Scaling digital health in developing markets

Opportunities and recommendations for mobile operators
and other stakeholders

June 2017

mHealth

Digital health is taking its first steps in some African, Asian and Latin American countries. The number of initiatives is growing, with a widespread opinion that digital health can help address key healthcare issues if it reaches scale.

This report provides an overview of the healthcare landscape in developing countries and assesses the role of digital health to help address key issues. It looks at technology enablers, challenges, use cases and evidence of the positive impact digital health can have on key health indicators. The report also assesses the role and opportunity for mobile operators and what needs to be done to scale digital health.

We conducted primary research to gather strategic views and insights from a number of companies across the digital health ecosystem. Organisations interviewed and definitions of terms are included in the Appendix.

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Executive summary

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Healthcare landscape – poor coverage and quality, and low digitisation are key issues

Developing countries continue to face poor healthcare funding, which affects access, quality, cost and key health outcomes.

- Some 400 million people do not have access to essential healthcare services, mostly in Africa and South Asia.*

- The shortage of health professionals and facilities is significant. The number of professionals, for example, is below the World Health Organization (WHO) recommendation in many countries.**

- Seven of the 10 most populous low- and middle-income countries have maternal mortality rates above the SDG target*** – India, Indonesia, Pakistan, Nigeria, Bangladesh, Philippines and Ethiopia. Current health infrastructure makes achievement of the target challenging.

A slow transition from legacy systems to modern ICT infrastructure is also a barrier to healthcare improvement. It affects the coordination of care and the integration and timely availability of data. It also creates supply-chain inefficiencies.

The healthcare sector is a late-comer to digitisation, even in high-income countries. Implementation is phased over a period of decades.

Priorities among low- and middle-income countries at an earlier stage of development are focused on addressing fundamental access and quality issues as well as cost inefficiencies. Advanced regions (US, Europe, parts of Asia) are exploring the use of artificial intelligence, Internet of Things, automation, cloud computing and big data for enhanced healthcare delivery and cost reduction.

* World Bank, WHO.

** Critical threshold = 23 doctors, nurses and midwives per 10,000 inhabitants.

*** <70 per 100,000 live births by 2030.

Widescale digital health can help address key healthcare issues

Early digital health solutions in some developing countries show encouraging results but greater scale is needed to drive longer-term benefits.

Digital health needs to focus on three objectives over the next five to ten years – help to expand coverage (access), enhance services (quality) and optimise resources (cost). Some solutions can help achieve multiple objectives.

Access

Digital health enables wider reach of healthcare delivery as some services (such as patient monitoring and diagnostics) can be delivered and managed remotely. Among others, Telefónica's AxisMed claims significant chronic disease cost reduction in Brazil; Orange provides telemedicine services in Africa.

Digital health also allows greater and faster patient access to health information delivered via mobile. Telenor provides a range of B2C health services in Asia, for example.

Quality

Digital health enables faster and more effective coordination of care and professionals as well as timely data sharing. Mobile Obstetrics Monitoring in Indonesia, Wired Mothers in Zanzibar and MAMA Bangladesh have contributed to maternal mortality reduction by allowing a digital link between midwives and doctors, earlier detection of risks and the provision of health information services to pregnant women.

Cost

The transition from paper to digital ensures that available health resources are used most effectively and where/when needed. This includes the digitisation of drug inventory, supply chain and patient records. For example, Vodacom's Stock Visibility Solution reduced the number of stock-outs in South Africa. Cellular networks can also be a platform for solutions that strengthen monitoring systems and help prevent the spread of infectious diseases. Examples include Orange in Senegal and several mobile operators in South Korea.

Scaling digital health – what needs to be done?

Digital health is still in its infancy. Many pilots are not followed by full-scale implementation due to a lack of sustainable financing, high risks for individual stakeholders and long time-to-market for commercial solutions.

Greater and more stable government investment in digital health – as opposed to cyclical/individual initiatives – can help drive scale in developing countries, as venture-capital activity is limited and private sector healthcare provision is at a low scale. Digital health stakeholders need to stimulate government investment by demonstrating how digital health solutions help address national healthcare issues of poor access, quality and cost inefficiencies. Ministries of health also need to encourage and support the implementation of national digital health plans aligned with ICT and broadband agendas. Policy and regulations that promote investment and facilitate faster time-to-market of digital health solutions are a further enabler to adoption and scale.

Governments spend about $1 trillion per year on health in developing countries. If local governments allocate 0.5% of that to digital health initiatives over the next five years, a cumulative $25 billion will be available for digital health companies, including operators.

Ecosystem collaboration is needed to address current fragmentation and create a holistic digital health model. Individual companies do not own the full set of resources and capabilities required. Public-private partnerships (PPPs) serve to share resources, capabilities, opportunities and risks among stakeholders. Such collaboration brings the potential for greater social and economic value for all stakeholders in the ecosystem. In a holistic digital health platform model, new core and complementary services can be more easily integrated and packaged for B2B clients.

Industry collaboration is also needed to address current interoperability issues and drive healthcare data integration. EHRs, for example, need to include a complete and secure patient data history that can be shared in real-time across healthcare organisations. Data integration also improves healthcare worker and patient trust in the health system, and increases the overall value of data collected, dramatically increasing the potential for AI and other advanced technologies in the longer term. The mobile industry can help by advising on the application of standards and by working with healthcare industry partners to deliver services based on the principle of interoperability.

Mobile operators need to pursue a holistic approach to digital health and position as ICT and digital service partners

Mobile operators are engaged in digital health in developing countries. All the largest groups – Vodafone, Bharti Airtel, Telefónica, America Movil, Telenor, Orange, MTN – as well as a number of smaller operators provide a range of B2G*, B2B and B2C services.

The current size of digital health across developing countries is small but the factors discussed earlier can drive scale. For operators, health is a nascent revenue stream and a further platform for cross-sector partnerships. Digital health usually sits within a wider "Business Services" unit. This allows a holistic approach to societal digitisation and helps navigate the IoT learning curve.

To be relevant in the digital health space, operators need to adopt strategies that can strengthen their role as ICT and digital service partners for governments, health providers and health tech companies. A holistic approach that looks at digital health as an integrated – as opposed to fragmented – portfolio of services is crucial to drive partnerships and opportunities, both locally and regionally.

Through a building block model – discussed in Chapter 5 – operators can play a role along the healthcare digitisation roadmap, from digitisation of healthcare professionals to digitisation of health centres, supply chain, patient data and integrated digital platforms for information, booking, payments and complementary services. Digitisation of health workers and centres are prerequisites to effective digitisation of health systems and, in the long term, uptake of the Internet of Things, data analytics and artificial intelligence.

The range of ICT services operators provide – directly or through partnerships – includes solutions for telehealth, imaging, supply chain, health work management, data management and hosting, cloud and IoT. Customer relationships and wide network coverage are also key assets; they can support the provision of identity-related services for patient registration, vital event tracking, health records and health-related payments. Operators can also leverage their relationships with local authorities in countries where tech players lack presence. This is key for partnering.
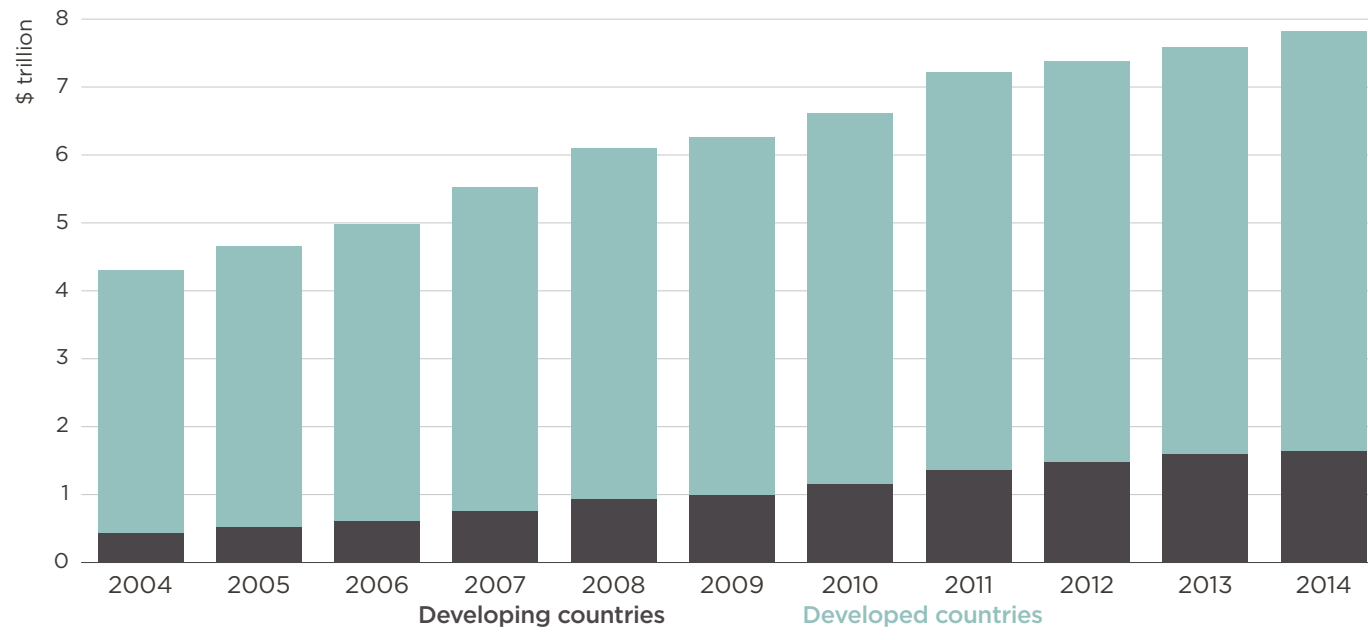
* Business to government.

Healthcare landscape

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Health expenditure is rising faster than the wider economy worldwide

Global health expenditure nearly doubled between 2004 and 2014, reaching $7.8 trillion. It is growing faster than the wider economy (GDP) in most countries thus adding pressure to the finances of public and private payers. Faster growth in the developing world is mostly due to historically low levels of health expenditure rather than a significant boost in private and public funding.

Most developing countries are still far from reaching the level of health expenditure and investment seen in developed countries. The result is that the developing world accounts for approximately 20% of the global health expenditure but hosts nearly 85% of the global population.

Source: World Bank

Global health expenditure

Growth rates

CAGR 2004–2014. Health expenditure and GDP based on nominal in $ terms, at actual exchange rates

Why is health expenditure growing?

Developed and developing countries face different health expenditure growth drivers. Ageing populations and rising incidence of chronic diseases are major drivers in the developed world. Most developing countries face the double burden of diseases (communicable and chronic) and the cost of expanding access to healthcare in rural areas where half the population lives.

Source: World Bank, WHO, International Diabetes Federation

Key health expenditure growth drivers

DEVELOPED COUNTRIES	DEVELOPING COUNTRIES
• Ageing populations – the 65+ age group accounted for 16.9% of the total population in 2014, up from 14.5% in 2004. This growth trend is set to continue.	• Increasing life expectancy – from 52 to 61 years in low-income countries between 2000 and 2014. For reference, it was 81 years in high-income countries in 2014.
• Rising incidence of chronic diseases – diabetes (the second most costly chronic disease after heart disease) affects a large portion of the population and has started to appear earlier in life. The number of people with diabetes will grow by 26% between 2015 and 2040 in North America, the Caribbean and Europe.	• Double burden of diseases – most countries face a mixture of communicable and chronic diseases.
• Cost of new devices and technologies, including IoT devices and solutions, artificial intelligence, automation, cloud computing and big data.	• Cost of expanding access to healthcare services – 51% of the population live in rural areas where there is a significant shortage of facilities and professionals. This requires increasing expenditure on healthcare coverage. The WHO forecasts a global shortage of 12.9 million healthcare workers by 2035 (7.2 million in 2013), mostly in Africa and Southeast Asia.

The divide between developing and developed countries remains significant

Funding, cost, access and quality of service are key components of any health system. They are also largely interrelated through a cause-effect chain that ultimately affects key health outcomes. Developed (high-income) and developing (low- and middle-income) countries show different pictures across all key components. There is still a significant gap in health outcome indicators such as maternal and child mortality rates, number of deaths due to diseases, and life expectancy.

Source: World Bank, 2015 or latest available

Key healthcare indicators by type of country

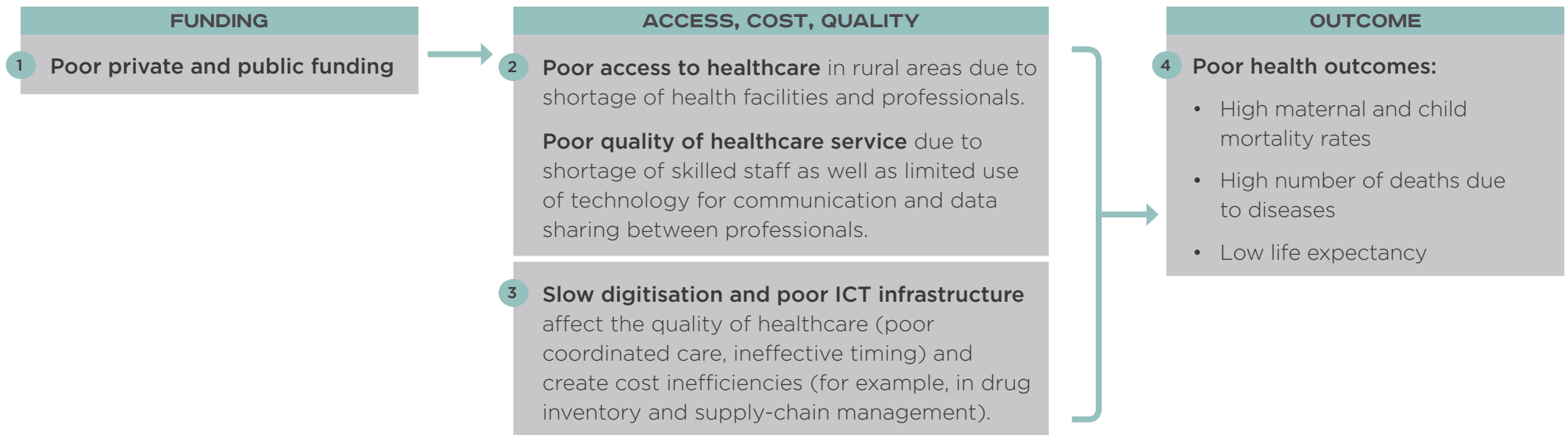| Category	Indicator	Low income	Middle income	High income
Funding	Public as percentage of total health expenditure	42%	52%	62%
	Health as percentage of total government expenditure*	11%	10%	18%
Cost	Health expenditure as percentage of GDP	6%	6%	12%
	Health expenditure per capita ($, PPP adjusted)	91	577	5,193
Access	Hospital beds per 1,000 inhabitants	1.8	2.2	4.2
	Physicians per 1,000 inhabitants	0.07	1.35	2.92
Outcome	Maternal mortality per 100,000 live births	571	196	10
	Life expectancy at birth (years)	59.6	70.0	80.1

* Middle-income figure not available. The data refers to Middle East and North Africa (excluding high-income countries).

Key health issues: poor funding, access, quality and ICT infrastructure

In developing countries, low levels of private and public financial resources spent on health affect access to healthcare as well as the quality of the health system. According to a WHO and World Bank report, 400 million people do not have access to essential health services, mostly in Africa and South Asia (2015). The digitisation of health systems and centres and use of technology for healthcare purposes lag behind developed countries. Poor access and quality, and low levels of digitisation have negative implications not only on key health outcomes but also the poverty rate.*

Source: GSMA Intelligence

Key health issues in the developing world

FUNDING	ACCESS, COST, QUALITY	OUTCOME
1 **Poor private and public funding**	2 **Poor access to healthcare** in rural areas due to shortage of health facilities and professionals. **Poor quality of healthcare service** due to shortage of skilled staff as well as limited use of technology for communication and data sharing between professionals.	4 **Poor health outcomes:** • High maternal and child mortality rates • High number of deaths due to diseases • Low life expectancy
	3 **Slow digitisation and poor ICT infrastructure** affect the quality of healthcare (poor coordinated care, ineffective timing) and create cost inefficiencies (for example, in drug inventory and supply-chain management).	

* According to a WHO and World Bank report, 6% of people in low- and middle-income countries are tipped into or pushed further into extreme poverty because of poor health spending.
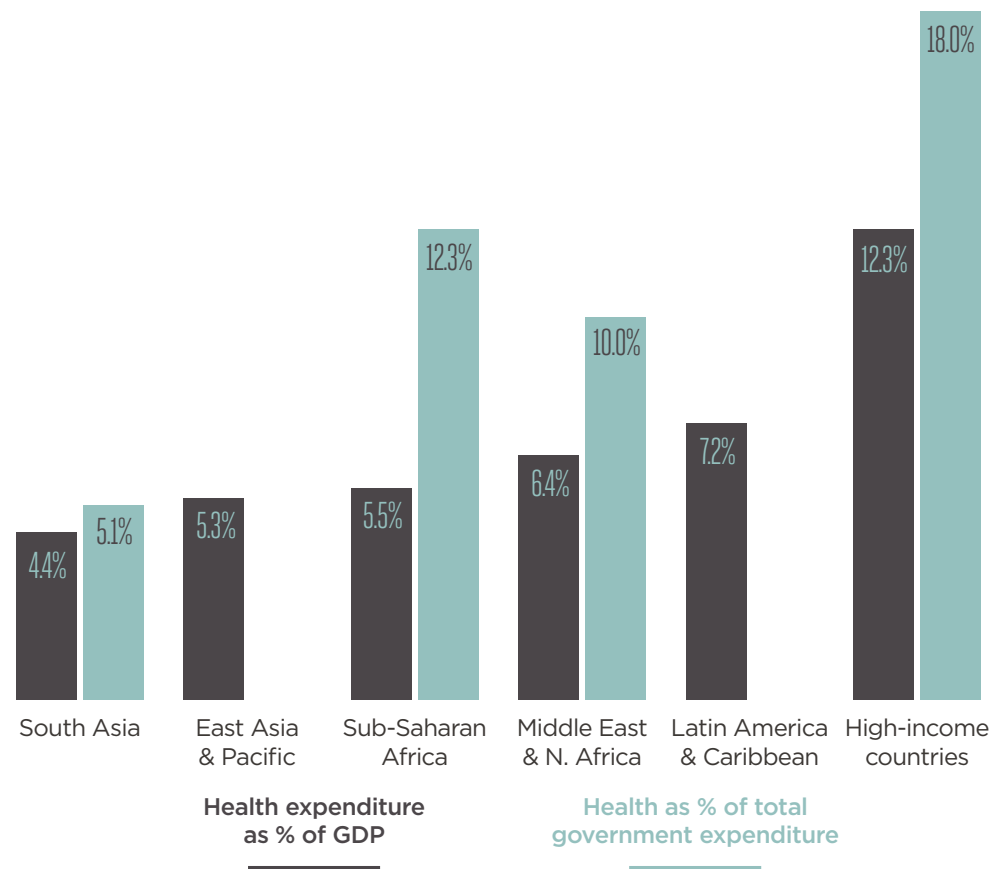
The private healthcare sector is lacking scale; greater public funding is key

Health expenditure as a percentage of GDP was between 4% and 7% in 2014 in low- and middle-income regions, compared to 12% in high-income regions. The divide in per-capita metrics (PPP adjusted) is even larger. Low-income countries spend on average nearly $100 per capita on health, compared to $600 for middle-income countries, and over $5,000 for high-income countries. This underinvestment in the developing world is due to:

- **poor private funding** as populations, especially in low-income countries, have little ability to cover their healthcare expenses either through private insurance or their own resources. This causes low private insurance presence

- **low government spend** on health despite significant macroeconomic progress, in particular in manufacturing (in South Asia) and agriculture (in Sub-Saharan Africa). Health accounts for a minor share of total government expenditure in most developing regions. In populous countries such as Bangladesh, Brazil, India, Indonesia, Kenya, Pakistan and South Africa, education spend outweighs spend on health. In many developed countries, government spend on health is higher than that on education.

Health expenditure by region

Health expenditure as % of GDP:
- South Asia: 4.4%
- East Asia & Pacific: 5.3%
- Sub-Saharan Africa: 5.5%
- Middle East & N. Africa: 6.4%
- Latin America & Caribbean: 7.2%
- High-income countries: 12.3%

Health as % of total government expenditure:
- South Asia: 5.1%
- Sub-Saharan Africa: 12.3%
- Middle East & N. Africa: 10.0%
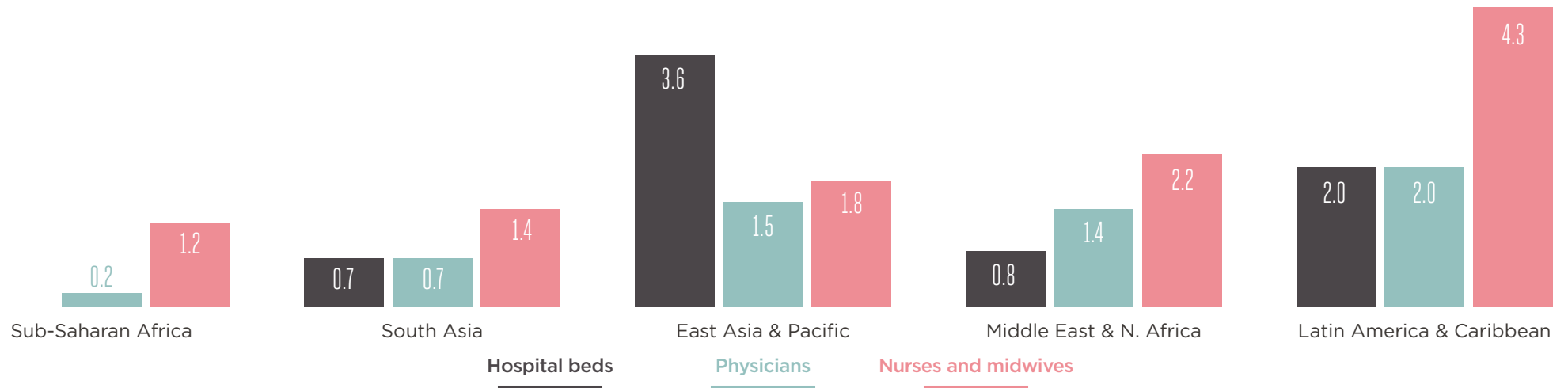- High-income countries: 18.0%

Note: SA, EAP, SSA, MENA and LAC exclude high-income countries, if any.

Significant shortage of facilities and professionals, especially in rural areas

All developing regions, apart from Latin America, have between one and two nurses and midwives per 1,000 inhabitants, compared to an average of nine in high-income countries. Many countries in Sub-Saharan Africa and South Asia have less than one doctor per 1,000 inhabitants. There is also a shortage of facilities such as hospitals (including hospital beds), surgeries and clinics, as well as poor technology infrastructure in health centres. The ratio of medical devices per million inhabitants ranges from 101 in Japan to 6 in Thailand, 3.6 in Mexico, and less than 1 in many countries in Sub-Saharan Africa and South Asia. The availability of skilled care during and immediately after birth is also a key issue, particularly in rural areas.

Source: World Bank, 2014 or latest available.

Key access indicators, per 1,000 inhabitants

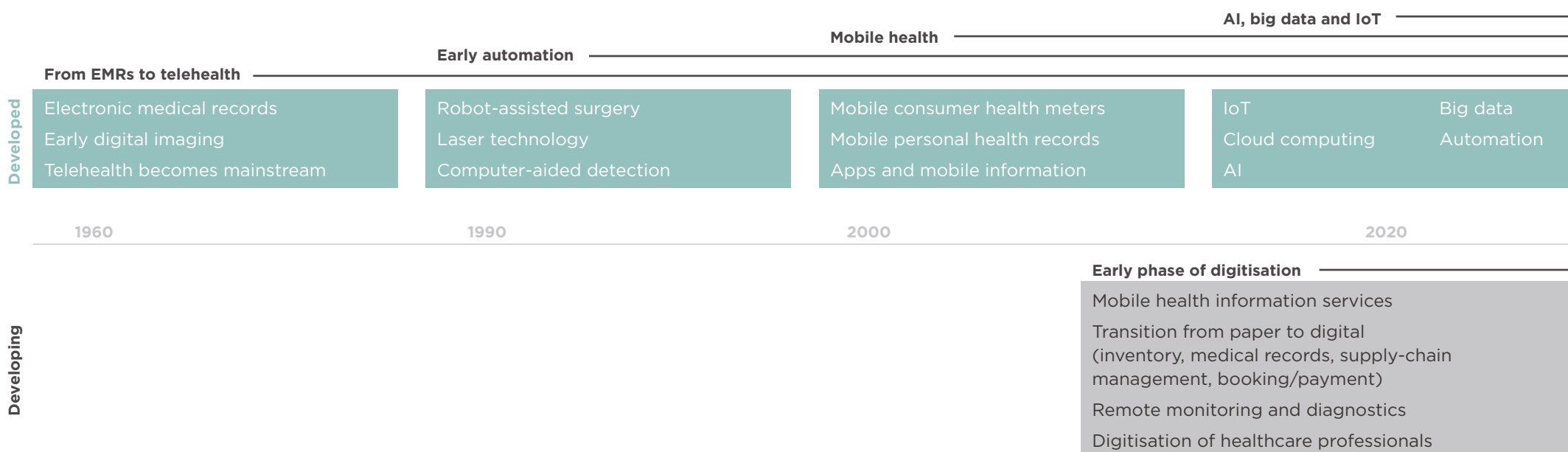|	Sub-Saharan Africa	South Asia	East Asia & Pacific	Middle East & N. Africa	Latin America & Caribbean
Hospital beds		0.7	3.6	0.8	2.0
Physicians	0.2	0.7	1.5	1.4	2.0
Nurses and midwives	1.2	1.4	1.8	2.2	4.3

SA, EAP, SSA, MENA and LAC exclude high-income countries, if any. Hospital bed data not available for SSA.

An early phase of digitisation is starting in some developing countries

While the developed world has experienced multiple phases of health digitisation over the last 60 years, the developing world has yet to see significant developments. Priorities among low- and middle-income countries at an earlier stage of development are focused on addressing basic access and quality issues as well as cost inefficiencies. Advanced regions are exploring the use of artificial intelligence, Internet of Things, automation, cloud computing and big data for enhanced healthcare delivery and cost reduction.

Source: GSMA Intelligence

Digitisation of the healthcare industry, by type of country

AI, big data and IoT ⟶

Mobile health ⟶

Early automation ⟶

From EMRs to telehealth ⟶

Developed

Electronic medical records	Robot-assisted surgery	Mobile consumer health meters	IoT	Big data
Early digital imaging	Laser technology	Mobile personal health records	Cloud computing	Automation
Telehealth becomes mainstream	Computer-aided detection	Apps and mobile information	AI	

1960   1990   2000   2020

Developing

Early phase of digitisation ⟶

Mobile health information services

Transition from paper to digital (inventory, medical records, supply-chain management, booking/payment)

Remote monitoring and diagnostics
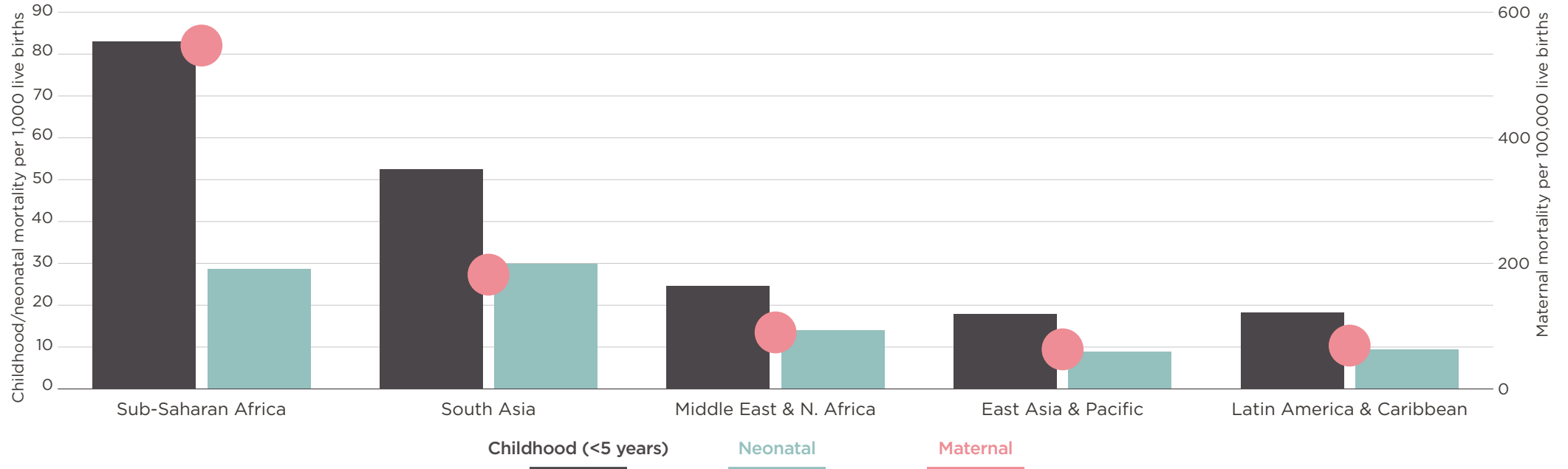
Digitisation of healthcare professionals

Despite recent progress, mortality rates remain high in developing regions...

In addition to rising levels of chronic conditions (e.g. diabetes, heart disease, asthma, cancer), developing regions face high rates of maternal and child mortalities as well as a high number of deaths due to communicable diseases such as Ebola, HIV and malaria. Maternal mortality remains a key issue in most developing countries. For example, in Sub-Saharan Africa, the maternal mortality rate declined from 717 to 547 per 100,000 live births between 2005 and 2015, but remains well above the average of 10 in high-income countries.

Source: World Bank, 2015

Key mortality rates

Childhood (<5 years)   Neonatal   Maternal

SA, EAP, SSA, MENA and LAC exclude high-income countries, if any. Maternal per 100,000 live births.

...and well above SDG 3 targets

The UN Sustainable Development Goal 3, *Good health and well-being*, adopted in September 2015, seeks to "ensure healthy lives and promote well-being for all at all ages". It includes 13 targets – most of them refer to three areas: child health; maternal health; and HIV/AIDS, malaria and other diseases. Significant progress has been made over the last 15 years on key mortality rates but challenges remain. The maternal mortality rate has the widest gap; its rate of improvement will need to double if 2030 SDG 3 targets are to be achieved. However, current health infrastructure may not support this significant improvement.

Source: World Bank, UN

SDG 3 – key mortality rate targets*

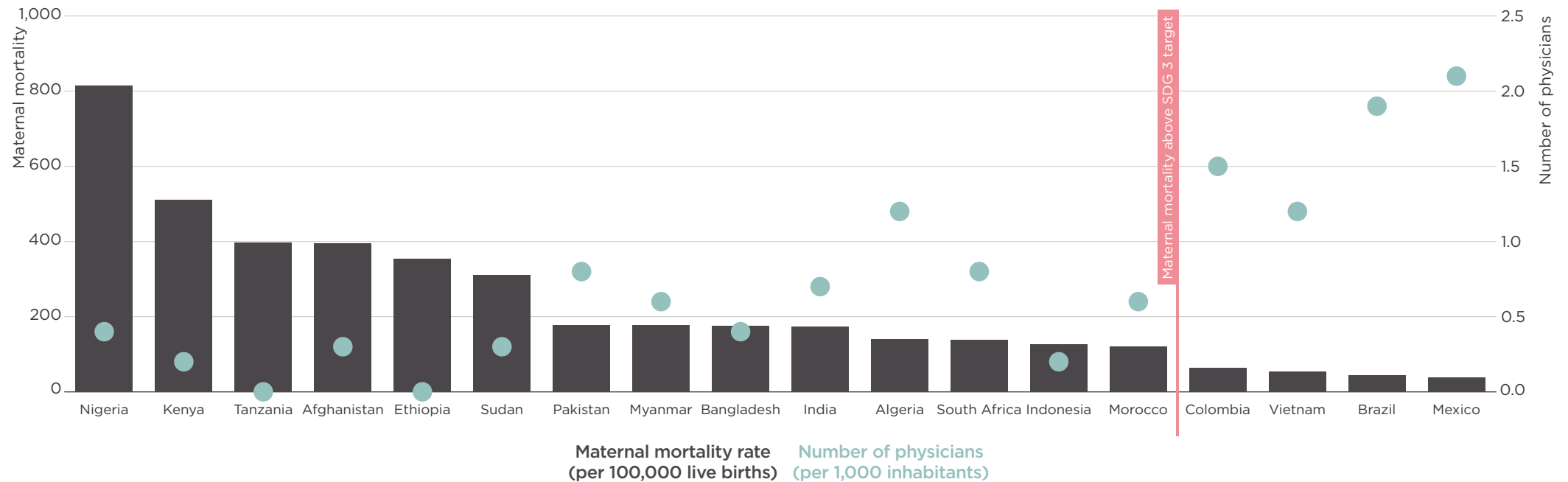| Target (by 2030)	2015 figure	Progress 2000–2015	Progress needed 2015–2030 to meet the target	Key challenge
Reduce global maternal mortality ratio to <70 per 100,000 live births	216 (global)	**37% reduction** from 341 to 216 per 100,000 live births	**68% reduction** from 216 to 70 per 100,000 live births	Increase access to midwives and adoption of remote monitoring (almost all deaths occur in low-resource settings).
All countries to reduce neonatal mortality to <12 per 1,000 live births	19 (global)	**39% reduction** from 31 to 19 per 1,000 live births	**37% reduction** from 19 to 12 per 1,000 live births	In developing countries half of all mothers and newborns do not receive skilled care during and immediately after birth.
All countries to reduce under-5 childhood mortality to <25 per 1,000 live births	43 (global)	**44% reduction** from 76 to 43 per 1,000 live births	**42% reduction** from 43 to 25 per 1,000 live births	Infectious diseases – the leading causes of child death are pneumonia, diarrhoea, injuries and malaria.

*Global figures. Since developing countries account for nearly 85% of the global population, past and future trends largely depend on the developing world

Shortage of professionals and slow progress of digitisation are barriers to addressing high mortality rate

A number of populous countries continue to have maternal mortality rates above the SDG target (<70 per 100,000 live births by 2030). This is mostly due to a shortage of physicians (doctors), nurses and midwives. In fact, all such countries have numbers of professionals below the WHO recommendation.* Poor use of technology-based solutions for communication between midwives and doctors and risk stratification is also a barrier to addressing high rates of mortality.

Source: World Bank, 2015 or latest available

Key health indicators: select developing countries with large populations

Maternal mortality above SDG 3 target

Maternal mortality rate (per 100,000 live births) **Number of physicians (per 1,000 inhabitants)**

*Critical threshold = 23 doctors, nurses and midwives per 10,000 inhabitants

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The role of digital health and key stakeholders

The intersection of health and technology

There is no standard definition of digital health. Several umbrella terms are often used to describe the intersection of health and technology, such as digital health, connected health and electronic health.
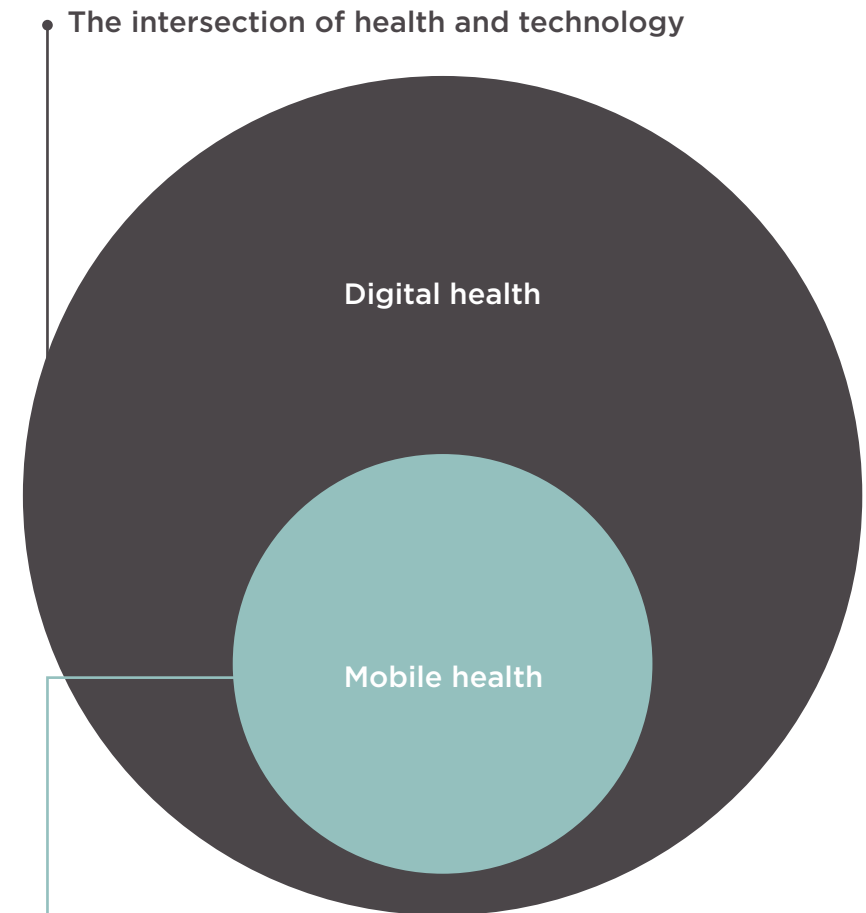
According to the World Health Organization, digital health is a collective term that encompasses both electronic health and mobile health:

- **electronic health** (e-health) is the cost-effective and secure use of information and communication technologies for health and health-related fields

- **mobile health** (m-health) is a component of e-health, and involves the provision of health services and information via mobile technologies, such as mobile phones, tablet computers and personal digital assistants.

Beyond a formal definition, the digital health ecosystem is moving towards a holistic approach that embraces technology enablers (networks, devices, platforms, software, equipment) and health solutions (products, services, content, applications).

Digital and mobile health

The intersection of health and technology

Digital health

Mobile health

Mobile is a key component of digital health. Mobile health solutions are digital health solutions that involve the use of mobile devices, networks and mobile-based solutions and services.

Most countries largely rely on mobile devices and networks

Mobile is key to improving healthcare in many developing countries as mobile network access is nearly ubiquitous while fixed infrastructure is scarce and mostly confined to large cities and business/industrial districts. The divide between mobile and fixed broadband penetration rates is large in many populous countries – Brazil, India, Indonesia, Mexico, Nigeria, Pakistan and Bangladesh.

Many developing countries have >90% 2G coverage, which allows the delivery of health information services via basic mobile channels such as SMS and IVR. 3G network coverage has also increased significantly (to approximately 80% of the population). This allows the use of software-based apps and solutions for supply-chain management, remote monitoring and diagnostics, for example.

Key mobile figures, developing world
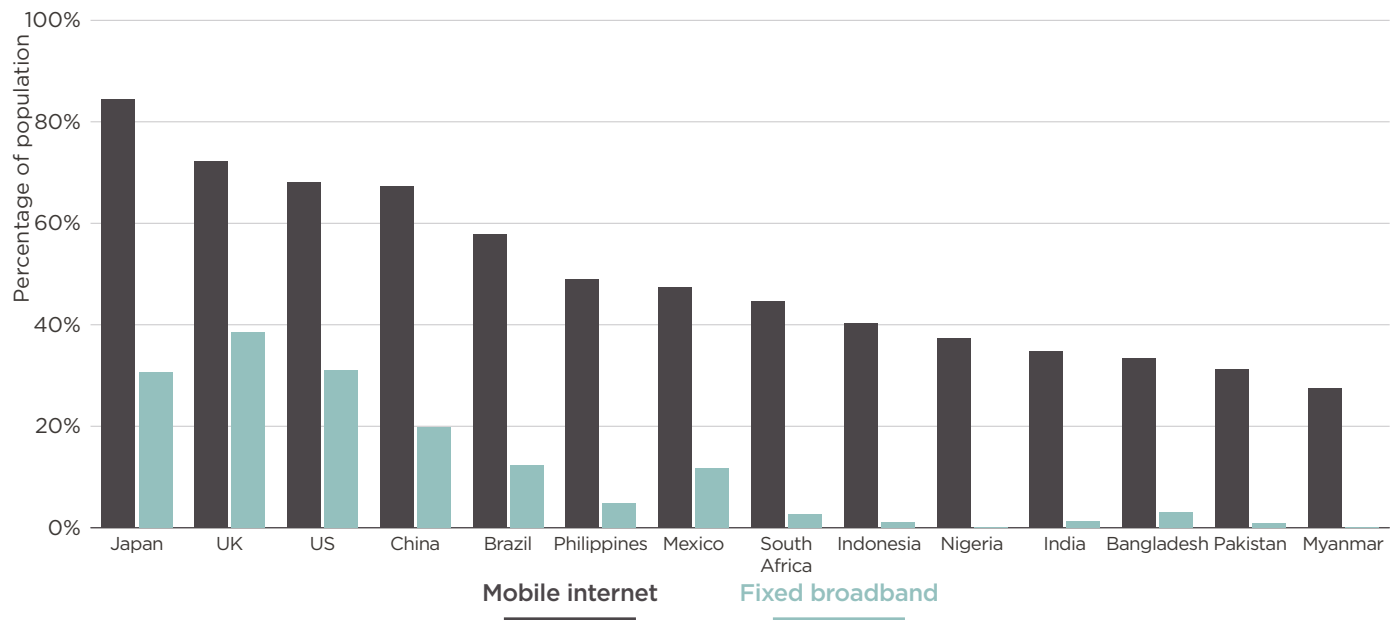
Cellular network coverage	3G: 79%. 2G: >90% in many countries
Mobile penetration	61%, 3.7 billion subscribers
Mobile internet penetration	43%, 2.6 billion subscribers

Data as of Q4 2016. Percentage of population.

Mobile internet versus fixed broadband penetration, select countries

Fixed broadband penetration in Nigeria and Myanmar is marginally above 0%.

Collaboration is key in a low-scale digital health space

Digital health is still in its infancy in developing countries. Many pilots are not followed by full-scale implementation due to a lack of sustainable financing, high risks for individual stakeholders and long time-to-market for commercial solutions and services. Collaboration among digital health stakeholders is key as individual companies do not own the whole set of capabilities (e.g. health, ICT, go-to-market expertise) or resources (e.g. funding, ICT infrastructure, distribution) required.

Governments play a key funding role as venture-capital activity is limited, private sector healthcare provision is at a low scale and the vast majority of people have low disposable incomes to self-finance their healthcare expenditure.

Large health tech companies such as Philips, GE and Siemens are engaged in developing countries, as are several non-profit organisations and NGOs supporting the digitisation of health (MedicMobile, Path, HIPS, D-tree, Jembi, CDC, PSI, Living Goods). Leading pharma companies and governments are also increasingly pursuing the digital transformation of healthcare, supported by a number of multinational technology companies such as IBM and Microsoft. Operators are looking to adopt the role of holistic ICT and digital service partners for governments, health providers and health tech companies.

Digital health stakeholders

FUNDING/PAYMENT
- Local governments
- Global foundations
- NGOs
- Start-ups

PROVISION OF DIGITAL HEALTH PRODUCTS AND SERVICES
- Pharmaceutical companies
- Large health tech companies
- Non-profit health tech organisations
- NGOs
- Operators

TECHNOLOGY PROVIDERS
- Operators
- Original equipment manufacturers
- Technology companies

Multilateral models allow leverage of multiple assets and capabilities

Public-private partnerships (PPPs) can be the most viable business model to share resources, capabilities and opportunities/risks among individual companies. Several PPPs involve governments (funders, payers), health tech companies (providers of healthcare solutions, content, software) and mobile operators (ICT partners). In government-led initiatives, although the government is the ultimate beneficiary, other parties are generally involved, at least for an initial period, to reduce the cost and risk to governments.

Recent PPPs in South Asia that involve mobile operators include a partnership in Indonesia between the government, the largest mobile operator Telkom Indonesia and Philips to provide a digital health solution, based on mobile technology, that helps address high maternal mortality. A full case study is available here.
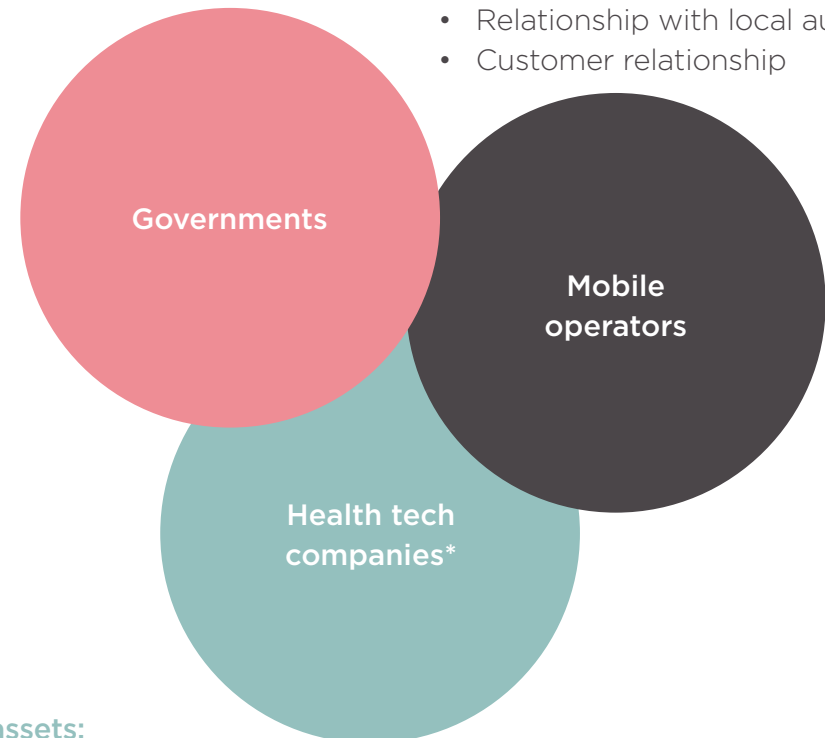
Example of PPP model

Key assets:
- Public health infrastructure
- Funding
- Wider population reach

Key assets:
- Connectivity
- ICT capabilities
- Go-to-market expertise
- Relationship with local authorities
- Customer relationship

Governments

Mobile operators

Health tech companies*

Key assets:
- Technology (e.g. devices, software, equipment)
- Health expertise
- Regional and global reach

* Includes large health tech companies as well as non-profit organisations and NGOs supporting the digitisation of health.
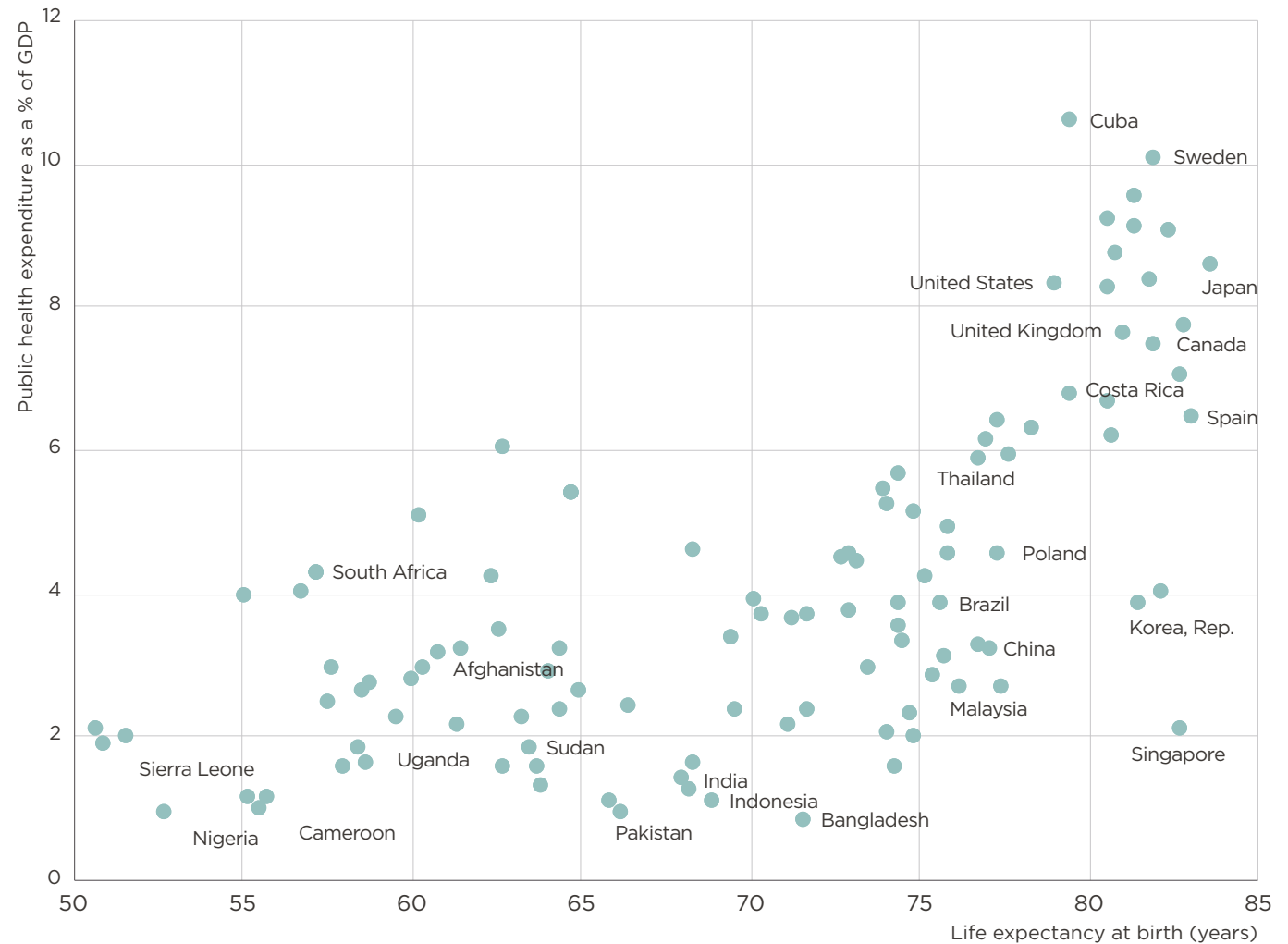
Greater government engagement drives better health outcomes

Governments play multiple roles – influencers, funders, payers and healthcare providers. Greater and longer-term public funding is key to supporting sustainable healthcare improvements as public expenditure has wider population reach than private health, and private sector healthcare provision is at a low scale. The chart shows a reasonable correlation between government expenditure on health and life expectancy. This demonstrates that greater public engagement can drive better health outcomes.

According to a 2015 WHO survey, 63% of responding countries had developed e-health strategies. Some countries, such as Rwanda and Malaysia, are developing national strategies that align digital health initiatives with ICT infrastructure and broadband plans.

Life expectancy versus public health expenditure

Scatter plot: x-axis "Life expectancy at birth (years)" from 50 to 85; y-axis "Public health expenditure as a % of GDP" from 0 to 12. Labeled countries include Cuba, Sweden, United States, Japan, United Kingdom, Canada, Costa Rica, Spain, Thailand, Poland, Brazil, China, Korea, Rep., Malaysia, Singapore, South Africa, Afghanistan, Sudan, Uganda, Sierra Leone, Nigeria, Cameroon, Pakistan, India, Indonesia, Bangladesh.
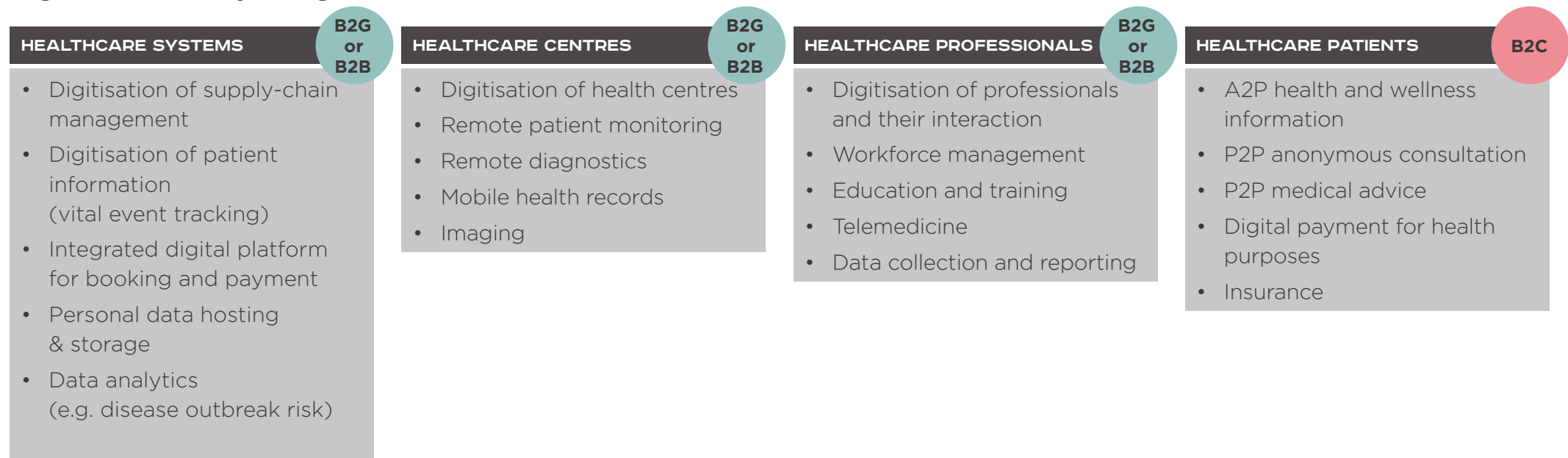
An increasing number of initiatives and solutions

The number of digital health initiatives continues to grow in the developing world, led by governments, health tech companies and operators. Key use cases can be divided into four categories outlined below. The transition from paper to digital is key across most use cases as very few countries use anything more sophisticated than paper.

This includes the digitisation of drug inventory, supply-chain management, patient records and integrated platforms for doctor booking and payment (from patients to doctors as well as health professional payrolls). Operators play a role across all categories, as discussed in the next section.

Digital health – key categories and use cases

HEALTHCARE SYSTEMS (B2G or B2B)	HEALTHCARE CENTRES (B2G or B2B)	HEALTHCARE PROFESSIONALS (B2G or B2B)	HEALTHCARE PATIENTS (B2C)
• Digitisation of supply-chain management	• Digitisation of health centres	• Digitisation of professionals and their interaction	• A2P health and wellness information
• Digitisation of patient information (vital event tracking)	• Remote patient monitoring	• Workforce management	• P2P anonymous consultation
• Integrated digital platform for booking and payment	• Remote diagnostics	• Education and training	• P2P medical advice
• Personal data hosting & storage	• Mobile health records	• Telemedicine	• Digital payment for health purposes
• Data analytics (e.g. disease outbreak risk)	• Imaging	• Data collection and reporting	• Insurance

Digital health does not require high-tech solutions at this stage

Most B2C digital health solutions (e.g. health information and consultation) are accessible via 2G mobile channels (SMS, IVR and voice) and basic phones. This ensures greater population coverage and simplicity of use. B2B/G solutions designed for professionals and centres – for example, those aimed at addressing high maternal mortality or supply-chain management inefficiencies – leverage 3G networks, smartphones, tablets, laptops, software-based apps, web portals and cloud computing. Imaging diagnostics use ultrasound devices wirelessly connected (3G) to specialists in clinics. Cloud computing capabilities are important

as cloud-based platforms need to remotely connect professionals and make medical data available to them.

The key challenge is the integration and interoperability among technologies. The current lack of interoperability means professionals need to carry multiple devices to perform their activities and communicate data to health centres. Data integration can also improve doctor trust of collected data as well as the overall value of medical data. Data collection needs to be integrated to make medical data clinically useful in real-time to healthcare professionals.

Source: GSMA Intelligence

Use of technology (excluding medical technology)

DIGITISATION OF:		NETWORK	CONNECTIVITY	MOBILE DEVICES	OTHER
	Healthcare systems	Mobile and fixed	Data	Smartphones, tablets, laptops	Such as cloud, web portals, data centres, enterprise systems
	Healthcare centres				
	Healthcare professionals	Mostly mobile (3G+)	Voice, SMS and data	Basic phones, smartphones, tablets	
	Healthcare patients	Mostly mobile (2G+)	Mostly voice and SMS	Any mobile phone	

The use of technology can help address key healthcare issues

Digital health initiatives need to focus on three key objectives over the next five to ten years – help to expand coverage of healthcare (access), enhance services (quality) and reduce/optimise resources (cost). Cost benefits can also be indirect as wider access and enhanced quality can ultimately help improve health outcomes and the burden of diseases.

Source: GSMA Intelligence

Key digital health benefits

ACCESS ↑	QUALITY ↑	COST ↓
Greater reach of healthcare delivery as some doctor services can be delivered to patients (and managed) via technology-based solutions (telehealth for remote monitoring and diagnostics).	**Better coordination of care** as digital health enables faster and secure communication and data sharing between healthcare centres, professionals and patients.	**Earlier risk detection and action:** digital health allows patients to take greater responsibility for active management of some of their own health issues and allows professionals to detect risks earlier. This can help reduce the burden of diseases.
Greater and faster patient access to health and wellness information delivered via mobile phones. This is key in developing countries where 51% of the population live in rural areas.	**Enhanced quality of professionals** as they are more equipped and can analyse greater data sets to take decisions. Digital health also includes tools for e-learning and training.	**Resource optimisation:** digital health can ensure that available health resources are used most effectively and where/when needed.

Mortality rate reduction due to better coordination of care – Wired Mothers in Zanzibar, Tanzania

Wired Mothers was a mobile health programme launched in Zanzibar, Tanzania, in the form of a cluster randomised controlled trial. The pilot lasted from September 2009 to August 2013. It linked pregnant women and new mothers to healthcare facilities before, during and after childbirth. The programme comprised:
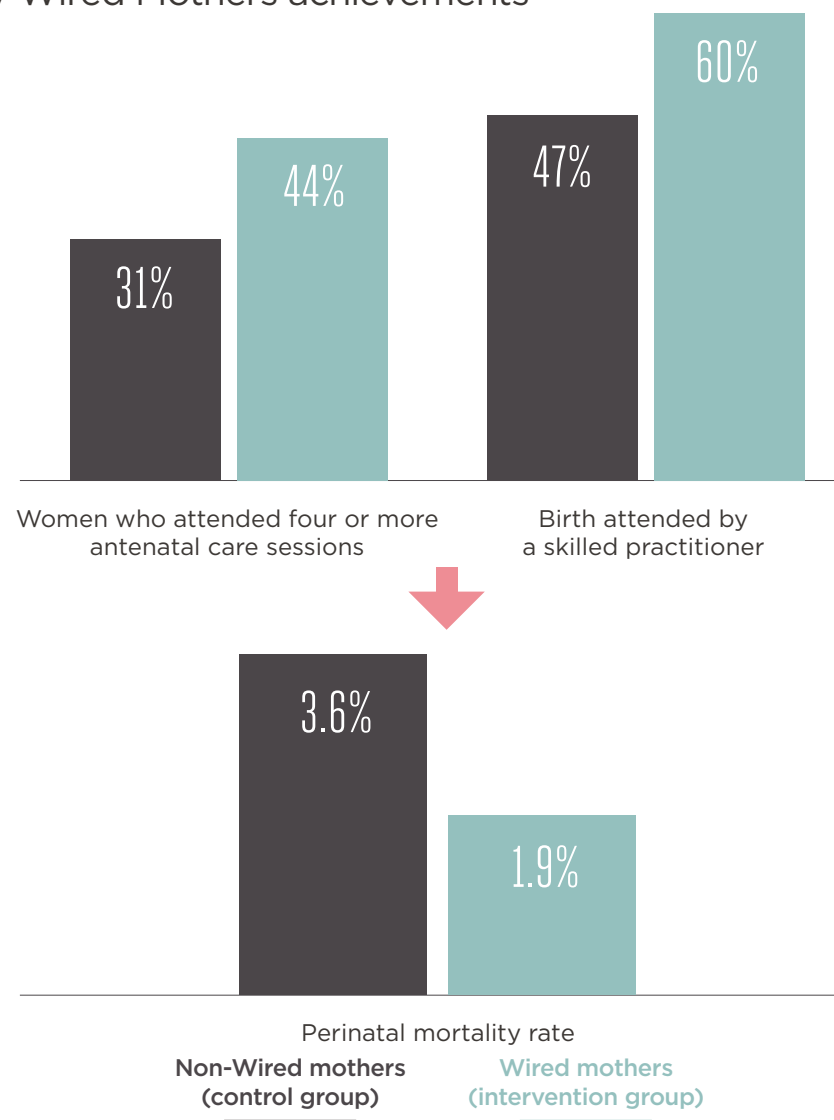
- an automated SMS service providing mothers with information and encouragement to attend antenatal care sessions

- a mobile phone system enabling mothers to contact their primary healthcare providers.

Some 98% of pregnant women make at least one antenatal visit during their pregnancy. However, many of them do not attend the recommended four visits. Wired Mothers increased attendance and reduced the perinatal mortality rate from 3.6% (non-Wired Mothers) to 1.9% (Wired Mothers).

The programme was a collaborative project between the Zanzibar Ministry of Health, Zantel (Millicom) and the University of Copenhagen.

Source: Zanzibar Ministry of Health, Zantel (Millicom), University of Copenhagen, GSMA Intelligence

Key Wired Mothers achievements

Women who attended four or more antenatal care sessions	Birth attended by a skilled practitioner
31% / 44%	47% / 60%

Perinatal mortality rate
3.6% (Non-Wired mothers control group) → 1.9% (Wired mothers intervention group)

Mortality rate reduction due to better coordination of care – Mobile Obstetrics Monitoring in Indonesia

In 2016, Philips signed an agreement with Sijunjung Regency in West Sumatra, Indonesia, for full-scale commercial implementation of its telehealth service Mobile Obstetrics Monitoring (MOM) in the region. The launch followed a successful pilot. MOM is a software solution (app-based, delivered via smartphone) for care providers. It is designed to help reduce maternal mortality rates through early monitoring and risk stratification.

The government pays for the service at the district level as healthcare is decentralised in Indonesia. There is no charge for patients; the solution is designed for healthcare professionals. MOM is developed by Philips, but no direct relationship exists between Philips and the government. Telkom Indonesia sources the software from Philips and sells it to the government.

As well as the distribution, the operator provides the backbone, ICT infrastructure and data capabilities. In a year-long pilot in collaboration with the Bunda Medical Center in Padang, Indonesia, MOM delivered positive results. About 1,500 mothers were benefiting from the solution as of January 2017 – see Case study.

Source: Philips

Key MOM pilot achievements

EARLY DETECTION OF RISKS	MOM increased threefold the early detection of high-risk pregnancies.
MATERNAL MORTALITY REDUCTION	The pilot had over 650 pregnancies in the programme.
	No women died from preventable causes related to pregnancy and childbirth.
	There was also a 99% reduction in anaemia from the first to the third trimester through enhanced patient management.

Greater and faster patient access to health information – MAMA Bangladesh
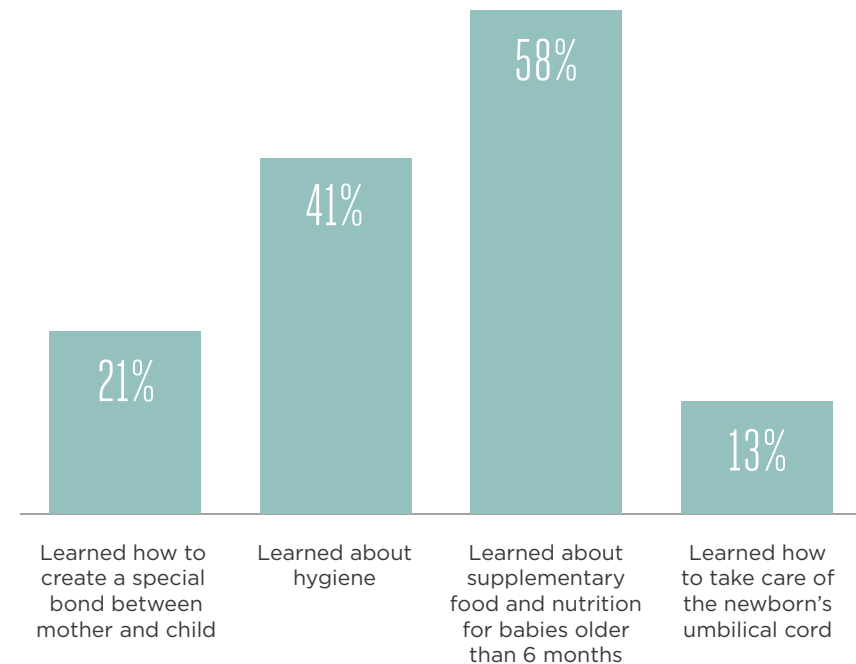
MAMA Bangladesh (Mobile Alliance for Maternal health Action), known locally as Aponjon, is a public-private initiative that leverages the penetration of mobile phones to develop a health information and education system for expectant and new mothers. Funding relies on multiple revenue streams: donor funding, corporate partnerships, mobile operator discounts and user fees. The core of the platform is a voice and SMS broadcast service but it also includes a helpline and mobile app. The service has had a significant impact on expectant mother behaviours. One survey showed that after receiving Aponjon SMS, 44% of women increased their food intake, 50% avoided heavy work and 13% made plans for the birth.

After completing a year-long pilot, Aponjon began to scale nationally in 2012 and now boasts 1.9 million subscribers. The service is accessible to all mobile phone users in the country. The programme is led by the Bangladesh social enterprise, Dnet, in partnership with the government of Bangladesh's Ministry of Health and Family Welfare.

Key Aponjon achievements

Proportion of Aponjon users who improved knowledge following service subscription

21%	41%	58%	13%
Learned how to create a special bond between mother and child	Learned about hygiene	Learned about supplementary food and nutrition for babies older than 6 months	Learned how to take care of the newborn's umbilical cord

Earlier risk detection and action – Mobile Ultrasound Patrol Project in Morocco

The Mobile Ultrasound Patrol Project is a mobile health initiative created, financed and powered through collaboration between Trice Imaging, Qualcomm Wireless Reach, Fujifilm SonoSite and Sony. Ultrasound devices can provide access to imaging diagnostics in places where imaging has never been available before. The aim of the project was to explore ways to improve care for women in developing countries through early detection and treatment of major causes of maternal mortality.

Participating doctors and nurses were issued backpacks containing ultrasound devices that were wirelessly connected through 3G to specialists in hospital clinics. A total of 575 patients were tested, with 98 flagged as potential at-risk pregnancies. Beyond significant cost savings, the solution reduced feedback time from one to two weeks to less than 24 hours.

Key Mobile Ultrasound Patrol Project achievements

TIME SAVING	• Reduced diagnostic review time from two weeks to less than a day. • Reduced transportation time of medical data for review from four days to two seconds.
COST SAVING	• Reduced diagnostic cost from $80 to $2 per patient.
IMPROVED QUALITY AND OUTCOME	• Medical practitioners improved their ultrasound skills. • The technology allowed detection of a number of cases of complications that would otherwise not have been detected.

Resource optimisation – Stock Visibility Solution in South Africa

Supply-chain management in the public sector often relies on medicine being procured centrally and distributed through a number of steps to the dispensing facilities that distribute medicine to patients. Paper-based processes and poor ICT investment cause problems with regards to the availability of medicines. Clinics and points of care around South Africa often struggle to meet demand for critical and life-saving medication.

Stock Visibility Solution (SVS) is a mobile solution developed by Mezzanine – a Vodacom-affiliated company – in partnership with Vodacom for the South Africa's National Department of Health (NDoH). It provides real-time visibility on stock levels for primary healthcare dispensaries. This enables the government to increase access to medicine where it is needed, when it is needed, often in remote parts of the country. SVS was first deployed as a pilot project from 2013 in select areas. In September 2016, South Africa's NDoH claimed it had implemented SVS at 3,126 clinics in eight provinces in South Africa – see Case study.

Key SVS achievements

During 2014/2015, the overall number of stock-outs declined significantly:

- in KwaZulu-Natal, by 46%, 49% and 14% for ARVs, TB medicines and vaccines respectively

- in Limpopo, the overall falls in the number of reported stock-outs during 2015 for ARVs, TB medicines and vaccines were 66%, 49% and 42% respectively.

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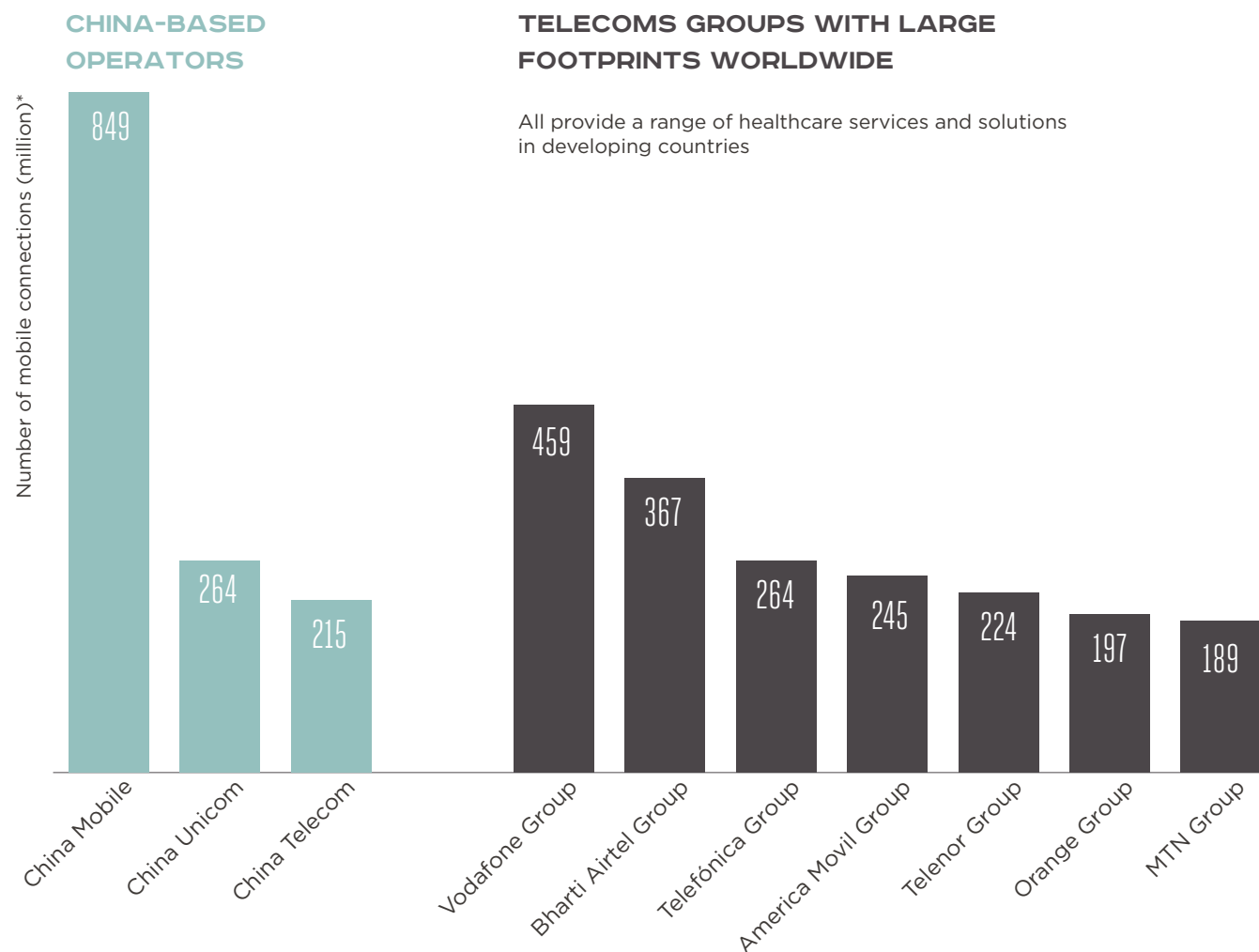
Opportunity for mobile operators

All the largest groups provide healthcare services

All the largest telecoms groups with multi-country footprints operate in the digital health industry. They provide – directly or via partnerships – B2G, B2B and B2C services and solutions.

The most common organisational model is a healthcare-dedicated line of business that sits within a wider Business Services unit. This unit leverages established expertise and skills in both health and ICT. For example, Orange Healthcare is a subsidiary of Orange Business Services; Vodacom Healthcare is part of Vodacom Business Africa. This model allows a holistic approach to ecosystem digitalisation across multiple industries, strengthens operators' credentials for PPPs and helps navigate the IoT learning curve. Vodafone also operates in the health space through Vodafone Foundation, a UK-registered charity that allocates Vodafone's funds to charitable projects.

Source: GSMA Intelligence

Top 10 groups by number of mobile connections

CHINA-BASED OPERATORS

TELECOMS GROUPS WITH LARGE FOOTPRINTS WORLDWIDE

All provide a range of healthcare services and solutions in developing countries

Number of mobile connections (million)*

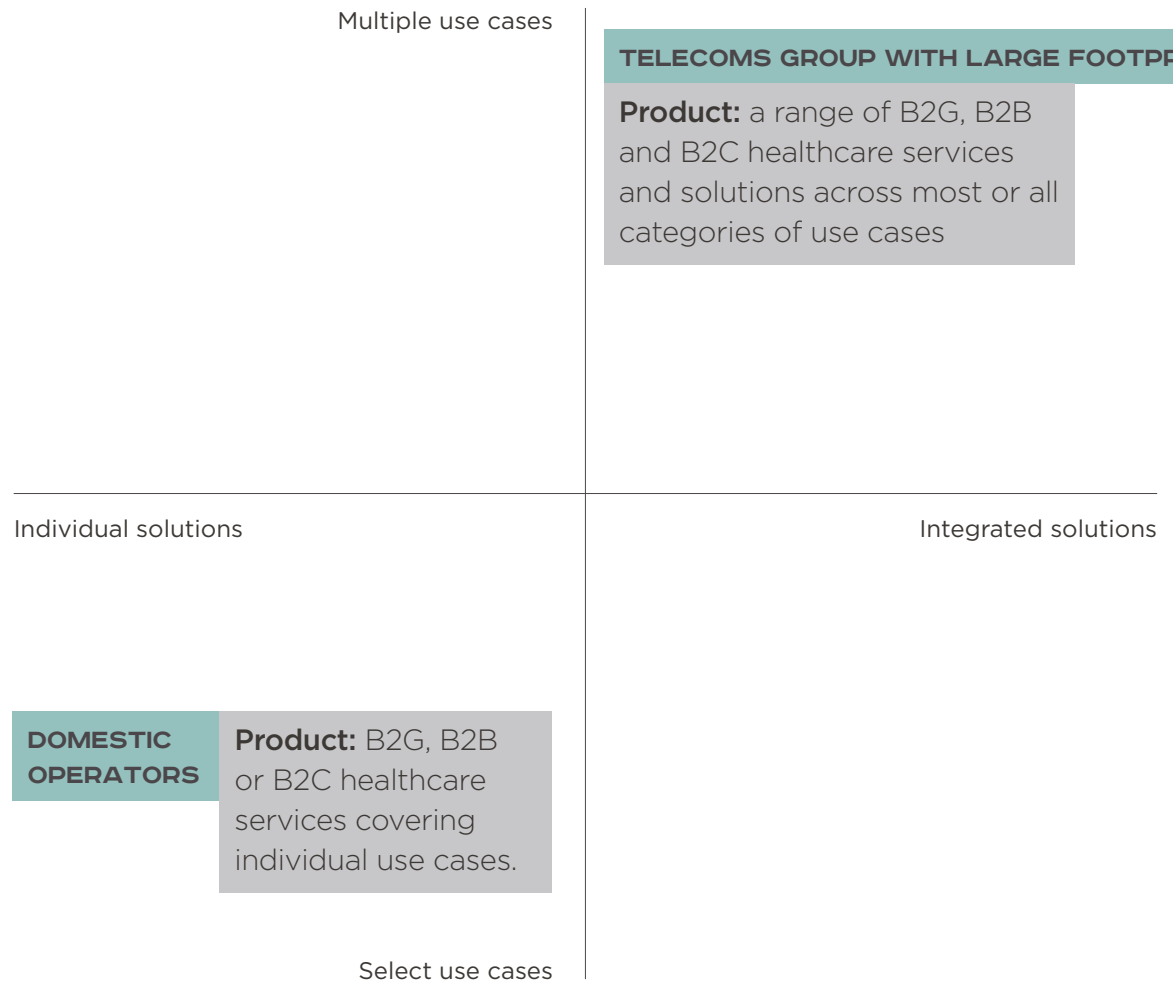| Group	Value
China Mobile	849
China Unicom	264
China Telecom	215
Vodafone Group	459
Bharti Airtel Group	367
Telefónica Group	264
America Movil Group	245
Telenor Group	224
Orange Group	197
MTN Group	189

* As of Q4 2016, exluding M2M

Smaller domestic mobile operators are heavily involved too

Digital health is not just confined to large operators. Although telecoms groups with wide footprints can leverage their broader business services and IoT assets/capabilities across multiple verticals and use cases, a number of smaller domestic mobile operators are also engaged and provide B2B, B2G and B2C healthcare services directly or via partnerships.

Notable examples include Dialog Axiata's Digital Health (integrated digital platform for bookings and payments), Telkom Indonesia (pregnancy monitoring in partnership with Philips and the government) and Millicom in Tanzania (birth registration).

Common operator approaches to digital health

Multiple use cases

TELECOMS GROUP WITH LARGE FOOTPRINTS

Product: a range of B2G, B2B and B2C healthcare services and solutions across most or all categories of use cases

Individual solutions   Integrated solutions

DOMESTIC OPERATORS

Product: B2G, B2B or B2C healthcare services covering individual use cases.

Select use cases

Moving beyond connectivity – a holistic ICT partner

Recent operators' digital health activity in developing countries shows two major trends:

- increasing engagement with governments to support the digitisation of healthcare

- a shift from individual to multiple (often integrated) solutions.

The range of ICT services operators provide – directly or through partnerships – includes solutions for telehealth, imaging, supply chain, health work management, data management and hosting, cloud and IoT. Customer relationships and wide network coverage are also key assets; they can support the provision of identity-related services for patient registration, vital event tracking, health records and health-related payments. Operators can also leverage their relationships with local authorities in countries where tech players lack presence. This is key for partnering.

Operators' assets and capabilities leveraged in digital health

CONNECTIVITY AND REACH (VOICE AND DATA)	ICT CAPABILITIES	CUSTOMER RELATIONSHIP	RELATIONSHIP WITH LOCAL AUTHORITIES	IDENTITY, PAYMENTS AND SECURITY
• 3.7 billion people used mobile services in developing countries in 2016; 4.4 billion by 2020 (69% of the population) • Increasing cellular coverage in rural areas where most health issues occur	• Help the digitisation of health centres, professionals and systems • Provision of enterprise services (e.g. telehealth, imaging, supply-chain management, health data management, data hosting and storage, cloud, IoT solutions, devices)	• Established brand • Wide distribution and extensive agent network • Established billing and CRM systems • Go-to-market expertise	• Established relationship with governments, regulators and fiscal authorities • Corporate social responsibility	• Digital identity (the SIM as a secure hardware asset in which to store identity credentials) • Mandatory SIM registration and know-your-customer • Mobile money

New revenue streams, cross-sector partnerships and customer loyalty

Analysis of trends, largely validated by organisations interviewed, suggests that the B2G/B2B opportunity is larger than B2C. Most operators' initiatives are B2G/B2B solutions.

B2C initiatives show weaker momentum than B2G/B2B, though two large companies – Telenor and Telefónica – provide a range of services. Subscription-based healthcare services are unlikely to generate significant revenue for mobile operators as most people have low disposable incomes to pay for healthcare and purchase wearables. However, affordable digital health services for consumers can lead to new mobile subscriber acquisition and churn reduction.

B2G/B2B
The digitisation of healthcare can generate new revenue streams beyond connectivity. Operators are looking to play the role of ICT partner. Telefónica, Orange and Vodacom are notable examples of operators offering a wide range of business solutions across most categories of digital health use cases. **Digital health is a further platform for cross-sector partnerships.** Digital health usually sits within a wider Business Services unit. This allows a holistic approach to societal digitisation and helps navigate the IoT learning curve.

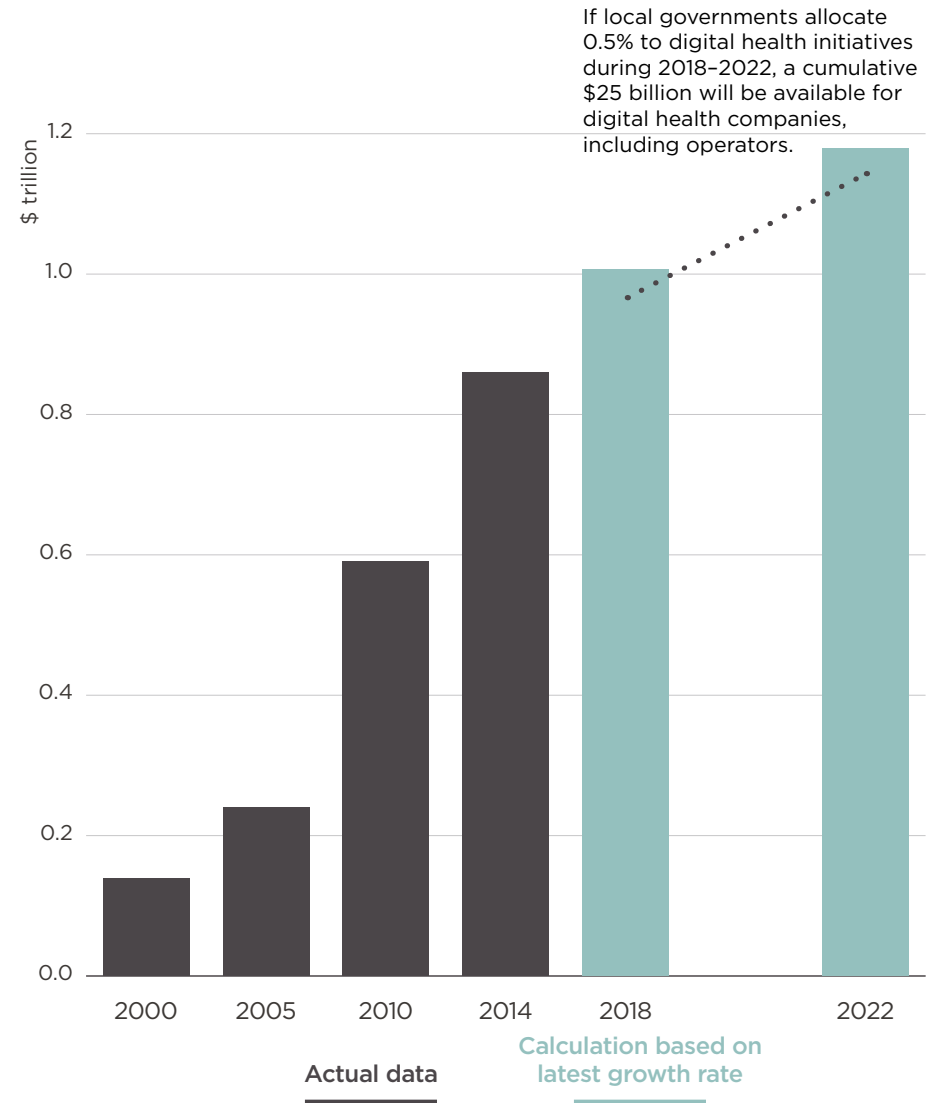| B2C |
| --- |
| **Customer acquisition** – Mobile-based services for information on health, wellness, consultation or insurance could be a factor in choosing a mobile provider (in addition to network coverage, distribution, service quality and pricing).

Customer loyalty – Telenor Pakistan claims churn improvements following the launch of Telenor My Health (a B2C health information service) in Pakistan. My Health is principally a loyalty tool; prices have been set low to generate significant uptake. It reached over 500,000 subscribers in August 2016, following launch in February 2015. |

High-level quantitative analysis of the potential opportunity

The chart shows high-level figures for the B2G digital health opportunity in developing countries.* Recent digital health plans financed by governments across a number of developed and developing countries point to a scale of investment that is on average 0.5% of the total public annual spend on health. Governments currently spend approximately $1 trillion on health in low- and middle-income countries. If local governments allocate 0.5% of that to digital health initiatives over the next five years, a cumulative $25 billion will be available for digital health companies, including operators.

Operators are looking to play the role of ICT and digital service partners for governments, health providers and health tech companies to exploit this opportunity. Operators are engaged across all key digital health use cases in low- and middle-income countries and often provide integrated solutions. Interviewed organisations largely concurred that governments are the largest clients for digital health initiatives.

*Assumptions do not represent GSMA's forecasts.

Source: World Bank

Government spend on health, developing countries

If local governments allocate 0.5% to digital health initiatives during 2018–2022, a cumulative $25 billion will be available for digital health companies, including operators.

Actual data

Calculation based on latest growth rate

Operators provide a range of solutions across different use cases

Select digital health use cases

B2G OR B2B	**Healthcare systems**	Digitisation of supply-chain management	Digitisation of patient information (vital event tracking)	Integrated digital platform for booking and payment	Personal data hosting and storage	Data analytics (e.g. disease outbreak risk)
	Examples	**Vodacom in South Africa:** drug stock management and cold chain tracking	**Millicom in Tanzania:** birth registration	**Dialog Axiata in Sri Lanka:** doctor booking and payment	**Orange in France*:** accredited by MoH to host personal healthcare data	**MNOs in S.Korea** and **Orange in Senegal** (solution for tracking epidemiological data)
	Healthcare centres	Digitisation of health centres	Remote patient monitoring	Remote diagnostics	Mobile health records	Imaging
	Examples	**Orange in Africa** and **Telefónica in LatAm**	**Telefónica in Brazil:** monitoring chronic conditions	**Millicom in Paraguay:** Telemedicina	**Vodacom in South Africa:** end-to-end solution Nompilo	**Telefónica in Uruguay:** medical imaging management
	Healthcare professionals	Digitisation of professionals and their interaction	Workforce management	Education and training	Telemedicine	Data collection and reporting
	Examples	**Philips and Telkom Indonesia:** pregnancy monitoring	**Vodacom in South Africa:** managing schedules, evaluating performance of health workers	**Telefónica in Brazil:** Axismed	**Vodacom in Africa:** mobile-based hearing screening	**Orange in Mali and Senegal:** paediatric telediagnosis
B2C***	**Healthcare patients**	A2P health and wellness information	P2P anonymous consultation	P2P medical advice	Digital payment for health purposes	Insurance
	Examples	**Telenor in Pakistan** (My Health) and **Bangladesh** (Tonic)	**Orange in Cameroon:** HIV/AIDS and sexually transmitted infections	**Telefónica in Brazil and Colombia:** Saluspot	**Airtel in Africa:** payment for medical consultation through mobile money	**Millicom in Guatemala, El Salvador and Costa Rica:** micro-insurance

Note: some solutions apply to more than one use case

* Not a developing country but a significant example worldwide. **Imported infectious disease prevention service. ***B2C includes B2G2C and B2B2C solutions.

1 **2** **3** **4** **5** **6** **7**

Scaling digital health: industry recommendations

Industry recommendations to help scale digital health

1 **Digital health stakeholders need to demonstrate the value of digital solutions to drive greater government investment**

Government is likely to be the largest funder of digital health initiatives in developing countries. Venture-capital activity is limited and the private sector healthcare provision is at a low scale. Greater and more stable government investment in digital health – as opposed to cyclical/individual initiatives – is key to help drive scale. Digital health stakeholders need to stimulate government investment by demonstrating how digital health solutions help address national healthcare issues. A key difference compared to developed countries is that digital health can not only improve quality and reduce costs but also increase access.

RECOMMENDATIONS

International organisations and donors	**Develop and update monitoring and evaluation (M&E) programmes.** Comprehensive M&E programmes will increasingly be needed to demonstrate digital health outcomes on access, quality and cost of healthcare. Global organisations (such as the WHO and the UN) and donors must continue to work together to develop common guidelines, indicators and tools for M&E on digital health. Social impact investors and donors can also play a vital role in financing and de-risking implementation.
Health providers and digital health providers	**Provide greater visibility of the positive health outcomes** – on access, quality and cost – associated with the use of digital health. Greater visibility of successful deployments at scale with digital health service providers could lead to an increase in investments, as well as a spill-over effect into other markets.
Ministries of health	**Encourage and support the implementation of national digital health plans aligned with ICT and broadband plans.** Setting outcome-based objectives is key to driving execution and tracking progress. Policy and regulation that promote investment and facilitate faster time-to-market of digital health solutions are a further enabler to adoption and scale.

Industry recommendations to help scale digital health

2 **Ecosystem collaboration is needed to address current fragmentation and create a holistic digital health model**

Wider collaboration between digital health stakeholders is needed as individual companies do not own the full set of resources and capabilities required. In Africa, developing Asia and Latin America, public-private partnerships will serve to share resources, capabilities, opportunities and risks among individual stakeholders. This collaboration is required to move from a currently fragmented approach to a holistic digital health model, with the potential for greater social and economic value for all stakeholders in the ecosystem.

RECOMMENDATIONS

All stakeholders

Create digital health working groups for cross-industry education and collaboration. Governments, international organisations, donors, social impact investors, healthcare providers, technology companies and operators have a limited history of collaboration. Working groups are a platform for exchanging experiences and best practices, and facilitating common standards and approaches.

Digital health providers, including operators

Move from "fragmented service" to "platform" business model. A transition from individual and fragmented digital health solutions (the current model for most companies in developing countries) to holistic digital health platforms can facilitate ecosystem collaboration, reduce risks for individual companies and accelerate time-to-market for new solutions. A platform model can also leverage synergies from different technologies available (IoT, mobile money, content channels, identity and others). In a holistic platform model, new core and complementary services can be more easily integrated and packaged for B2B clients. This requires more strategic enterprise mind-sets and capabilities within digital health companies.

Industry recommendations to help scale digital health

3 **Industry collaboration is needed to address current interoperability issues and drive healthcare data integration**

Limited interoperability and integration between different IT systems is a barrier to scalable and more effective digital health. This is mostly due to the use of proprietary elements, slow adoption and inconsistent use of existing standards and common interfaces, rather than a lack of standards. Data integration also improves healthcare worker and patient trust in the health system and increases the overall value of data collected, dramatically increasing the potential for AI and other advanced technologies in the longer term.

RECOMMENDATIONS

All stakeholders

Drive awareness of technology integration benefits through collaborative initiatives. Education is needed to demonstrate the benefits of interoperability such as faster access to integrated patient data, better and more coordinated quality of care, and cost efficiencies.

Digital health providers, including operators

Engage with industry organisations at an early stage. Some organisations such as the Personal Connected Health Alliance and Integrating the Healthcare Enterprise (IHE), work on the development of standards for healthcare. Early engagement during the digital health service design process and across all solutions can drive adoption of open standards and interoperability.

Mobile operator community

Play an active role in defining standards.
The mobile industry can help by advising on the application of standards and by working with healthcare industry partners to deliver services based on the principle of semantic interoperability (the ability of two or more systems to exchange information), which is key to enable digital health to scale. This level of interoperability is possible via potentially disparate EHR systems, business-related information systems, medical devices, mobile technologies and other systems.
See the GSMA report: <u>Digital Healthcare Interoperability</u>.

Pursue a holistic approach to digital health and position as ICT and digital service partners

To be relevant in the digital health space, operators need to adopt strategies that can strengthen their role as ICT and digital service providers within the digital health ecosystem.
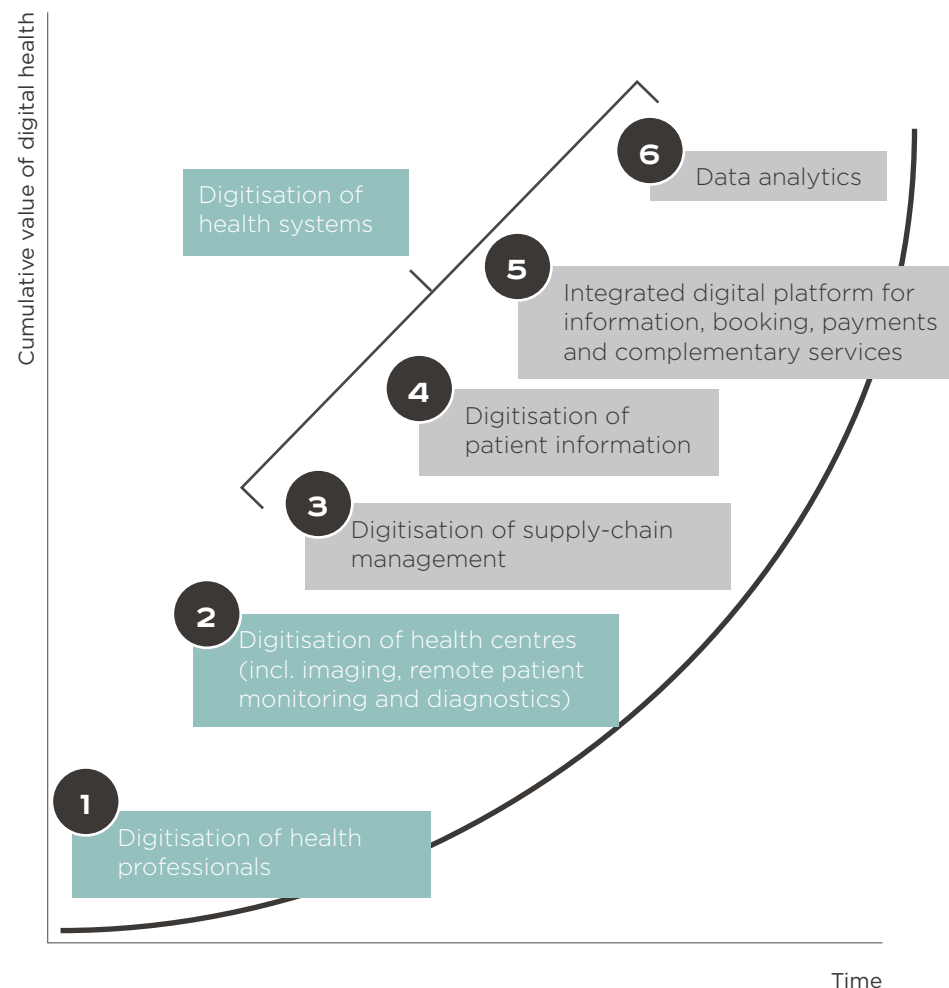
1 **Pursue a holistic role.** A holistic approach that looks at digital health as an integrated – as opposed to fragmented – portfolio of services provides greater opportunities, both locally and regionally. The chart shows a digital health roadmap using a building block model. Digitisation of health workers and centres are prerequisites to effective digitisation of health systems and, in the long term, the uptake of IoT, data analytics and AI.

2 **Position at the centre of the ecosystem.** Operators need to position themselves as ICT and digital service partners for governments, health providers and health tech companies. Operators can leverage a range of assets and capabilities such as connectivity, identity and payments platforms as well as customer and local authority relationships (see Moving beyond connectivity).

3 **Establish strategic partnerships.** Digital health is a nascent area for operators. It requires a mixed set of ICT and health skills and resources, and a partnership-based model. Acquisitions of health tech companies can also be considered to expand operator presence but this is a more expensive and challenging option versus partnering.

Digital health roadmap for operators

Cumulative value of digital health

Digitisation of health systems

6 Data analytics

5 Integrated digital platform for information, booking, payments and complementary services

4 Digitisation of patient information

3 Digitisation of supply-chain management

2 Digitisation of health centres (incl. imaging, remote patient monitoring and diagnostics)

1 Digitisation of health professionals

Time

Healthcare is labour-intensive: digitisation of health professionals and associated tech education are key early steps

Digitisation of health professionals	Digitisation of health centres	Digitisation of health systems

1 In developing countries – where 51% of the population live in rural areas – healthcare will increasingly be delivered by mobile points of care linked to doctors in health centres. Digital solutions (e.g. for patient data collection and reporting, and telemedicine) for nurses, midwifes and community care workers – mostly accessible via smartphone – improve the quality of records and support remote monitoring and diagnostics.

Example: The Philips/Telkom Indonesia partnership with the government is a notable example of digitisation of health professionals aimed at addressing high maternal mortality rates.

KEY ISSUE	KEY PAIN POINTS	DIGITAL HEALTH BENEFITS	CHALLENGES	RECOMMENDATIONS FOR OPERATORS
Most healthcare professionals do not use technology extensively. They still rely on legacy systems for records and communication.	Slow coordination between mobile points of care and doctors. Late detection of risks and ineffective timing for care.	Enhanced quality of professionals as they are more equipped and can analyse greater data sets to take decisions. Earlier detection of risks and action.	Many professionals have low ICT literacy. A phase of technology education is needed. Lack of interoperability – many professionals need to carry multiple devices to perform their activities and share data.	Engage with health tech companies and governments to take the role of ICT and distribution partner for solutions delivered via mobile devices. Stimulate adoption of smartphones and tablets by health professionals, through subsidy, financing and data-centric offerings.

Most hospitals and clinics need to upgrade ICT systems and embrace digital health centre model

| Digitisation of health professionals | **Digitisation of health centres** | Digitisation of health systems |

2 The digitisation of health centres involves multiple activities and technology upgrades, from higher speed broadband connectivity to a holistic set of ICT assets and capabilities. The digitisation of hospitals and clinics allows the use of solutions for remote patient monitoring, remote diagnostics, health data management, data security, and imaging. These solutions use a range of technologies: from fixed and mobile connectivity to medical and communication devices, cloud computing and ICT enterprise systems.

Example: Telefonica's AxisMed in Brazil provides solutions for chronic condition monitoring and treatment.

KEY ISSUE	KEY PAIN POINTS	DIGITAL HEALTH BENEFITS	CHALLENGES	RECOMMENDATIONS FOR OPERATORS
Most health centres still rely on legacy ICT systems or paper for core health activities. This limits overall efficiency, telehealth and the use of patient data.	Almost all maternal deaths occur in low-resource settings. Lack of monitoring tools, telehealth and response systems are contributing factors.	Greater reach of healthcare delivery as some doctor services can be delivered via technology-based solutions (telehealth for remote monitoring and diagnostics).	Digitisation of health centres requires significant financial resources, technology integration, interoperability and wide ecosystem collaboration. Scalable implementation plans and greater visibility of the value of digitisation is needed.	Act beyond connectivity, for example by leveraging operator cloud services and data centres, and exploit opportunities for ICT roles within partnerships. Take a partnering role at an early stage. Telefónica – for example – is a partner in some infrastructure initiatives (e.g. a digitised hospital in Peru).

Digitisation of supply-chain management is crucial to overcome current issues of timely availability of resources

Digitisation of health professionals	Digitisation of health centres	Digitisation of health systems

3 **Digitisation of supply-chain management**

Paper-based processes and a lack of modern ICT systems cause supply-chain issues, especially in drug stock management. Governments and pharmaceutical companies are looking at digital solutions to better ensure the availability of medicines where and when needed, particularly in the most rural areas.

Example: Vodacom provides a Stock Visibility Solution as well as cold chain monitoring in South Africa. Orange provides a stock e-monitoring solution in Kenya.

KEY ISSUE	KEY PAIN POINTS	DIGITAL HEALTH BENEFITS	CHALLENGES	RECOMMENDATIONS FOR OPERATORS
Paper-based processes cause drug stock management issues. Most facilities are not ICT equipped.	No medicines available where or when needed. Low stock visibility. Inefficient stock allocation.	Timely stock distribution to facilities. Real-time or near-real-time visibility of stock levels. Regular monitoring (daily basis).	Healthcare is decentralised in some developing countries. Moving from district to nationwide implementation is challenging; it requires multiple relationships.	Exploit end-to-end and integrated – instead of fragmented – digital solutions throughout the whole supply-chain. This includes the provision of devices, mobile data plans and cloud solutions as well as the tech education needed.

Digitisation of patient data is a multi-year journey that involves not only technology but also identity, privacy and security issues

Digitisation of health professionals	Digitisation of health centres	Digitisation of health systems

4

Digitisation of patient information

Digitisation of patient information can involve multiple use cases over time, from mobile registration at birth, followed by mobile registration of other information useful for healthcare purposes, to integrated and complete patient health records that can be shared in real-time across healthcare organisations and healthcare professionals.

Examples of current fragmented initiatives:
Millicom is partner of a "Scaling up of Birth Registration" initiative in Tanzania*.
Vodacom provides a mobile health record solution in Africa (Nompilo).

KEY ISSUE	KEY PAIN POINTS	DIGITAL HEALTH BENEFITS	CHALLENGES	RECOMMENDATIONS FOR OPERATORS
Paper-based processes for patient registration, and data storage.	Low vital event tracking (e.g. low birth registration rates). Lack or unstructured patient data history and integration.	Digital storage of patient data allows faster and secure access to data. Better coordination of care (communication and data sharing between centres and professionals).	Lack of digital data expertise in the health industry. Data privacy. Data security. Lack of interoperability and technology integration.	Leverage mobile network coverage and customer relationship (SIMs) to support digitisation of identity-related services for health. Operators are already subject to identity-related requirements (mandatory SIM registration, know-your-customer).

* The partnership includes UNICEF, RITA (the lead government agency in Tanzania responsible for civil registration) as well as VSO (an international NGO working in Tanzania).

Open platforms – instead of fragmented products – help spur core and complementary health services across multiple use cases

Digitisation of health professionals	Digitisation of health centres	Digitisation of health systems

5 **Integrated digital platform for information, booking, payment and complementary services**

Health centres need to digitise access to information, booking and payments to better manage the supply/demand of healthcare services in developing countries. Open platforms also allow integration of complementary services (micro-insurance, discounts on services, health services delivered at home) at a later stage.

Examples: Dialog Axiata's Digital Health in Sri Lanka provides health centres with an integrated platform for booking, payments and services, while Airtel in Africa allows payment for medical consultations via mobile money.

KEY ISSUE	KEY PAIN POINTS	DIGITAL HEALTH BENEFITS	CHALLENGES	RECOMMENDATIONS FOR OPERATORS
Finding a doctor and booking an appointment is challenging in most rural areas as the closest hospital/point of care can be some distance away.	Information knowledge gap between supply and demand of healthcare services. Fraudulent and incorrect payments.	Health centres can better manage the supply/demand of healthcare services. Patients have a centralised and digital access to health information.	Open digital platforms require wide ecosystem collaboration to reach sufficient and diversified content and services. Implementation takes several years but integration of additional services can be faster.	Leverage current mobile assets: networks, authentication and verification capabilities, customer relationships, payment and billing platforms. Develop health-related services and content in partnership with health and technology companies.

In the longer term, greater, integrated data and enhanced human and machine capabilities can spur data use cases

Digitisation of health professionals	Digitisation of health centres	Digitisation of health systems

6 **Data analytics**

Health is a data-intensive industry. Current initiatives aim to address the spread of imported infectious diseases. In the long run, greater amounts of integrated data and enhanced capabilities by humans and machines (AI) can spur new use cases for clinical decision support, better care coordination and improved patient wellness. The use of data analytics to provide detailed health pictures at a national level can allow governments to adequately respond to and plan citizens' health needs.

Examples (of tackling disease outbreak risk) include an <u>operator initiative</u> in South Korea* and Orange in Senegal.

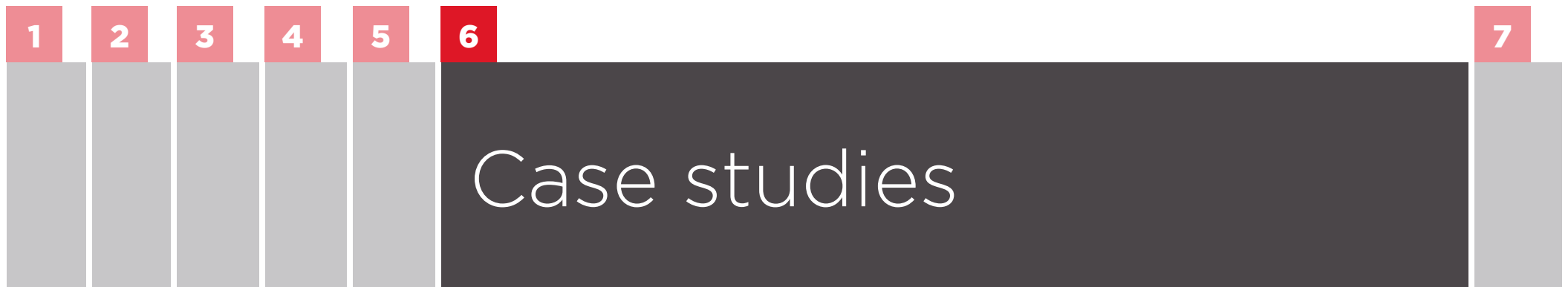| KEY ISSUE	KEY PAIN POINTS	DIGITAL HEALTH BENEFITS	CHALLENGES	RECOMMENDATIONS FOR OPERATORS
High risk of spread of imported infectious diseases. High burden of communicable diseases.	Poor control of imported infectious diseases. Limited coverage of risks as current initiatives cover small geographies.	The integration of mobile roaming data with government health-related data can strengthen monitoring systems and allow preventive measures to be taken against the spread of imported infectious diseases.	Data privacy and security (with some initiatives, personal information is only kept for a certain period of time and is not used for other purposes). Lack of expertise in how to extract value from big data.	Promote regional and global implementation of initiatives that involve the use of cellular network-based data. Collaborate in initiatives that aim to use big data for health-related purposes. Develop own data analytics capabilities within IoT.

* Solution aimed at people travelling to/from developing countries.

1 2 3 4 5 **6** 7

Case studies

Case studies: an overview

Operator profiles

Orange   Telefónica   Telenor   Vodacom

National digital health plans

Rwanda   Malaysia

Case studies

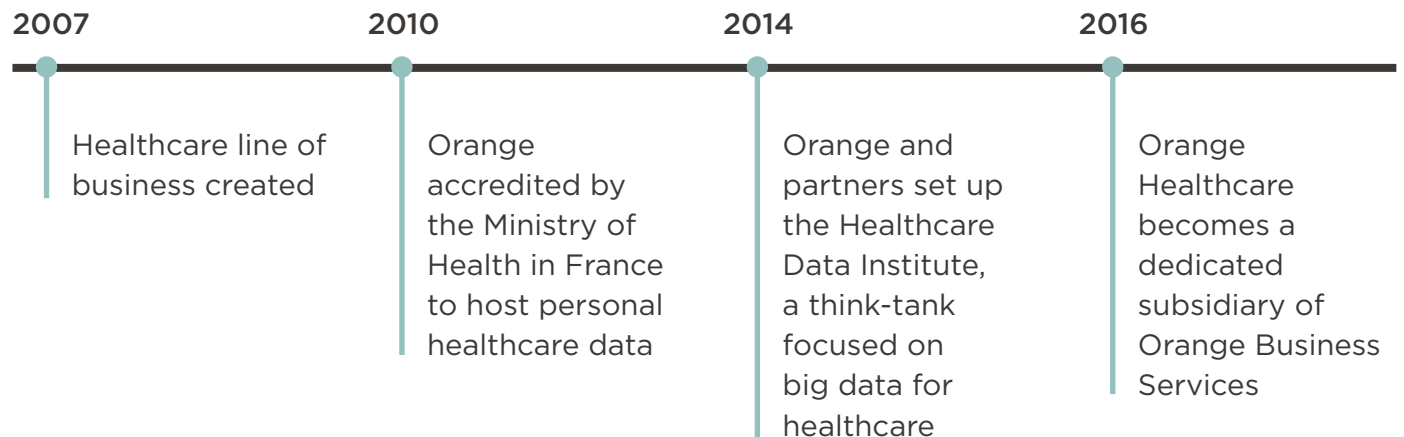| Country	Provider	Health problem	Solution
Indonesia	Philips and Telkom/AdMedika	High maternal mortality rate	Mobile Obstetrics Monitoring
South Africa	Vodacom	Inefficient drug stock management	Stock Visibility Solution
Brazil	Telefónica	High burden of chronic diseases	AxisMed
Sri Lanka	Dialog Axiata's Digital Health	Poor digitisation of booking/payment	Doc990
Bangladesh	Telenor's Grameenphone	Poor access to health information/insurance	Tonic
South Korea	Multiple operators	Transmission of infectious diseases	Infectious disease prevention service
India	BBC Media Action and Reliance Communications	High maternal mortality rate	Kilkari

Orange Healthcare

Orange Healthcare is a subsidiary of Orange Business Services, a global provider of ICT services and solutions across multiple industries. It operates in France and internationally across the Orange footprint, including African markets such as Botswana, Cameroon, Kenya and Mali. Orange Healthcare aims to use technology to support the digital transformation of healthcare, streamline the healthcare pathway and host & exploit health data.

In the developing world, Orange has a portfolio of B2G, B2B and B2C healthcare services across several African markets as a result of its own activities and partnerships. An example is My Healthline in Cameroon – a SMS-based advice/information hotline jointly launched with the Ministry of Health. It was initially designed in cooperation with local doctors to allow people to anonymously access information and advice on contraception, HIV/AIDS and sexually transmitted infections. The service was then extended to other medical topics.

Source: Orange

Orange Healthcare: key milestones

2007
Healthcare line of business created

2010
Orange accredited by the Ministry of Health in France to host personal healthcare data

2014
Orange and partners set up the Healthcare Data Institute, a think-tank focused on big data for healthcare

2016
Orange Healthcare becomes a dedicated subsidiary of Orange Business Services

Telefónica Health

Telefónica's health business sits within Telefónica Business Solutions, which manages globally the Enterprise, Multinational Corporations, Wholesale and Roaming businesses within the Telefónica Group. Telefónica Health operates through three business lines, mostly in the B2B and B2G markets.

- Digitisation of health services – Telefónica has an ICT partner role within PPPs and provides a range of solutions. The operator is also a financial partner for some health initiatives (e.g. building a hospital in Peru). Cloud services are part of this proposition and ensure hospitals are connected and utilise up-to-date technology.

- Population health management – solutions for chronic condition monitoring and treatment. Telefónica's AxisMed subsidiary in Brazil is the largest example in Latin America (see Case study).

- Patient information and empowerment – this includes wearables and trackers as well as interaction through web, SMS, voice and video content. Telefónica aims to leverage its large mobile customer base in Latin America.

Telefónica's digital health areas

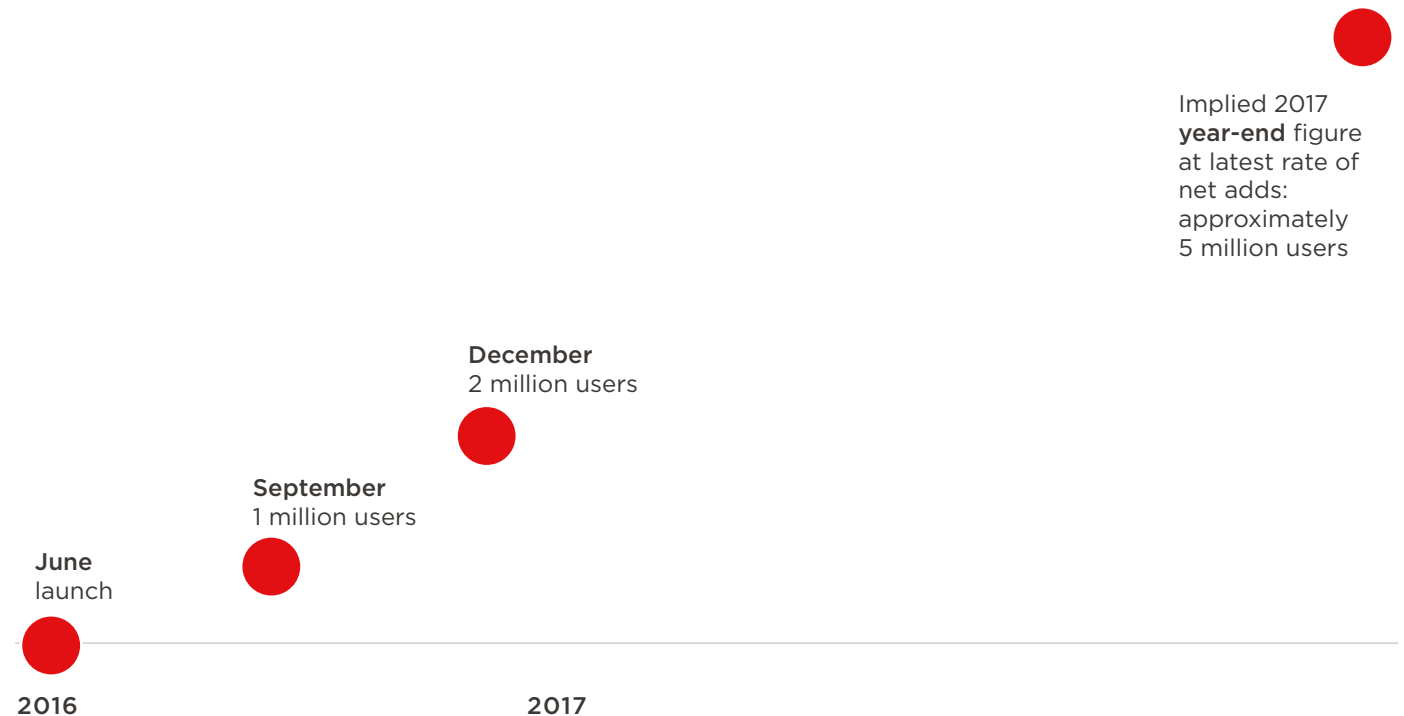|	Examples
Digitisation of health services	**Solutions** Cloud-based digital medical imaging. Digital hospitals: Telefónica acts as an ICT partner in health facility construction and renovation.
Population health management	**AxisMed (Brazil)** 1.5 million patient interactions per year. Significant reduction of costs associated with patients with chronic diseases.
Patient information and empowerment	**Saluspot** Largest provider of professional medical information and online consultations in the Hispanic world, with 1.5 million unique visits per month. Available in Colombia and Brazil.

Telenor Health

Established in 2015, Telenor Health aims to use technology to help make quality health and wellness information, advice and services accessible to people, particularly in emerging markets. It is part of Telenor Digital Businesses, a global unit that manages Telenor's investments in digital with the aim of creating strong verticals. Telenor Health launched its first mobile health service, Tonic, in Bangladesh in June 2016, through Telenor's local operator Grameenphone (see Case study). Tonic is seen by Telenor as the first step to scaling mobile health services to millions of consumers across Telenor's markets and beyond.

Telenor also operates other health initiatives in developing countries: Telenor Myanmar, in partnership with Marie Stopes Myanmar, launched the Mate app, which offers perinatal advice for expectant mothers. Meanwhile, My Health – a B2C health and wellness information service provided in Pakistan – reached half a million users in August 2016, following launch in February 2015.

Source: Telenor

Telenor's Grameenphone in Bangladesh – Tonic uptake

Implied 2017 **year-end** figure at latest rate of net adds: approximately 5 million users

December
2 million users

September
1 million users

June
launch

2016

2017

Vodacom Healthcare

Vodacom Group is majority owned by Vodafone Group (65% holding) and provides mobile services across five African markets (South Africa, Tanzania, DRC, Mozambique and Lesotho) with a total of 65 million mobile customers at the end of 2016. Through a dedicated enterprise-focused ICT subsidiary – Vodacom Business Africa (VBA) – Vodacom also offers managed services to enterprises in around 30 countries in Africa.

Vodacom Healthcare is part of the Vodacom Business Africa subsidiary. It provides a range of digital healthcare solutions primarily for the B2G/B2B market, often through partnerships with health companies. In addition, Vodacom works with the Vodafone Foundation to deliver charitable projects.

Source: Vodacom

Examples of Vodacom Healthcare solutions in Africa

AitaHealth

Smartphone-based application that allows health workers to deliver preventative care to households

Stock Visibility

A solution that allows clinics, dispensaries and pharmacies to manage medicine stock levels

Workforce Management

A solution that manages schedules and evaluates the performance of healthcare workers in remote, rural areas

Pharmaceutical cold chain tracking

A solution that enables clients to monitor the cold chain of delivered goods. It allows risk management during and at handover, and follows the protocols set by the Medicines Control Council

mVaccination

A mobile solution that allows health workers to increase the coverage of immunisation programmes

HearScreen

Smartphone-based screening solution that allows clinical hearing tests to be conducted via mobile

Vodafone Foundation

The Vodafone Foundation is a UK independent registered charity that allocates Vodafone's funds to charitable projects around the world. The Vodafone Foundation is funded by annual contributions from Vodafone Group Plc and local operating companies. Since 1991, the Vodafone Foundation has contributed over £560 million to charitable activities worldwide. These projects are usually managed in partnership with other charitable organisations and NGOs. The Vodafone Foundation works through a network of 27 local foundations and social investment programmes.

Through its Connecting for Good programme, the Vodafone Foundation supports projects focused on delivering public benefit through the use of mobile technology across health, education and disaster relief. Although independent, the Foundation draws on technology and expertise within Vodafone to maximise its impact. The Vodafone Foundation receives an average of 12,000 requests per year for funding and support. It has launched notable mobile health projects in Africa.

Source: Vodafone Foundation

Vodafone Foundation's key projects in partnership with USAID

TANZANIA mobilising maternal health

Using mobile technology to connect mothers to healthcare and reduce maternal/neonatal deaths and injury

40,283 women receiving information on healthy pregnancy through an app developed for health workers

502% increase in obstetric fistula surgeries in seven years due to M-Pesa 'Text to Treatment' system

6,961 women and newborns transported to hospital for free in emergencies through the Ambulance Taxi service

LESOTHO mobilising HIV identification and treatment

Using mobile technology to increase the number of HIV+ children and pregnant women accessing treatment

87,000 people tested for HIV, over half children/adolescents

$8 MILLION global campaign launched in 2014 for the mobilisation of paediatric HIV/AIDS care in Lesotho

580 HIV+ children, adolescents and pregnant women supported by Vodafone technology

Spotlight on Rwanda and Malaysia

Rwanda

Rwanda has more than 10 years' experience in national digital health plans; the first strategy was launched in 2006. Between 2010 and 2020, the government of Rwanda has committed to invest more than $50 million in e-health.

In 2009, the government committed $32 million to e-health for the period 2010–2015, including $7 million allocated to ICT infrastructure development and $4.5 million to internet-enabled e-health services. The latest e-health plan includes a further $21 million to be invested up to 2020.

Results achieved by 2015 include: 96% of health facilities connected to the internet; 27% of hospitals using telemedicine; and nearly 200,000 patients tracked using RapidSMS (a mobile solution that tracks the first 1,000 days of life, helping prevent deaths among mothers and newborns).

Malaysia

In Malaysia, the 2016–2020 national e-health plan includes a number of initiatives to strengthen the health service with robust ICT infrastructure/systems, the establishment of a Health Data Warehouse as well as an IT workforce development programme. It also includes a "one person, one record" initiative to develop lifetime health records through data integration, accessibility and interoperability.

The 2020 connectivity target is for state hospitals and health departments to be connected with speeds of 20 Mbps; labs with 10–30 Mbps; and health/dental clinics and offices with 6 Mbps. The plan includes the development of a cloud-based, online healthcare platform to remotely connect patients to health and medical information, and with doctors.

Philips and Telkom Indonesia – Mobile Obstetrics Monitoring

About Philips and Telkom Indonesia

HealthTech is Philips' largest business worldwide. In 2016, it generated €17 billion of revenue globally and accounted for 71% of the company's total revenues. Telkom Indonesia is the largest mobile operator in the country with 174 million mobile connections and 45% market share as of the end of 2016.

Problem

Despite a significant reduction from 212 maternal deaths per 100,000 live births in 2005 to 126 in 2015, the maternal mortality rate in Indonesia remains high and above the UN Sustainable Development Goal (SDG) global target of less than 70 by 2030. This is mainly attributed to lack of health information as well as poor access to and quality of healthcare in rural areas.

Solution (B2G)

In 2016, Philips signed an agreement with Sijunjung Regency in West Sumatra, Indonesia, for full-scale commercial implementation of its telehealth service, MOM, in the region. The launch followed a successful pilot. The smartphone-based health service is designed to help reduce the maternal mortality rate. Its main users are community health workers, midwives, doctors and health centres.

Business model

The government pays for the service at a district level as healthcare is decentralised in Indonesia. There is no charge for patients. MOM is developed by Philips, but no direct relationship exists between Philips and the government. Telkom Indonesia sources the software from Philips and sells it to the government, by adding a margin to the wholesale cost. As well as distribution, the mobile operator provides the backbone, ICT infrastructure and data capabilities via its subsidiary AdMedika.

Philips and Telkom Indonesia – Mobile Obstetrics Monitoring

Context

	2016 or latest available year
Population	262 million
Unique mobile subscribers*	206 million (79% of population)
Smartphone adoption	52% of connections (excl. M2M)
Health expenditure as % of GDP	2.8% (2014)
Public health expenditure as % of total	38% (2014)
Health as % of total government expenditure	5.7% (2014)
Maternal mortality rate (per 100,000 live births)	126 (2015)
Neonatal mortality rate (per 1,000 live births)	14 (2015)
Childhood (under-5) mortality rate (per 1,000 live births)	27 (2015)
Nurses and midwives (per 1,000 inhabitants)	1.4 (2012)
Physicians (per 1,000 inhabitants)	0.2 (2012)
Hospital beds (per 1,000 inhabitants)	0.9 (2012)

The problem

Maternal mortality was 126 per 100,000 live births in 2015, above the SDG target (less than 70 by 2030). The current infrastructure makes the target challenging as most deaths occur in rural areas where there is a shortage of professionals and facilities. Since Indonesia is the fourth most populous country globally, missing the target may affect the achievement of the global target.

Why a mobile solution?

Indonesia has mobile penetration of 79% of population and the fourth-largest smartphone user base in the world. Midwives and doctors also have personal technology skills that support the adoption of smartphone-based solutions.

*Unique mobile subscribers – number of individuals subscribing to a mobile service. Unique mobile subscribers differ to mobile connections in that a unique user can have multiple connections.

Philips and Telkom Indonesia – Mobile Obstetrics Monitoring

Source: Philips

Mobile Obstetrics Monitoring

Midwife's app

Midwife records pregnancy data and vital measurement on her mobile
- Data collection
- Sync to server (USB sync or SMS sync)

Home

The power of timely information

Doctor's app

Doctor reviews patient information anytime, anywhere
- Remote viewing of reports
- Remote viewing of patient information

On the go

Health Center

MOM web portal

Midwife registers pregnant woman. Resident doctor reviews data and ultrasound reports.
- Patient registration
- Record examinations, investigations, management and delivery details
- Generation of reports

MOM is an app-based software solution delivered via smartphone for community healthcare workers. MOM comprises two apps:

- the first app is for midwives. It allows them to collect pregnancy and vital measurement data (weight, blood pressure, temperature) and sync it to the server (MOM web portal) via USB or SMS

- the second app is for doctors and allows them to view patient data and information remotely, as well as review reports anytime and anywhere.

General Practitioners at regional primary care centres can also access the data via a MOM web portal to monitor women's conditions and identify high-risk pregnancies via a dashboard interface. MOM also features training and education services for healthcare workers as well as a protocol of antenatal care to guide care-givers. The tool includes a Clinical Decision System to guide in the risk assessment of the pregnancy.

Philips and Telkom Indonesia – Mobile Obstetrics Monitoring

Pilot

In a year-long pilot project in collaboration with the Bunda Medical Center in Padang, Indonesia, MOM increased the early detection of high-risk pregnancies three-fold. The pilot had more than 650 pregnancies within the programme. No women died from preventable causes related to pregnancy and childbirth through early monitoring and risk stratification. There was also a 99% reduction in anaemia from the first to the third trimester through early identification and enhanced patient management.

FULL-SCALE IMPLEMENTATION

1,500

About 1,500 mothers were benefiting from the solution as of January 2017.

Vodacom – Stock Visibility Solution (SVS)

About Vodacom

Vodacom is the largest mobile operator in the country with 36 million mobile connections and 44% market share as of the end of 2016. The Vodacom Foundation is the corporate social investment arm of Vodacom, and health is one of its three main focus areas.

Problem

Supply-chain management in the public sector often relies on medicine being procured centrally and distributed through a number of steps to the dispensing facilities that distribute medicine to patients. Paper-based processes and lack of ICT investment cause problems with the availability of medicines. Clinics and points of care around the country often struggle to meet the demand for critical and life-saving medication.

Solution (B2G)

The Stock Visibility Solution (SVS) is a mobile solution developed by Mezzanine – a Vodacom-affiliated company – in partnership with Vodacom. It provides real-time or near-real-time visibility of stock levels at primary healthcare dispensaries. This enables the government to increase access to medicine where it is needed, when it is needed, often in remote parts of the country.

Business model

Vodacom provides SVS as a managed service. The operator provides the hardware, software, connectivity, data, training, support and hosting, bundled into a single per-user, per-month cost. Some solutions may require a set-up cost, but revenue is largely driven by monthly fees. The client is the ultimate owner of the devices, which are upgraded every 24 months. The system and the data belong to the client; Vodacom has no rights to any data.

Vodacom – Stock Visibility Solution (SVS)

Context

	2016 or latest available year
Population	55 million
Unique mobile subscribers*	38 million (68% of population)
Smartphone adoption	42% of connections (excl. M2M)
Health expenditure as % of GDP	8.8% (2014)
Public health expenditure as % of total	48% (2014)
Health as % of total government expenditure	14.2% (2014)
Maternal mortality rate (per 100,000 live births)	138 (2015)
Neonatal mortality rate (per 1,000 live births)	11 (2015)
Childhood (under-5) mortality rate (per 1,000 live births)	41 (2015)
Nurses and midwives (per 1,000 inhabitants)	5.1 (2013)
Physicians (per 1,000 inhabitants)	0.8 (2013)
Hospital beds (per 1,000 inhabitants)	2.8 (2005)

The problem

Drug stock management was a major supply-chain challenge in South Africa. The National Department of Health (NDoH) relied on manual processes to manage drug stock levels in South Africa's primary healthcare system, as not all clinics are equipped with ICT systems. The NDoH engaged Vodacom to provide a solution.
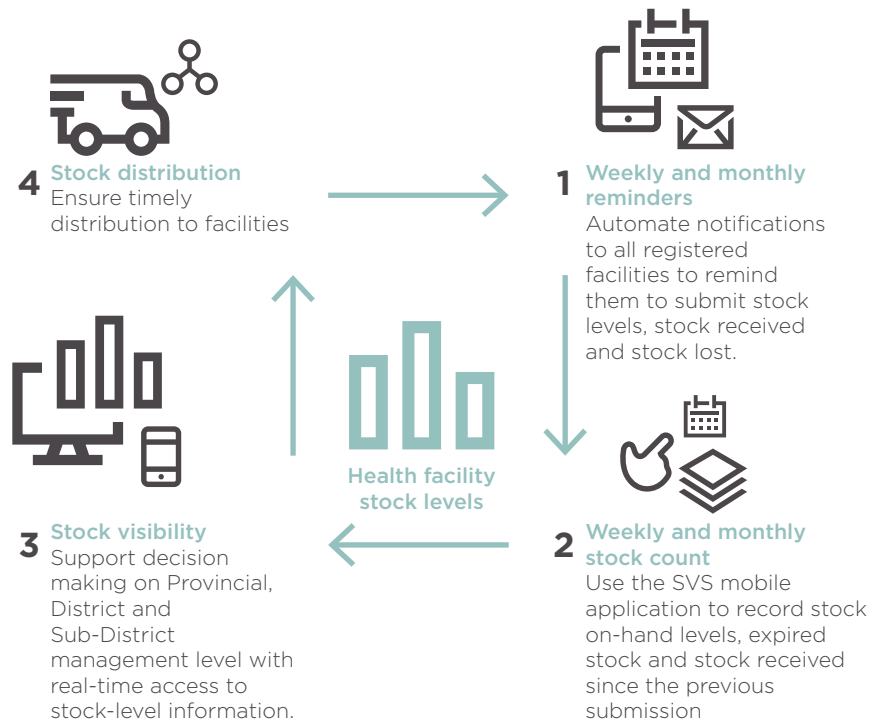
Why a mobile solution?

Increasing smartphone adoption in South Africa and SVS functional simplicity allow users to manage a number of mobile activities throughout the drug stock management chain.

*Unique mobile subscribers – number of individuals subscribing to a mobile service. Unique mobile subscribers differ to mobile connections in that a unique user can have multiple connections.

Vodacom – Stock Visibility Solution (SVS)

Stock Visibility Solution

4 Stock distribution
Ensure timely distribution to facilities

1 Weekly and monthly reminders
Automate notifications to all registered facilities to remind them to submit stock levels, stock received and stock lost.

Health facility stock levels

3 Stock visibility
Support decision making on Provincial, District and Sub-District management level with real-time access to stock-level information.

2 Weekly and monthly stock count
Use the SVS mobile application to record stock on-hand levels, expired stock and stock received since the previous submission

The Stock Visibility Solution (SVS) makes a smartphone and application bundle available to dispensing facilities to capture stock levels on a daily basis. The data and information synchronise in real time to a cloud-hosted server that automates alerts and reports for the benefit of various levels of supply-chain management.

Real-time access to stock level information from medicine dispensaries allows low stock levels to be pro-actively replenished and out-of-stock facilities to receive priority attention. The NDoH can monitor critical supply chains and compare centrally purchased volumes with medicine actually available on the shelves of dispensaries.

Vodacom – Stock Visibility Solution (SVS)

Pilot

SVS was first deployed as a pilot project in 2013 in the Limpopo, Gauteng, KwaZulu-Natal, Eastern Cape and Free State provinces. During this phase, the department monitored only three drug categories consisting of up to 60 items, with the intention of expanding the solution to monitor complete dispensaries if the outcome of the pilot project proved to be positive. The pilot project was successful.

Adoption

In September 2016, South Africa's National Department of Health had implemented SVS at 3,126 clinics in eight provinces in South Africa. Since implementing SVS nationally, the department is now able to monitor stock levels of all medicines in its inventory, which could include more than 800 medicine types.

ADOPTION

3,126 CLINICS

Expansion

Most countries in Africa rely on paper-based record keeping. SVS could be extended to any country (within and beyond Vodacom's footprint) where the lack of information and control of healthcare stocks creates supply-chain issues. As of 2017, SVS or SMS For Life 2.0 (which includes SVS plus Disease Indicators and a capability to deliver e-learning content to healthcare providers through the same managed service) is being or will be deployed in a number of other Sub-Saharan Africa countries.

Telefónica – AxisMed

About Telefónica and AxisMed

Telefónica is the fourth-largest telecoms group by number of mobile connections worldwide. Its subsidiary Vivo is the largest mobile operator in Brazil with 68.8 million mobile connections and 29.6% market share as of the end of 2016. AxisMed is a chronic care management provider based in Brazil. It was founded in 2005. Telefónica purchased a controlling stake in 2013.

Problem

There are rising levels of chronic conditions such as diabetes, COPD and heart disease. In Brazil, AxisMed estimates that such patients account for 40% of healthcare costs despite representing just 4% of the population.

Solution (B2B)

AxisMed is a remote monitoring solution that tracks and transmits biometric data relevant to patients with chronic conditions, such as blood glucose levels and blood pressure, to medical professionals who oversee their treatment plans. The professionals are on-call 24×7 in the event of any complications.

Business model

AxisMed operates a B2B model. Its largest clients are insurance companies and healthcare cooperatives. It also serves large corporate health plans, including Siemens, Whirlpool and Ambev's local subsidiaries. AxisMed provides devices and connectivity as well as health professionals, including doctors, psychologists, nutritionists, pharmacists, social workers, nurses and physiotherapists.

Telefónica – AxisMed

Context

	2016 or latest available year
Population	210 million
Unique mobile subscribers*	147 million (70% of population)
Smartphone adoption	69% of connections (excl. M2M)
Health expenditure as % of GDP	8.3% (2014)
Public health expenditure as % of total	46% (2014)
Health as % of total government expenditure	6.8% (2014)
Maternal mortality rate (per 100,000 live births)	44 (2015)
Neonatal mortality rate (per 1,000 live births)	9 (2015)
Childhood (under-5) mortality rate (per 1,000 live births)	16 (2015)
Nurses and midwives (per 1,000 inhabitants)	7.6 (2013)
Physicians (per 1,000 inhabitants)	1.9 (2013)
Hospital beds (per 1,000 inhabitants)	2.3 (2012)

*Unique mobile subscribers – number of individuals subscribing to a mobile service. Unique mobile subscribers differ to mobile connections in that a unique user can have multiple connections.

The problem

As in many countries, rising incidence of chronic diseases is a key cost issue, which frequently requires medical oversight but infrequent consultations in many circumstances. Without oversight, such patients may make poor choices or not adhere to treatment plans. For this reason, patients in chronic management represent 40% of healthcare costs despite being only 4% of the population – though they have a far higher representation in private insurance plans, at 30%.

Why a mobile solution?

Remote chronic patient management allows professional monitoring, prevention and support. The mobile solution is secure, low cost, and can be quickly implemented. Mobile has also wide reach in Brazil (70% population penetration in 2016).

Telefónica – AxisMed

AxisMed is a multichannel platform that allows doctors, psychologists, nutritionists, pharmacists, social workers, nurses and physiotherapists – who are available 24×7 – to stay in touch with patients via mobile app, SMS, video, web and voice.

Biometric data is transmitted from connected devices given to each patient. The devices are capable of monitoring blood glucose, blood pressure and other metrics, depending on the patient's condition.

AxisMed was the first Brazilian company to be recognised by the US-based chronic condition carers association, Care Continuum Alliance.

COBERTURA
NACIONAL
100% do território

MEMBRO DA

CareContinuum
ALLIANCE

Telefónica – AxisMed

The service is available nationally and since launch has served 19 million patients. It has 1.5 million active interactions annually with its patients. The main private health insurers in Brazil, which are clients of AxisMed, have reduced their chronic patients associated costs by 30%.

INTERACTIONS

1.5m
ACTIVE
INTERACTIONS

Over 80% of patients monitored have adhered to their treatment plan, which AxisMed says has reduced hospital emergency ward visits by two-thirds and the length of hospital stays by 50%.

The pharmaceutical usage retention rate is 99% among patients monitored.

Dialog Axiata's Digital Health – Doc990

About Dialog Axiata and Asiri Hospital Holdings

Dialog Axiata is the largest mobile operator in the country with 12 million mobile connections and 46% market share (as of 2016). Asiri Hospital Holdings is a group of hospitals. Dialog Axiata and Asiri Hospital Holdings formed a JV in 2016 (70% and 30% stakes respectively) – Digital Health Private Limited.

Problem

More than 80% of the population live in rural areas in Sri Lanka. Finding a doctor and booking an appointment to access healthcare is challenging for many as the closest hospital or point of care can be some distance away. Lack of information about the range of available hospitals and healthcare services is also an issue.

Solution (B2B)

The solution provides integrated e-commerce infrastructure for the healthcare sector allowing digital medical appointment management for healthcare providers. Patients access the service by calling 990 from one of the mobile operator services, by visiting a website or downloading the app. The service also includes a digital solution for uploading prescriptions, free medicine delivery and a range of healthcare services delivered at home.

Business model

This is a digital platform for health centres. Digital Health aims to add all registered and accredited private medical and healthcare institutions to ensure greater coverage. Booking charges for consumers vary according to location.

Dialog Axiata's Digital Health – Doc990

Context

	2016 or latest available year
Population	21 million
Unique mobile subscribers*	14 million (69% of population)
Smartphone adoption	41% of connections (excl. M2M)
Health expenditure as % of GDP	3.5% (2014)
Public health expenditure as % of total	56% (2014)
Health as % of total government expenditure	11.2% (2014)
Maternal mortality rate (per 100,000 live births)	30 (2015)
Neonatal mortality rate (per 1,000 live births)	5.4 (2015)
Childhood (under-5) mortality rate (per 1,000 live births)	9.8 (2015)
Nurses and midwives (per 1,000 inhabitants)	1.6 (2010)
Physicians (per 1,000 inhabitants)	0.7 (2010)
Hospital beds (per 1,000 inhabitants)	3.6 (2012)

The problem

Access to medical information (e.g. list of hospitals and clinics, list of services provided) and fast bookings/ payments are significant issues in Sri Lanka due to paper-based processes. Many services are also only available at hospitals and clinics.

Why a mobile solution?

Some 14 million people use mobile services in Sri Lanka (Q4 2016). This equates to 69% of the population and will reach 77% by 2020. More than 40% of total mobile connections are smartphone connections (representing an addressable market for the Doc990 smartphone app).

*Unique mobile subscribers – number of individuals subscribing to a mobile service. Unique mobile subscribers differ to mobile connections in that a unique user can have multiple connections.

Dialog Axiata's Digital Health – Doc990

1 Hospital coverage

30 hospitals are available with Doc990
(as of March 2017).

2 Specialisation

Nearly 200 options available.

Telenor/Grameenphone – Tonic

About Grameenphone

Grameenphone is the largest mobile operator in Bangladesh, with 60 million mobile subscribers. Telenor owns a controlling stake of 55.8%. It was Telenor's first Asian venture, launching in 1997.

Problem

Very few in the country have the means to pay for health insurance or self-finance their healthcare. Spend on healthcare, both public and private, is low, even compared to similar developing countries. Likewise, Bangladesh has very poor access metrics; the number of doctors, nurses and midwives is below the WHO recommendation. Poor access to health information and low patient empowerment create cost inefficiencies and a high burden of diseases.

Solution (B2C)

Tonic is a health and wellness services platform that provides a range of digital health services. It includes preventative advice content, appointment booking, phone-based access to primary care, discounts on health tests and specialist care as well as insurance in the event of hospitalisation. Tonic is part of a wider portfolio of non-core revenues streams – Grameenphone has an established position in microfinance, making insurance and healthcare an extension for its business.

Business model

Tonic is a subscription-based digital wellness and health service for consumers. As of May 2017, Telenor provides its mobile customers with three packages: 1) Tonic Premium (BDT298 or $3.6 per month); 2) Tonic Advanced (BDT128 or $1.6 per month); 3) Tonic Basic (pay per call for primary care consultations. Otherwise free). Telenor expects Tonic to increase mobile ARPU and improve loyalty.

Telenor/Grameenphone – Tonic

Context

	2016 or latest available year
Population	164 million
Unique mobile subscribers*	87 million (53% of population)
Smartphone adoption	28% of connections (excl. M2M)
Health expenditure as % of GDP	2.8% (2014)
Public health expenditure as % of total	28% (2014)
Health as % of total government expenditure	5.7% (2014)
Maternal mortality rate (per 100,000 live births)	176 (2015)
Neonatal mortality rate (per 1,000 live births)	23 (2015)
Childhood (under-5) mortality rate (per 1,000 live births)	38 (2015)
Nurses and midwives (per 1,000 inhabitants)	0.2 (2011)
Physicians (per 1,000 inhabitants)	0.4 (2011)
Hospital beds (per 1,000 inhabitants)	0.6 (2011)

*Unique mobile subscribers – number of individuals subscribing to a mobile service. Unique mobile subscribers differ to mobile connections in that a unique user can have multiple connections.

The problem

Total spend on healthcare in Bangladesh is only $88 per capita (PPP adjusted), below the South Asia average of $234. Total health expenditure is 2.8% of GDP in Bangladesh while low- and middle-income countries spend on average 6% of their GDP on healthcare. Likewise, access metrics are well below the levels of similar countries. The mortality rate (176 per 100,000 live births) also needs to fall sharply if Bangladesh is to meet the SDG 3 target.

Why a mobile solution?

In contrast to healthcare, banking, finance and insurance, mobile access has greater coverage and penetration of population. More than half of the population use mobile services. Mobile can drive greater access to health care services and greater delivery of healthcare information.

Telenor/Grameenphone – Tonic

Consultations and advice

- Personalised health content (SMS, app, web)

- Mobile-based consultations with doctors (calls and in-app chat)

Healthcare services

- Nationwide appointment booking service

- Country-wide network of partners providing discounts on services (health checks, labs, medications, procedures)

Financial coverage

- Tonic Cash (for hospital admissions)

Telenor/Grameenphone – Tonic

Users

- June 2016: launch

- September 2016: 1 million

- December 2016: 2 million

Engagement

- **Health tips and articles**
  Reaching 2–3 million people per month through mobile channels

- **Tonic Doctor**
  More than 80,000 phone-based primary care consultations

- **Tonic Discounts**
  25,000 discounts used to save money on medical services

- **Tonic Cash**
  Over 350 claims settled and paid

Mobile operators – imported infectious disease prevention service

About the operators

KT, LG Uplus and SK Telecom are the three mobile operators in South Korea (with market shares of 31%, 20% and 49% respectively). The pilot programme started in November 2016 with KT. LG Uplus joined in December 2016. SK Telecom was scheduled to join the programme in April 2017.

Problem

A stronger monitoring system is needed to prevent the spread of infectious diseases. Zika cases have raised concerns of a widespread epidemic in South Korea just a year after an outbreak of Middle East Respiratory Syndrome (MERS).

Solution (B2G)

The service allows preventive measures to be taken against imported infectious diseases by integrating customers' roaming data with government data. Using information on subscribers who have visited infectious disease outbreak areas, the Korea Centers for Disease Control and Prevention (KCDC) sends texts to check on them for a 21-day monitoring period. If people who have visited outbreak areas see a doctor with symptoms, the KCDC enables doctors to check the system for information on visits. User information such as name, gender, date of birth and disease is only kept for a certain period of time and is not used for any other purpose.

Business model

A public-private partnership between the government (KCDC) and the mobile operators.

BBC Media Action and Reliance Communications – Kilkari

About BBC Media Action and Reliance Communications

BBC Media Action is the BBC's international development charity. In India, BBC Media Action has initiated various projects that help to increase knowledge and improve the health of mothers and children, using a combination of TV, radio, online, street theatre, outdoor advertising and mobile.

Reliance Communications is an Indian integrated telecoms operator. It provides mobile (nearly 90 million connections as of December 2016) and fixed services.

Problem

India's maternal mortality rates are high compared to developed countries, despite increased investment and health authorities' efforts in recent years. The national average maternal mortality rate per 100,000 births was 174 in 2015. This is partly attributable to negative reproductive, maternal, neonatal and childcare behaviours among families and communities.

Solution (B2B)

In January 2016, the government of India launched a nationwide mobile health programme designed by BBC Media Action to help nearly 10 million new and expecting mothers make healthier choices and lead longer, healthier lives. Kilkari (the word for a baby's gurgle in Hindi) delivers free, weekly audio messages about pregnancy, child birth, and child care directly to families' mobile phones from the second trimester of pregnancy until the child is aged one.

Business model

The government of India, through the Ministry of Health and Family Welfare (MoHFW), covers all Kilkari call costs, making the service free to all pregnant women and mothers registered in its Maternal and Child Tracking System (MCTS) database. Reliance was selected to provide PRI (primary rate interface) lines to the national Kilkari service.

See GSMA mHealth report: Kilkari: A maternal and child health service in India. Lessons learned and best practices for deployment at scale, October 2016

BBC Media Action and Reliance Communications – Kilkari

Context

	2016 or latest available year
Population	1.3 billion
Unique mobile subscribers*	686 million (51% of population)
Smartphone adoption	28% of connections (excl. M2M)
Health expenditure as % of GDP	4.7% (2014)
Public health expenditure as % of total	30% (2014)
Health as % of total government expenditure	5.0% (2014)
Maternal mortality rate (per 100,000 live births)	174 (2015)
Neonatal mortality rate (per 1,000 live births)	28 (2015)
Childhood (under-5) mortality rate (per 1,000 live births)	48 (2015)
Nurses and midwives (per 1,000 inhabitants)	1.7 (2011)
Physicians (per 1,000 inhabitants)	0.7 (2012)
Hospital beds (per 1,000 inhabitants)	0.7 (2011)

The problem

The maternal mortality rate in India is among the highest in Asia, with 174 maternal deaths per 100,000 live births, well above the SGD 3 global target of less than 70 by 2030. This problem is mainly attributed to lack of information and access to quality healthcare as well as negative behaviours among women during pregnancy, such as poor nutrition.

Why a mobile solution?

India has nearly 700 million mobile subscribers – the second largest user base after China. The adoption of mobile is growing rapidly – 65% of the population will be mobile phone users by 2020.

*Unique mobile subscribers – number of individuals subscribing to a mobile service. Unique mobile subscribers differ to mobile connections in that a unique user can have multiple connections.

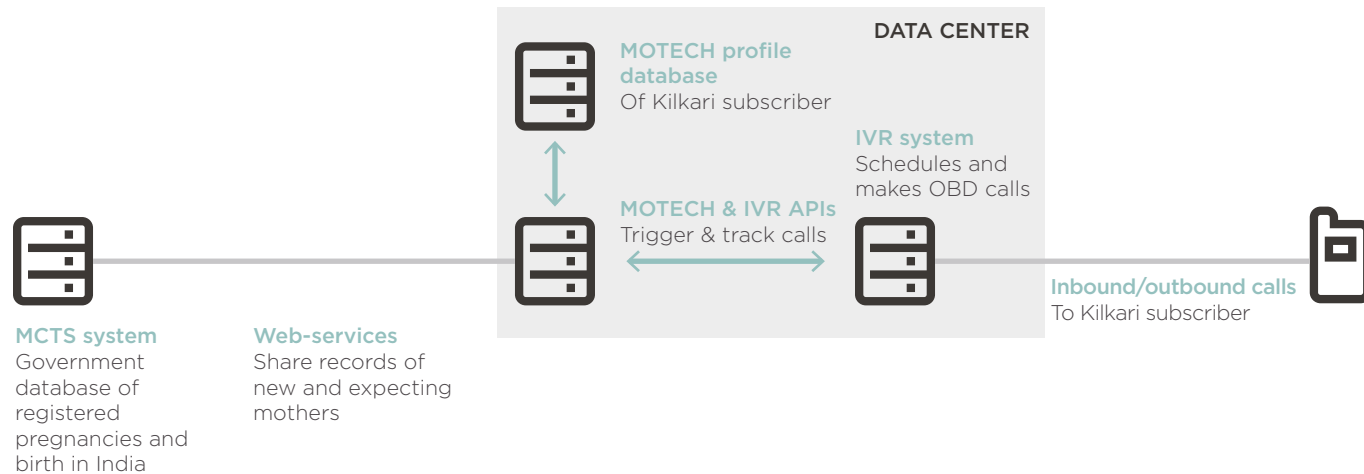# BBC Media Action and Reliance Communications – Kilkari

Kilkari is hosted on a centralised, national platform deployed in a data centre contracted by the MoHFW and powered by the Mobile Technology for Community Health (MOTECH) platform. MOTECH was originally developed in 2009 through 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.

Steps to service delivery

The government of India's Maternal and Child Tracking System (MCTS) is a national database that registers the majority of pregnancies and births in India. Pregnant women who have registered their pregnancy or the birth of their child in MCTS are automatically subscribed to Kilkari.

DATA CENTER

MOTECH profile database
Of Kilkari subscriber

IVR system
Schedules and makes OBD calls

MOTECH & IVR APIs
Trigger & track calls

MCTS system
Government database of registered pregnancies and birth in India

Web-services
Share records of new and expecting mothers

Inbound/outbound calls
To Kilkari subscriber

Subscribers receive a weekly call on their mobile phone, delivering recorded audio messages tailored to the woman's stage of pregnancy or the child's age. Through IVR technology, the service delivers audio content in the form of recorded outbound calls to any mobile phone in India.

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.

BBC Media Action and Reliance Communications – Kilkari

Stakeholders

BBC Media Action

- Leads a consortium of partners and donors in the delivery of the Kilkari service.

- Develops content in partnership with national and international health experts and organisations.

- Supports the training of community health workers.

Government

- Provides access to the MCTS national pregnancy and birth database, which is updated by operatives located at primary health centres across India.

- Covers the cost of providing the service to the end user.

- Validates content through the National Health Systems Resource Centre (NHSRC).

Reliance Communications

- Provides connectivity and long codes through an enterprise contract.

- Pre-existing interconnect agreements between operators mean anyone can call a long code from any network.

Donors and partners

- Grameen Foundation originally designed and built MOTECH, an open source software that powers Kilkari.

- USAID and the Gates Foundation are providing management and technical support for three years, during which time BBC Media Action will transition technical support to the government of India.

BBC Media Action and Reliance Communications – Kilkari

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.

Within four weeks of launch, BBC Media Action was able to reach more than 750,000 women.

In the second phase in 2017, the service is likely to be rolled out in the remaining Empowered Action Group states. In 2018, Kilkari will begin operation across the entire country.

1 **2** **3** **4** **5** **6** **7**

Appendix

Definitions

Country income groups according to the World Bank

Low income	$1,025 or less
Lower middle income	$1,026 – $4,035
Upper middle income	$4,036 – $12,475
High income	$12,476 or more

Definition of terms used in report

Developing countries are low- and middle-income countries as defined by the World Bank. These countries account for nearly 85% of the global population.

Digital health is the intersection of technology and healthcare. Beyond a formal definition, the digital health ecosystem is moving towards a holistic approach that embraces technology enablers (networks, devices, platforms, software, equipment) and health solutions (products, services, content, applications). Mobile is a key component of digital health.

Mobile health solutions are digital health solutions that involve the use of mobile devices, networks and mobile-based solutions and services for healthcare.

Organisations interviewed

We conducted primary research to gather strategic views and insights from a number of companies across the digital health ecosystem.

Operators and technology companies

Non-profit tech organisations and public institutions

About the authors

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Pablo Iacopino is a Senior Manager at GSMA Intelligence, responsible for leading research projects and industry radar content. Before joining the GSMA in 2016, he led the Europe research practice at Pyramid Research and the global forecast programme at Analysys Mason. His telecoms experience also includes equity research and strategy & investor relations at TIM. Pablo holds a Master's degree in business administration and a postgraduate Master's degree in statistics and economics from Università degli Studi di Roma 'La Sapienza'.

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Mike Meloan joined GSMA Intelligence in October 2014 as a Lead Analyst with a focus on financial and M&A analysis. Mike authors regional Mobile Economy reports, Global Mobile Radar analysis and other sector research. Prior to the GSMA, Mike started his career as an investment banker at Goldman Sachs while also covering the European telecoms sector for a decade in the research division of Goldman Sachs, and later for an independent research firm.

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with almost 300 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, Mobile World Congress Americas and the Mobile 360 Series of conferences.

For more information, please visit the GSMA corporate website at gsma.com

Follow the GSMA on Twitter: @GSMA

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GSMA Intelligence is the definitive source of global mobile operator data, analysis and forecasts, and publisher of authoritative industry reports and research. Our data covers every operator group, network and MVNO in every country worldwide – from Afghanistan to Zimbabwe. It is the most accurate and complete set of industry metrics available, comprising tens of millions of individual data points, updated daily.

GSMA Intelligence is relied on by leading operators, vendors, regulators, financial institutions and third-party industry players, to support strategic decision-making and long-term investment planning. The data is used as an industry reference point and is frequently cited by the media and by the industry itself.

Our team of analysts and experts produce regular thought-leading research reports across a range of industry topics.

For more information, visit gsmaintelligence.com

Mobile for Development

Mobile for Development brings together our mobile operator members, the wider mobile industry and the development community to drive commercial mobile services for underserved people in emerging markets. We identify opportunities for social and economic impact and stimulate the development of scalable, life-enhancing mobile services.

For more information about GSMA mHealth Programme
visit gsma.com/mobilefordevelopment/programmes/mhealth

mHealth

By forging stronger connections between the mobile and healthcare industries, the GSMA mHealth Programme is supporting commercially sustainable health services that transform the lives of people in need and promote the wellbeing of mothers and families in developing countries. Mobile can increase the quality, reduce the cost and extend the reach of healthcare to benefit millions. mHealth services have the potential to generate significant impact by reaching women and children who lack access to essential healthcare and nutritional information.

For more information about GSMA mHealth Programme
visit gsma.com/mobilefordevelopment/programmes/mhealth

mHealth point of contact

Natalia Pshenichnaya is the Head of GSMA mNutrition, comprising the mHealth and mAgri programmes. She oversees the portfolio of projects across Africa and Asia as well as investment decisions and implementation support to members and partners.

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