakeholders, see figure 1.

FIGURE 1

Main technical stakeholders in Kilkari service

Railtel		Data centre
Reliance Communications		PRI lines[15]
		Connection
IMI Mobile	Configuration deployment and support	IVR System
		Integration
BEEHYV	Technical support	MOTECH[16]
	Integration	MCTS database[17]
The Grameen Foundation	Configuration deployment	

15. PRI Line (Primary Rate Interface) line is a form of ISDN (Integrated Services Digital Network) line which is a telecommunication standard that enables traditional phone lines to carry voice, data and video traffic, among others

16. MOTECH is a software system developed by the Grameen Foundation that harnesses the ubiquity of mobile phones to deliver and receive information from patients and caregivers https://MOTECHproject.org

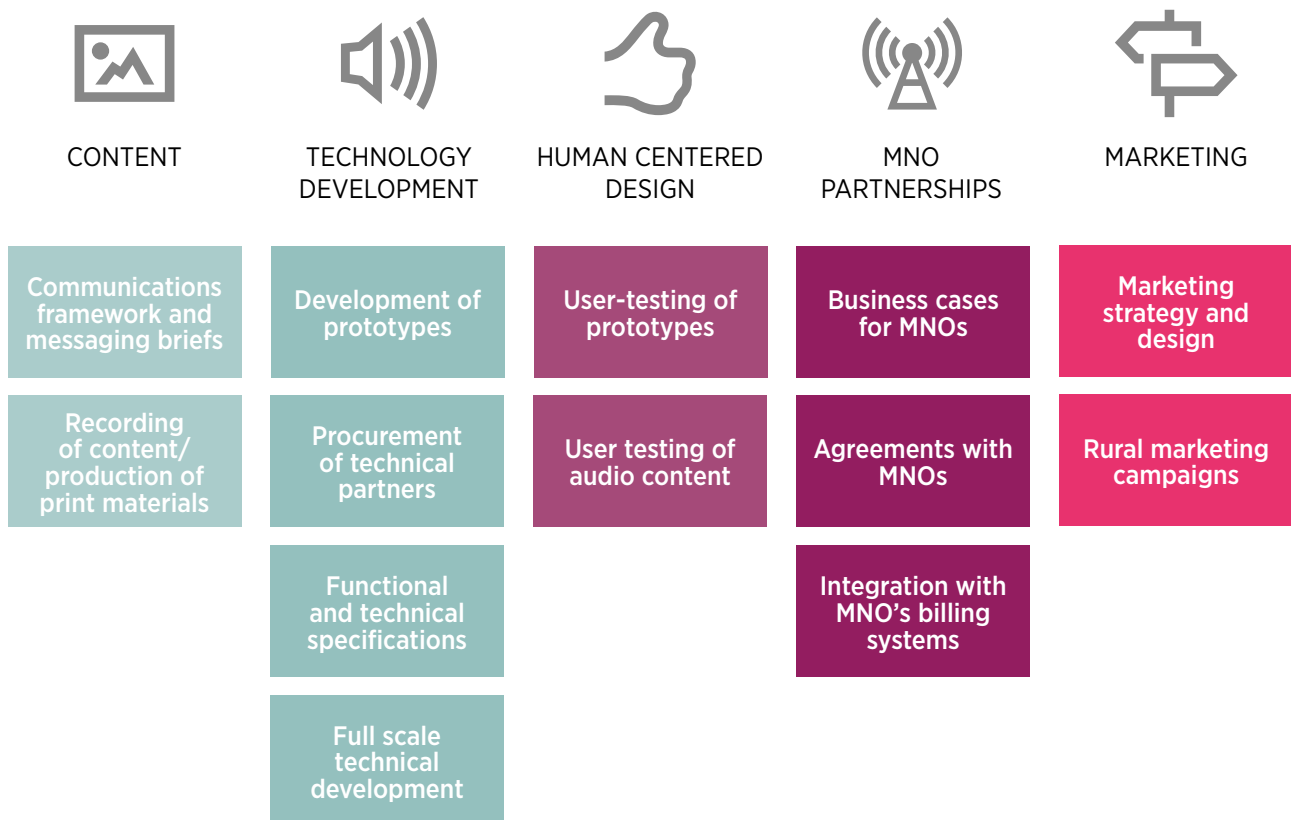17. MCTS: Government of India's Maternal and Child Tracking System

A program management unit (PMU), set up by the Gates Foundation at the request of the Ministry of Health and Family Welfare (MoHFW) and staffed by PricewaterhouseCoopers and BBC Media Action, liaised between technical stakeholders and the government on a weekly basis. The technical development process – from kick off to go live, took twelve months.

Cost drivers

In Bihar, where BBC Media Action first developed and launched Kilkari, the key cost drivers spanned many different areas, including formative research, concept development and the development of business cases for MNOs.

FIGURE 2

Key cost drivers

CONTENT	TECHNOLOGY DEVELOPMENT	HUMAN CENTERED DESIGN	MNO PARTNERSHIPS	MARKETING
Communications framework and messaging briefs	Development of prototypes	User-testing of prototypes	Business cases for MNOs	Marketing strategy and design
Recording of content/ production of print materials	Procurement of technical partners	User testing of audio content	Agreements with MNOs	Rural marketing campaigns
	Functional and technical specifications		Integration with MNO's billing systems	
	Full scale technical development			

The capital investment required to develop and deploy Kilkari at the national level was significantly less than that required during the R&D phase in Bihar, because the investment to design, develop and test the service at scale had already been made. At the national level, key CAPEX and OPEX cost drivers have included:

FIGURE 3

CAPEX and OPEX cost drivers

CAPEX

- Re-development and user-testing of national version of content
- IVR software licenses
- Third party hardware and software
- Scale up and configuration of MOTECH
- Configuration and deployment of the IVR system"
- Integration of MOTECH with the IVR system and MCTS
- Configuration of the PRI lines
- Information and security audit
- Development and production of marketing materials

OPEX

- Call costs
- Running of data center
- Technical support and annual maintenance costs
- Ongoing project management, tracking and reporting costs
- Sensitizing community health workers about Kilkari
- Face-to-face monitoring programme

Funding the service

The Government of India is covering Kilkari call costs and the cost of the data center. This commitment is indicative of the scale and ambition of the government's Digital India Mission.

The Gates Foundation partnered with BBC Media Action to lead the design, development and deployment of Kilkari, including procuring an unlimited national license for the propriety IVR system (transferable to the government at no additional cost) and the procurement of the third party hardware and software required to host the services in the initial phase, as well as procurement of a mobile technology solution provider to configure, deploy and support the IVR system.

The Gates Foundation also supported the development of the backend system for Kilkari, using the open source application development platform, MOTECH, which is now supported by Indian software development company Beehyv. The Gates Foundation and Barr Foundation also supported the development and testing of the national version of the Kilkari content by BBC Media Action.

USAID and the Gates Foundation are supporting the management and technical support of Kilkari for a period of three years, during which time BBC Media Action will transition technical support to the Government of India. USAID is also funding BBC Media Action to support state government in the roll out of the service, and to implement a comprehensive face-to-face monitoring program to track the performance of Kilkari across six states.

Pricing Kilkari

Phase one: multi-operator model

When BBC Media Action first launched Kilkari in the state of Bihar in 2013, it aimed to achieve both scale and sustainability. As a result, Kilkari was designed as a cross operator service, with a standard VAS revenue share business model. Any pregnant woman and mother in the state of Bihar could subscribe to Kilkar, thanks to BBC Media Action's partnership with the six largest MNOs in India: Airtel, BSNL, Idea, TATA, Reliance and Vodafone, and aggregator OnMobile Global Ltd. The service was billed to the consumer, because BBC Media Action wanted to try to generate sufficient revenue to cover Kilkari's ongoing running costs. At the same time, all MNOs agreed to reduce the standard, commercial IVR VAS tariff from INR 6 (USD 0.09) per minute to INR 50 paise (USD 0.007) per minute. This change in pricing allowed the base of the pyramid to afford Kilkari. Additionally, the MNOs agreed to share revenue with OnMobile to help cover running costs.

To minimise network costs, BBC Media Action, the MNOs and OnMobile agreed on a decentralized approach, where local outbound calls to subscribers were made from each MNO's infrastructure in Bihar – communicating with OnMobile's centralized IVR system in Bangalore to access subscriber records, and to record usage habits. Kilkari subscribers in Bihar received one pre-recorded audio messages per week, from the third trimester of pregnancy until the child was a year old (64 weeks). BBC Media Action's market research revealed that although base of the pyramid subscribers in Bihar were willing to pay approximately INR 1 (USD 0.01) per week for a two minute Kilkari message, they were not prepared to pay INR 64 upfront (USD 1.0) for the entire service, due to cash flow limitations. As a result, BBC Media Action reached an agreement with OnMobile and the MNOs to open the same subscription short code for Kilkari across all six networks, configuring their billing systems to deduct INR 1 per week from each subscriber.

Although more than 100,000 households eventually subscribed to Kilkari in Bihar, a number of weaknesses in the standard VAS approach began to emerge.

The first major challenge was related to subscription activation and weekly billing, which was caused by the credit usage habits of pay-as-you-go subscribers

in Bihar. Ninety-nine percent of base of the pyramid subscribers in Bihar have pay as you go SIM cards, and they typically only top up (buy credit) when they have to make a call. In this region of India, mobile phone usage shows similar features of pay phone usage with mobile users buying only enough credit to make a call and spending all that credit on that call. As a result, as much as 50 per cent of rural mobile subscribers in Bihar have little or no balance on their phone at any given time.

The tendency of the customer base to use mobile phones as pay phones meant that between the time it took for a subscription request to be made by a consumer and the subscription to be activated (up to 48 hours), the balance on the consumers' phone would go below INR 1. Even if the subscription was successfully activated, the weekly process of deducting INR 1 per week would repeatedly fail due to a lack of funds on the subscriber's phone. This in turn meant that the subscription would automatically go into a suspended status until the funds could be deducted causing service disruption.

Another major challenge to the standard VAS approach adopted for Kilkari was represented by the fact that even though approximately 32 per cent of rural women in Bihar own their own mobile phones, BBC Media Action's research indicated that the SIMs were not registered in their names, and they rarely went to the MNO points of sale to buy credit. Almost all financial decisions related to the phone were taken by a male member of the household. As a result, women wishing to subscribe to Kilkari first had to get their husband's approval. Given that expenditure on preventative health is significantly lower than expenditure on curative health in India, and given that the majority of households in rural Bihar regard child birth and child rearing as natural occurrences that wives and mothers are equipped to handle with little support, even the minimal cost of Kilkari could act as a barrier to take up.

A third challenge to the standard VAS approach initially adopted for Kilkari was that in spite of the fact that the service reduced tariff still covered the MNOs' per minute network costs, and produced a very small profit which was shared by MNOs with OnMobile, it still did not generate sufficient revenue to cover all the other costs associated with running the service, including hosting and support costs, marketing costs and ongoing management costs. Kilkari, as it was first launched in Bihar, thus demonstrated the challenges of creating a

commercial mHealth service which is both affordable to the base of the pyramid and sustainable.

In addition, it is worth noting that the decentralized, cross operator, short code approach also took a huge amount of effort to set up. Just negotiating contractual agreements with the MNOs - including common short codes and (significantly reduced) common tariffs, revenue share agreements, service level agreements (SLAs) and liability and indemnity clauses took up to nine months. Configuring and testing short codes, tariffs, and subscription billing across six MNOs' multiple network switching centers in Bihar also took a considerable amount of time, and maintaining the system was complex because Voice Extensible Markup Language (VXML) code and content had to be maintained in six different locations, each with different types of connectivity back to the centralized platform in Bangalore.

Phase two: single operator model

When it came time to scale Kilkari nationally, BBC Media Action, in collaboration with the Government of India, decided to adopt a very different approach. This was possible because the Ministry of Health and Family Welfare decided to make the service free to all pregnant women and mothers registered in its Maternal and Child Tracking System database, beginning with six states in the first phase of the roll out. Given that the government was willing to cover all call costs, and women with unique mobile numbers in its database would automatically be subscribed to Kilkari, the complexities of configuring short codes and tariffs to enable subscription activation and weekly billing could be dispensed with and a much simpler toll free, long code approach could be implemented. With MNOs already having pre-existing interconnect agreements for routing calls to each other's long codes (a normal 10 digit mobile number), it was no longer necessary to negotiate agreements with multiple operators and open common short codes across operators to enable universal access (anyone from any network can call a long code on another network).

The government went out to tender to procure one mobile operator to provide PRI lines to a national Kilkari platform under an enterprise agreement. Because of the anticipated volume of calls, initially to six states but ultimately across India and the existence

of a database of millions of women, the government was able to procure a significantly reduced rate for long distance outbound calls. This in turn enabled BBC Media Action and its technical partners to redevelop the Kilkari service on a centralized, single operator, toll free, long code platform. As a result, within four weeks of launch, BBC Media Action was able to reach out to more than 750,000 women.

TABLE 2

The evolution of Kilkari pricing from commercial cross operator VAS to toll free enterprise model

Model	Elements	Advantages	Disadvantages
Standard commercial cross operator VAS	**Billed to the consumer**	**Less dependency on external funding** When call costs are deducted from the consumer, the dependency on a single entity for external funding is reduced and the risk of service discontinuation is reduced.	**Limited take up** Even a minimal fee can be a barrier to take up if it is a preventative health service targeting women, and financial decisions about the mobile are controlled by the male members of the household. **Billing challenges** Minimal, weekly billing is preferred to a larger upfront fee, but weekly billing is problematic in an environment where up to 50 per cent of rural subscribers have zero balance on their phones at any given time. **Sustainability of commercial business model for BoP unproven** If the tariff is affordable by the base of the pyramid, it is unlikely to generate sufficient revenue to cover per minute network costs , marketing costs and running costs – even at scale.
	Cross operator – short codes used to standardized tariff	**Greater access – if standardized billing is required** If the consumer is being billed for calls, and the cost of the service needs to be standardized so that all consumers are paying the same tariff, then a cross operator, short code approach enables much wider access.	**Complex and time consuming to set up** Cross operator services with common short codes, common (reduced) tariffs and revenue share agreements are time consuming to set up, requiring significant legal input, which can be expensive. They are also complex to implement, with some operators requiring that short codes and tariffs be manually configured at multiple MSCs in a single state.

	Decentralised platform	**Lower per minute network costs** A decentralized approach allows calls to originate or terminate locally, which significantly reduces call costs.	**Complex and time consuming to maintain and support** A decentralised, cross operator deployment is more complex to maintain and support. It can be challenging and time consuming to diagnose technical issues when there are many points of failure.
Toll free, centralized, enterprise model	**Call costs covered by government**	**No financial barriers to take up** Service can be delivered even if there's no balance on the phone.	Dependency on one entity for covering call costs is a risk to sustainability, because if funding/investment priorities change, then the service could be discontinued.
	Enterprise contract with one operator to provide connectivity and long codes.	**Much less complex and time consuming to negotiate** A toll free, long code platform with PRI lines provided by a single operator has a lot less moving parts than a cross operator short code platform and it is thus much more straightforward to maintain. Pre-existing interconnect agreements between operators mean anyone can call a long code from any network	If long codes are not toll free, then consumers would all be charged different rates to access a service, depending on the type of package they have purchased from their MNO.
	Centralized platform	Much less complex and time consuming to maintain and support	Long distance calls are more expensive

Vendor partnerships

The opportunities and challenges of scaling and supporting open source

BBC Media Action and its donors and partners chose to scale MOTECH, the open source software that powered Kilkari in Bihar, nationally. By investing in an open source mHealth platform, the procurement hurdles and financial constraints faced by government in adopting the system were reduced, as was the total cost of government ownership. However, when deciding to use open source software, it is critical to acknowledge the risks.

Firstly, open source software may be created by small, boutique vendors or not-for-profit organizations that might not have the capacity required to support the software to industry standard SLAs at scale. In addition, although open source technology can be adoptable by anyone, in most cases those adopting the technology lack the know-how to fix or further develop the applications.

The biggest challenges faced during the national scale up of Kilkari related to the MOTECH platform. Attempts were made to scale the software in India, but due to time constraints and a lack of local

expertise in the application, the code was eventually configured in the United States by the Grameen Foundation, which originally designed and built MOTECH. Finding a robust support solution for MOTECH, including support resources physically located in the government's data centre in India, also proved challenging. Initially, a large multinational software vendor was contracted to manage MOTECH in India, but it struggled to support unfamiliar code. Beehyv, a smaller Indian-based open source software development vendor with several years' experience of MOTECH was later contracted and has proved adept at supporting and further developing the national version of MOTECH.

The key lesson learned from the deployment of a boutique open source platform is that although open source software reduces the cost of ownership and procurement challenges, the number of robust, sustainable options available to further develop and support the software are more limited than large scale, proprietary alternatives.

The challenges of procuring cost-effective proprietary software licenses

The IVR system that schedules and tracks Kilkari calls triggered by MOTECH is proprietary software, developed by mobile technology solution provider, IMI Mobile. Founded in India, IMI Mobile has grown to become a global mobile VAS provider, technology solution provider and aggregator headquartered in London. IMI Mobile works with a large number of MNOs and blue-chip enterprises, and its solutions are being delivered in Europe, the Americas, MEA and India.

BBC Media Action went through a challenging procurement process before selecting IMI Mobile. The process was difficult because an unlimited license for a globally scaled voice platform, transferrable to the government at no additional cost, is not an industry standard license. Negotiating cost effective licensing terms for carrier grade propriety software, to be used to deliver free health education to millions of women, many of whom are illiterate and living below the

poverty line, is not an easy proposition, given that typical revenue share business models and pricing norms are not applicable.

Several large scale multinational vendors of commercial IVR systems responded to BBC Media Action's RFP, but were ultimately unable to agree to these terms. BBC Media Action was able to overcome this challenge due to IMI Mobile's recognition of ground breaking nature of the initiative, including the significant potential it will unlock for similar services in other government domains if successful.

In the procurement process, it was evident that multinational software vendors, which primarily earn revenue on proprietary hardware and software licensing, are less likely to agree to commercial terms that are cost effective for digital development initiatives aimed at the base of the pyramid. Fully managed solution providers, which have a more substantial stake in an ongoing partnership than a standard AMC agreement, are more willing to compromise on licensing terms.

The role of end-to-end commercial aggregators

In India, most aggregators have made a significant investment in developing their own in-house voice service delivery platforms, content management systems, profile databases, reporting/business intelligence systems and billing engines. They usually earn revenue by providing fully managed services to MNOs with exacting SLAs and small profit margins. They have had to build large support teams in multiple locations, and network operations centres where they monitor hundreds of mobile services running across hundreds of sites and dozens of operators globally. They are thus in a very good position to provide relatively low cost support at scale. In BBC Media Action's experience, the most effective mobile technology solution providers are thus commercial aggregators with a track record of not only developing mobile VAS software solutions, but also hosting and supporting them at scale.

Service design

Kilkari uses out-bound dialling IVR technology to deliver quality health education and behaviour change communication to women registered in the Government of India's Maternal and Child Tracking System (MCTS), a national database that registers the majority of pregnancies and births in India. All those pregnant women who have registered their pregnancy or the birth of their child in MCTS in the phase 1 roll out states are automatically subscribed to Kilkari. Subscribers receive a weekly call on their mobile phone, delivering pre-recorded audio messages linked to the woman's stage of pregnancy or the child's age.

For example, during the last trimester of pregnancy, messages cover issues such as how to plan for safe delivery; emergency signs during pregnancy and after delivery, and how to recognize labor signs. Similarly, families with new-borns receive information including about new-born care, the importance of exclusive breastfeeding, immunisation and what and when to begin feeding the baby anything other than breast milk. Kilkari is hosted on a centralized, national platform deployed in a data center contracted by the Ministry of Health and Family Welfare (MoHFW).

FIGURE 4

Steps to service delivery
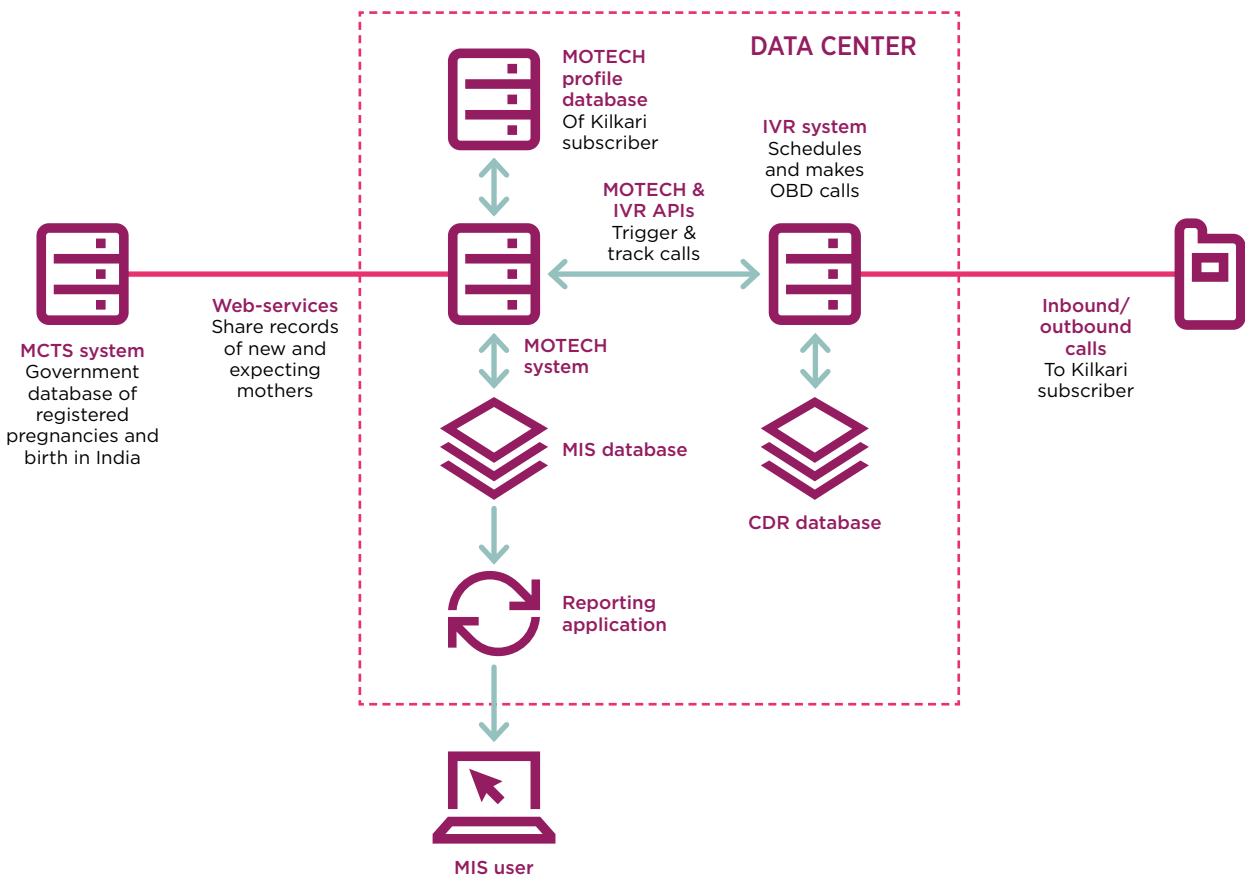
Through IVR technology, the service makes audio content available in the form of pre-recorded outbound calls to any mobile phone in India. IVR is able to overcome the challenges of low language literacy, low technical literacy and poor quality handsets among the target population because it provides immediate access to audio content. Women are automatically subscribed to Kilkari when they register their pregnancies or births at the local public health centre, thus they do not need to go through multiple subscriptions steps (double DTMF consent) to begin receiving the service. The backend MOTECH rules engine generates a schedule of outbound calls for each woman, based on her last menstrual period or the child's data of birth, so she does not have to navigate complex IVR trees to receive content on different topics, linked to different stages of pregnancy and child care.

Supporting the service at scale

Although the focus of the M4D sector sector has significantly shifted from pilots to scale-ups, little attention has been given to operations at scale. After the excitement of the launch, focus often tends to shift to new developments and new projects. However, the work involved in maintaining a mobile service that is delivering content every week to close to a million households cannot be underestimated.

The substantial operations teams and product management staff employed in every major MNO and aggregator demonstrate the need for ongoing teams of dedicated skilled professionals to:

Resolve technical issues raised by users

Monitor end-to-end system performance and information security against SLAs

Make upgrades and deploy patches

Enhance functionality as per government change requests

Manage and report on data produced by the system

Management Information System data is critical not just for tracking key performance indicators, but also to reconcile call detail records (CDRs) submitted by the MNO with CDRs generated by the IVR platform to validate invoices for call minutes. The complexity of synching and de-duplicating multiple databases, when megabytes of call data records are being generated every day, is a significant task. In addition, the effort involved in generating weekly and monthly management reports for government and donors on the take up and usage of the services against numerous KPIs is substantial.

Marketing

Overview and strategy

Kilkari does not need the kind of marketing investment required by most commercial services, because the government already has a 'customer' database.

The national version of Kilkari was able to rapidly reach almost a million subscribers in a month, thanks to its integration with the Government of India's Maternal and Child Tracking System (MCTS) database. MCTS is updated by data entry operatives located at primary health centers across India. They use an online interface to digitize and enter data collected by community health workers. A huge amount of data is captured about each pregnancy and birth, including the last menstrual period of the pregnant woman or the date of birth of the child. A mobile phone number for contacting the woman is also captured.

MCTS shares a small subset of this data with the Kilkari system, which uses the data to automatically subscribe and create a messaging schedule for each pregnant women or new mother, based on her last menstrual period or the child's age. MCTS is currently sharing data for six states with Kilkari. The service is thus leveraging the significant investment that the Government of India has made in digitizing its health records; adding value to this investment by enabling the delivery of life saving maternal and child health information to the right woman at the right time.

Although Kilkari does not require any marketing investment to reach families, BBC Media Action has supported state governments in training community health workers how to talk to women about Kilkari so that they know what to expect when they start receiving calls. BBC Media Action also developed posters to promote Kilkari in primary health centers, and a radio advertisement to raise awareness of Kilkari nationally, which the government played on All India Radio.

Key lessons learned

In Bihar, where Kilkari was billed to the consumer at INR 1 per week, BBC Media Action developed and rolled out a 360-degree marketing campaign to persuade BoP families to subscribe. Since men control access to the majority of phones in rural Bihar, and are responsible for making financial decisions and buying credit and services for the phone, BBC Media Action decided to target fathers primarily in the marketing and promotion of the service. As the target audience was spread across rural Bihar, BBC Media Action's strategy to market Kilkari focussed on a range of below-the-line (BTL) marketing initiatives, such as rural activation via agents at street theatre performances; incentivising community health workers to act as promoters; and targeted digital marketing via SMS and OBD by MNOs.

Rural activation was used to achieve the two primary objectives of generating awareness and tapping the early adopters of the service by visiting towns and villages in eight priority districts. BBC Media Action used Kilkari branded vans to create awareness. They were equipped with audio-visual aids and a Kilkari song which was played out aloud in the villages they visited. There were other branding initiatives, such as wall paintings, stencilling, tin plates, posters and stickers in the villages.

Leveraging partnerships with leading MNOs, BBC Media Action also reached out to families in Bihar with BTL marketing campaigns delivered via OBD and SMS. In addition, above-the line (ATL) marketing included the use of the posters and danglers displayed in 60,000 top up shops across Bihar.

Through these marketing campaigns, over 1,000 villages were exposed to the Kilkari brand via over 2,000 van activities and static branding in all the villages visited. However only 60,000 people subscribed, and loyalty among subscribers was limited. When BBC Media Action used its call centre to find out why, it discovered that many of the people who had subscribed were young men without children, who were just curious about the service.

BBC Media Action learned a number of critical lessons through this process. Firstly, male BoP subscribers in rural Bihar with very little disposable income are reluctant to pay for preventative (as opposed to curative) maternal and child health advice for their wives. They consider maternal and child health to be the domain of women, and trust their mothers to make sure 'the needful' is done. Secondly, mobile top up shops do not lend themselves to conversations about maternal and child health. Top up shops are an almost exclusively male domain, where young men often go to buy not just Bollywood songs and films, but also pornography. It is not considered a socially acceptable venue for women to frequent. BBC Media Action also learned that the many pregnant women or new mothers in rural Bihar rarely leave the house, even to make the trip to the centre of the village to engage in a video van activation, and equally that families are very reluctant to allow male promoters to interact with these women in their homes.

As a result, BBC Media Action decided to change its marketing approach. First, BBC Media Action identified community health workers, who are regularly in touch with pregnant women, mothers of children and their families as an effective channel for encouraging and motivating families to subscribe to Kilkari. An incentive programme was devised where every community health worker who helps a family become a loyal Kilkari subscriber receives talk time credit on her mobile phone. An extensive face-to-

face training programme was carried out to educate community health workers about Kilkari, and to teach them how to promote the service. They were also informed about the incentives they could earn by promoting the service. This marketing approach was much more effective, generating 130,000 loyal subscribers, where 70 per cent listened to nearly 100 per cent of every Kilkari message. Nonetheless, this marketing approach was slow going, because in states such as Bihar, where community health workers have a catchment area of 1,000 people – they may only make a dozen home visits a month.

BOX 2

Marketing Kilkari in India and BBC Janala in Bangladesh - Lessons learned

BBC Media Action has used television, radio and newspaper advertising, top up shops, rural activations and USSD, SMS and OBD promotions very successfully to market mobile-based English language learning in Bangladesh. BBC Janala was an English language learning service designed to improve the livelihoods of young, literate Bangladeshis. Developed with funding from UK AID, BBC Janala aimed to equip them with language skills to improve their employment prospects. The program was rolled out in coordination across television, radio, newspaper, online, IVR, SMS, mobile internet, and CD-ROM, and quickly became one of the largest educational brands in Bangladesh. The mobile based services were billed to the user, at a rate of BDT 50 paise (USD 0.0052) per minute (for the IVR services). Standard SMS and mobile internet access rates applied. The IVR service generated 100,000 calls on the first day, and went on to attract close to 10 million users.

BBC Media Action attributes the limited results of marketing techniques in Bihar that succeeded so well in Bangladesh to several factors. Firstly, in Bangladesh the target market was the young, literate population of a higher socio economic class. Secondly, in Bangladesh, BBC Janala promoted English language skills designed to improve employability, providing a more obvious reason for investment than preventative health education for poor rural mothers.

Content

The Kilkari content, developed by BBC Media Action, is presented in the voice of a female doctor character, called Dr Anita. Authoritative yet sympathetic and engaging, Dr Anita is a friend, philosopher and guide to both community health workers and families. Dr Anita serves the twofold purpose of making content credible across both services (it is the same voice delivering key information and imparting skills) and of creating common currency for conversations around maternal and child health – between community health workers and families, between women, and within the family. In villages where people are buying branded biscuits, mobile network services, cooking oil, salt, soap, and fertilizers, Dr Anita and the Kilkari brand make it easier for people to identify with the digital services, which has no physical entity as such.

The Kilkari service delivers one message per week for up to 72 weeks, depending on when the new or expecting mother was subscribed to the service. The 72 messages cover birth preparedness and antenatal care; safe delivery; new-born care; postnatal care; family planning; routine immunization; immediate and exclusive breastfeeding; complementary feeding; identifying and preventing malnutrition; hand washing; preventing childhood infectious diseases (diarrhoea, pneumonia and malaria), and stopping open defecation.

Content sources and validation process

The health-messaging framework for Kilkari was developed in partnership with nationals and international public health experts, who provided input and reviewed all of BBC Media Action's final scripts to ensure that they complied with local government priorities and conditions in the state. Content for the national version of Kilkari was redeveloped with the Ministry of Health and Family Welfare (MoHFW). This process involved working with the Ministry's four health divisions (maternal health, family planning, child health and immunization) to prioritize and schedule, based on information needs through pregnancy, child birth and child care, 72 messages for the Kilkari service; develop technical health messaging briefs for the 72 messages; and script the 72 messages in multiple languages. The outputs from each of these three stages, including scripts written in standard Hindi, were reviewed by each of the four divisions. The content was also reviewed by the National Health Systems Resource Centre (NHSRC), an apex body of the MoHFW that provides technical assistance.

Content stylization and localization

When trying to change social norms and behaviors that have persisted for centuries, particularly among low literate or illiterate populations, just providing information is not enough. In fact, regardless of level of education or social class – people are unlikely to change their behavior if they're just told 'the facts'. For example, people smoke despite the fact that every packet of cigarettes says that smoking causes cancer. In order to persuade people to think and do things differently, you need to get inside their heads to understand the barriers to behavioral change, and the triggers that might empower people to break these barriers. This is why behavioral change communication content needs to be localized – because unless it is culturally specific and relevant, it won't resonate.

Persuading a young mother in India not to give her infant water and honey before it is six months old, despite her mother-in-law's age old wisdom to the contrary, requires an in-depth understanding of the power dynamics of the rural Indian family, which could be radically different from those observed in other cultures. It also requires creative insights into the contextually specific keys – of ego, self-image and devotion – that might unlock the propensity of the mother-in-law so to think and act differently from widely accepted customs and traditions.

Human centered design

BBC Media Action uses an iterative human centered design (HCD) approach whereby the content and usability of the service are repeatedly user-tested with beneficiaries to ensure accessibility, engagement and impact. BBC Media Action spent six months, and four rounds of user-testing to get the content for Kilkari Bihar right. This was an intensely challenging exercise because BBC Media Action found that the majority of women were unfamiliar with basic health concepts. For example, they were not familiar with iron and had never heard of an ambulance. Their general vocabulary was also limited, and they used a lot of colloquial expressions. Painstakingly, over the course of six months – BBC Media Action put together a dictionary of health vocabulary and phrases that rural women could understand.

The national version of the Kilkari content was also user-tested with new and expecting mothers and their families in four Hindi speaking states. An Oriya version of the content for the state of Odisha was also produced and tested. Two tribal versions of the language have subsequently been produced, with the support of the Barr Foundation, for the majority tribal populations in the state of Jharkhand. User-testing in the state government's High Priority Districts (districts where the need is greatest) revealed that Hindi was not understood by the majority of tribal women. And content production in Assamese is currently underway for the state of Assam.

BOX 3

Kilkari's sample messages

BBC Media Action's content is originally scripted in the required languages – it is not a translation of an English script. The sample message below is a translation of a Hindi script into English. Much of the nuances of the language, including the humor, rhythm and sensitivity of the script, is lost in translation.

Hello dear friends,

I, Dr Anita, am back with the Government of India's Kilkari mobile message for this week. In this week's message, I will tell you about the advantages of a form of family planning, called the post-partum intrauterine device. Soon, there will be a new member in your household. This is the best time for you to start thinking about family planning, because iit is possible for you to get pregnant even right after you deliver your baby. So how are you going to protect yourself from unwanted pregnancies? Do not worry – the post-partum intrauterine device is an effective, safe and easy solution. It is a one-time procedure that will give you a long break from being pregnant. You can have the post-partum intrauterine device inserted within 48 hours of delivery which is effective for up to 5-10 years so that you do not need to visit the hospital again. And what's great about it is that you can have the post-partum intrauterine device removed whenever you decide to have a child again. This service is free at any government hospital. So ask your ASHA or Auxiliary Nurse Midwife (ANM) about the post-partum intrauterine device today. Remember – this device will protect you from the stress and anxiety associated with an unwanted pregnancy. I'll be back with more essential information about your health and the health of your baby next week, so wait for my call from the Kilkari mobile service. Stay healthy.

User stories

Sanskriti Suman, the mother of a seven-month-old baby from Gola Bazaar village, in the state of Jharkhand, said she first found out about Kilkari from her Accredited Social Health Activist (ASHA) when she was registering her pregnancy at the Primary Health Centre. She began receiving messages from the Kilkari service towards the end of her pregnancy and continues to receive messages on a weekly basis. When asked what she thought of the service, she said, "I like it when Dr Anita explains all the information so clearly and whatever she says is easy to follow and do." Talking about the messages she has recently been receiving from Kilkari, Sanskriti said:

"Everyone in my family had been telling me not to start complementary feeding so early, but Dr Anita told me about starting complementary feeding at six months and the ASHA also told me that this is important. Since then I have been feeding my child the different kinds of food that Dr Anita said to give in addition to milk, and my child is healthy. My whole family knows about Kilkari and I discuss the information I get regularly with my husband and ASHA."

Sumitra Kerketta, an Auxiliary Nurse Midwife (ANM) and eight months pregnant, from Koynar Toli village in the state of Jharkhand, says that what she most likes about Kilkari is the fact that it provides information about both the mother and child's health. Since she is currently pregnant, she is been receiving messages about having a healthy diet and eating one extra meal a day:

"I knew that I should be eating a little extra but I wasn't doing it earlier. Ever since I received the message I have been trying to improve my diet and eat well – Kilkari helped me with this." "I discuss the messages from Dr Anita with my mother often and my family is aware of the service. The information is useful for me even though I am an ANM because it reminds me about what I need to do."

Looking ahead

Kilkari is being rolled-out in three phases. In the first phase in 2016, Kilkari was rolled out to approximately 2 million families in six Empowered Action Group states. In the second phase in 2017, which is dependent on the successful impact of Kilkari, the service is likely to be rolled out in the remaining Empowered Action Group states, as well as Assam, in 2017. In 2018, Kilkari will begin to scale across the rest of the country.

Planned impact evaluation to measure quantifiable outcomes

The ongoing national scale up of Kilkari in India represents an unprecedented opportunity, with global relevance in order to:

Demonstrate the impact of digital development on health outcomes at scale

Understand the cost of delivering these benefits to millions of citizens

Learn from the five-year journey which has led to the adoption of these services by the Government of India

With support from USAID, BBC Media Action is analysing the call data records generated on a daily basis by Kilkari to provide weekly and monthly reports on the uptake and usage of the service. Data can be analysed down to the level of individual subscribers and on the basis of location, time and content.

Indicators include:

	The number of subscribers called by the service
	The number of subscribers answering calls
	Their age on service
	Their loyalty to the service (repeat listener patterns)
	The total minutes of content played
	Average number of minutes played per subscriber
	Average duration of calls by subscribers

Tracking and analysing call data records over time provides key insights that enable on-ground project staff and government officials to make timely decisions about implementation and planning. The data generated can be aggregated, analysed, and used by project and government staff to understand differences in usage between villages, blocks, districts and states.

With support from the Gates Foundation, and strategic direction provided by government, BBC Media Action is also in the process of carrying out a call centre survey of Kilkari subscribers. Different segments of subscribers – including low, medium and high listeners and those who have successfully completed or deactivated the service are being called to provide immediate feedback on the perceived value of the service and any operational issues that need to be addressed.

USAID is supporting the roll out of an extensive face to face monitoring plan, which will track the uptake and usage of the service and differences in knowledge, attitudes and behaviours among those exposed to Kilkari on an ongoing basis. Data will be collected every quarter from women in six states for the next two years, and cross referenced with the call data records being generated by the IVR system.

BBC Media Action is currently working with independent evaluators to design robust impact-evaluation studies and a financial analysis of Kilkari to assess the value of delivering free health education to millions of new and expecting mothers in India.