

Touching lives through mobile health

Assessment of the global
market opportunity



February 2012



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Executive Summary

Healthcare is a challenge in developed and developing countries...

In spite of the advancements in medical technologies and a general increase in income levels, healthcare continues to pose challenges of affordability, complexity and access across the world.

In developed markets, per capita healthcare expenditures have risen faster than both income levels and inflation rates over the past decade due to rising incidence of lifestyle driven chronic diseases and ageing populations. Yet, there have been no corresponding improvements in the quality of healthcare delivery in many countries. In contrast, developing countries primarily face the challenge of providing healthcare access to their citizens.

Mobile is poised to play a significant role in healthcare...

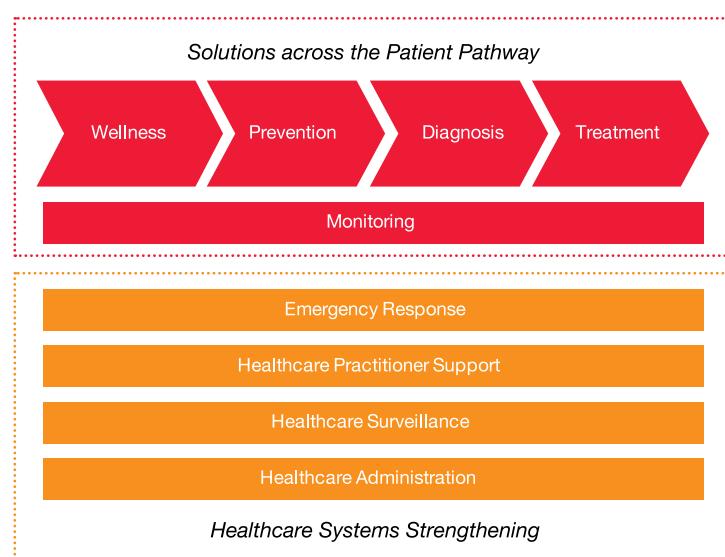
In contrast to healthcare access, mobile access is becoming almost ubiquitous worldwide. Almost all developed markets already have mobile penetration greater than 100%. Mobile penetrations in Africa, Asia-Pacific and Latin America are also expected to increase to 82%, 98% and 119% respectively in 2014. Also, the increasing penetration of smartphones as well as the 3G and 4G networks will provide a significant boost to the use of the mobile platform for providing healthcare services.

Thus, the feasibility of mobile devices supporting healthcare is greater than ever before. Mobile health - the use of mobile communication and devices for providing healthcare services or achieving health outcomes - stands at a significant inflection point.

The global Mobile Health market has started taking shape...

Mobile health services can be categorised into two broad areas: Solutions across the Patient Pathway and Healthcare Systems Strengthening. Solutions across the Patient Pathway - Wellness, Prevention, Diagnosis, Treatment and Monitoring, entail direct touch-points with patients. Healthcare Systems Strengthening solutions - Emergency Response, Healthcare Practitioner Support, Healthcare Surveillance and Healthcare Administration, do not involve direct interactions with patients, but are primarily aimed at improving the efficiency of healthcare providers in delivering patient care.

Mobile Health Services Categorization Framework



Source: GSMA and PwC analysis

In addition to delivering social benefits, Mobile Health is expected to garner revenue of US\$ 23 billion in 2017...

The worldwide mobile health revenue¹ is expected to reach about **US\$ 23 billion** across all stakeholders – mobile operators, device vendors, healthcare providers and content/application players - by 2017.

By 2017, the largest markets for mobile health services will be Europe and Asia-Pacific (APAC) with 30% market share each, followed by the developed markets of North America (USA and Canada) with 28% share. Latin America and Africa will comprise 7% and 5% share respectively.

Among the various categories, Monitoring services will account for the largest share globally (approximately 65%), corresponding to about US\$ 15 billion in 2017. The Monitoring services market will be driven primarily by solutions that aid chronic disease management and independent ageing, with revenues accruing from developed countries and affluent pockets of large developing countries such as China. Independent ageing solutions are expected to comprise nearly 30% of the Monitoring services market with revenues of over US\$ 4.3 billion in 2017. Besides, chronic disease management and post acute care services are expected to garner about 70% share, corresponding to almost US\$ 10.7 billion, in 2017, with bulk of the revenues coming from the former².

¹Mobile health refers to the use of mobile communication and devices for providing healthcare services or achieving health outcomes. The mobile health market, calculated here, includes charges paid for mobile calls, data connectivity, VAS (value-added services such as SMS/USSD/IVR), license/usage fees for applications, and special devices with mobile connectivity (e.g. for monitoring). It does not include the expenditure on smartphones or ordinary mobile phones. It also excludes services that are not closely associated with healthcare delivery and can be used in other industries as well.

²Source: PwC analysis

Diagnosis services are expected to comprise nearly 15% of the mobile health market, corresponding to almost US\$ 3.4 billion, in 2017, with most of the revenues coming from developing countries. The adoption of Diagnosis services is expected to support developing countries in bridging their healthcare access challenges. The worldwide Diagnosis services market will be split almost evenly between call-centre/IVR based services and mobile telemedicine services with revenues of approximately US\$ 1.7 billion and US\$ 1.6 billion respectively in 2017.

Healthcare Systems Strengthening services and applications are expected to contribute about 6% to the overall mobile health market (corresponding to nearly US\$ 1.4 billion) in 2017. Even though Healthcare Practitioner Support will be the dominant category in both developed and developing countries, Healthcare Surveillance Support services and applications will also have high applicability and social benefit through empowering remote health workers in developing countries.

Mobile operators are expected to be the key beneficiaries of the expected growth in the mobile health market and command nearly 50% share of the overall market, corresponding to about US\$ 11.5 billion, in 2017. The majority of revenue, nearly US\$ 8.8 billion, will accrue from their revenue share arising from Monitoring services. Diagnosis and Treatment solutions will also be attractive opportunities for operators and will contribute approximately US\$ 1 billion and US\$ 0.9 billion to operator revenues respectively.

Further, the pie is large enough to incentivise other ecosystem players to innovate and participate in the mobile health market, thereby driving it forward. Device vendors, content/application players and healthcare providers can expect to garner US\$ 6.6 billion, US\$ 2.6 billion and US\$ 2.4 billion respectively in 2017.

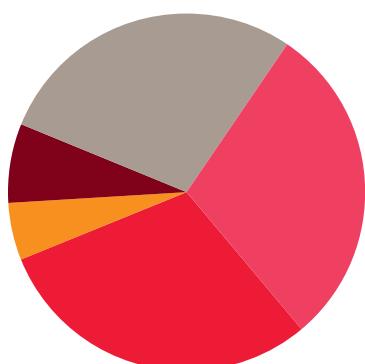
Worldwide mobile health revenue and Global mobile health market opportunity by regions (US\$ billion) and percentage of overall market, 2017

World-wide Mobile Health Revenue, 2013E-2017E



Global Mobile Health Market Opportunity by Regions, US\$ Billion and % Share of Overall Market, 2017E

Total Market Size: US\$ ~23 Billion



Source: PwC analysis

Ecosystem players need to focus on key scaling factors to enable the mobile health opportunity...

Mobile health can be an integral component of healthcare in the future. However, a concerted effort from governments, mobile operators and device vendors will be required to enable mobile health to scale up to its potential.

Government Thrust

Governments are not only important stake-holders in the overall ecosystem but also in the position to **influence the uptake of mobile health solutions by healthcare providers, especially physicians, through policy formulation**. When governments across the world embrace constructive policy agenda for mobile health, the market will start scaling up rapidly to its potential. Governments need to mandate the use of mobile health services by public healthcare providers and also incentivise private players to adopt these services. Government policy will also most likely be the key positive influencer for the mass physician uptake of mobile health. Governments have the authority to drive policies to compel uptake. They also have the reach and funding needed to provide awareness and training of physicians on a mass scale.

Regulatory Support

Regulators across the world must be careful to address issues that can inhibit the growth of mobile health. Regulations should **effectively address issues such as certification of devices as well as applications and standardisation and inter operability**. This will help increase the confidence and trust of both physicians and patients on account of well-defined and consistent ways in which they interact with various components of mobile health solutions.

Physician Acceptance

The acceptance of mobile health solutions by physicians will be a key enabler for scaling up the market as physicians will also facilitate user adoption through their recommendations. However, physicians' typically slow adoption of new technologies, along with the 'fee-for-service' mindset, could act as a dampener for the rapid adoption of mobile health. Government policy can be an important first step towards mass physician acceptance. It is also important for other mobile health ecosystem players to highlight the benefits of mobile health services and applications so that healthcare providers understand its potential in **reducing risk and improving efficiency**. Ecosystem players need to also proactively engage with physicians and jointly run pilots to prove the efficacy of mobile health solutions, especially for the large opportunities in Solutions across the Patient Pathway.

User Adoption

Widespread user adoption will be the final factor that will drive the ultimate, long-term growth of mobile health. **Affordability, availability and acceptability of content and devices** will play a key role in achieving adoption on a mass scale. Ecosystem players such as device vendors also need to **focus on usability issues** and make devices and services consumer-friendly. **Partnerships with or endorsements by major healthcare providers** will also help mitigate the anxiety or reluctance of individuals in adopting mobile health.

Healthcare is a worldwide challenge

In spite of the advancements in medical technologies and a general increase in income levels, healthcare continues to pose challenges of affordability, complexity, and access across the world.

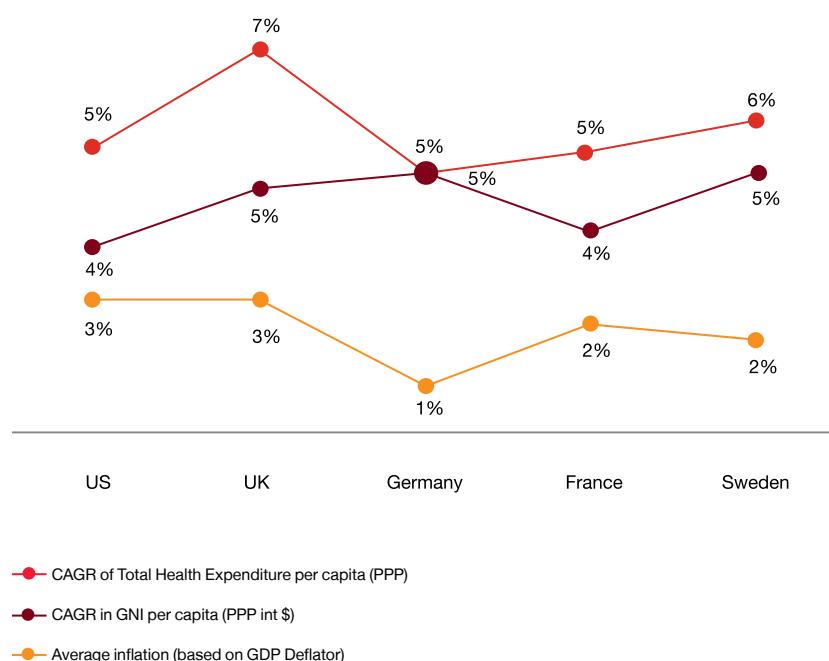
Healthcare challenges in developed markets

Developed markets primarily face rising healthcare expenditures due to the increasing incidence of chronic diseases and ageing populations. However, rising expenditures have not translated to significant improvements in healthcare service delivery.

Rising Healthcare Expenditure

Total healthcare expenditure per capita in developed markets has followed a relentless upward trajectory. For instance, the OECD³ average of total healthcare expenditure per capita has increased almost 75% from US\$ ~2,280 in 2000 to US\$ ~3,970 in 2009⁴. Further, per capita healthcare expenditure has risen faster than both income levels (as measured by GNI⁵ per capita) as well as inflation over the past decade. This has exerted significant pressure on the finances of both individuals as well as institutions, such as governments and insurance companies, which pay for the services on behalf of individuals.

Comparison of Increases in Total Health Expenditure per Capita, GNI per Capita, and Overall Price Levels in Selected Developed Countries, 2000-2008



Source: WHO. The World Bank. OECD. PwC analysis

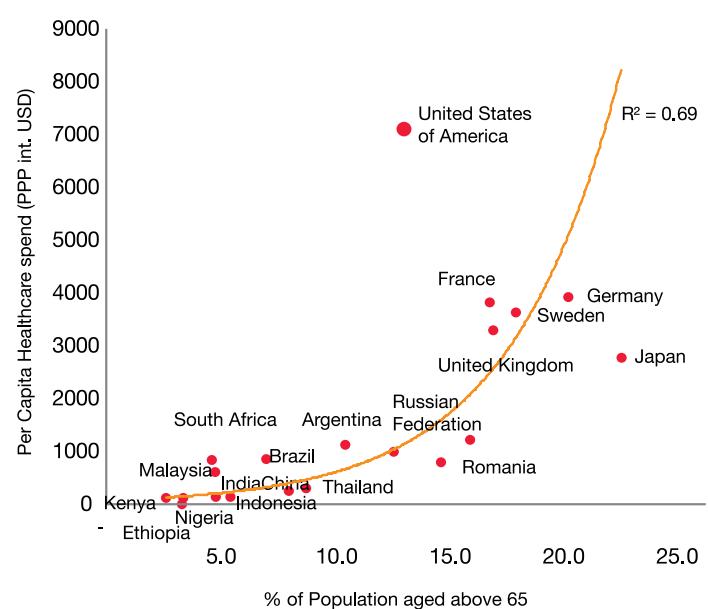
Pressure on healthcare service delivery

While individuals in developed countries are paying more for healthcare, there have not been significant improvements in service levels in many countries. For instance, more than half of the patients need to wait for four weeks or more for an appointment with a specialist in countries such as Canada, Sweden, Norway, France and Australia⁶. Further, the waiting times for elective surgeries in several developed countries have continued to stay high. For instance, in Australia, the median waiting time (in days) for cataract surgery, hip replacement and knee replacement increased from 80, 95, and 114 in 2000 to 84, 100, and 147 respectively in 2009 despite significant increase in total outlays⁷. The healthcare spend per capita in Australia increased more than two-fold from US\$ ~1,730 in 2000 to US\$ ~3,870 in 2009.

Care of Ageing Populations

Developed regions also face the challenge of providing cost-effective care for their elderly citizens, which comprise a sizeable portion of the overall population. Japan, Western Europe and North America are expected to have elderly-dependency ratios⁸ of ~53%, ~43% and ~33% respectively in 2030. In comparison, the corresponding ratios are expected to be only ~6%, ~17% and ~18% in Africa, Asia and Latin America respectively in 2030⁹. Ageing populations are associated with the greater burden of non-communicable diseases such as diabetes, cancer, and cardiovascular problems. Ageing populations also have a strong impact on the overall healthcare burden faced by a country.

Per capita health expenditure (PPP Int. US\$) and % of population aged above 65 in selected countries, 2009/2010



Source: WHO. The World Bank. OECD. PwC analysis

³Organisation for Economic Co-operation and Development, ⁴Source: Health Nutrition and Population Statistics, The World Bank, September 2011, ⁵Gross National Income, ⁶Source: Health at a Glance 2011, OECD Indicators, OECD 2011
⁷Source: Australian Institute of Health and Welfare (AIHW). The World Bank, ⁸Elderly-dependency Ratio = Population aged 65 years and over / Number of people aged 15 to 64 years ⁹Source: UN Data

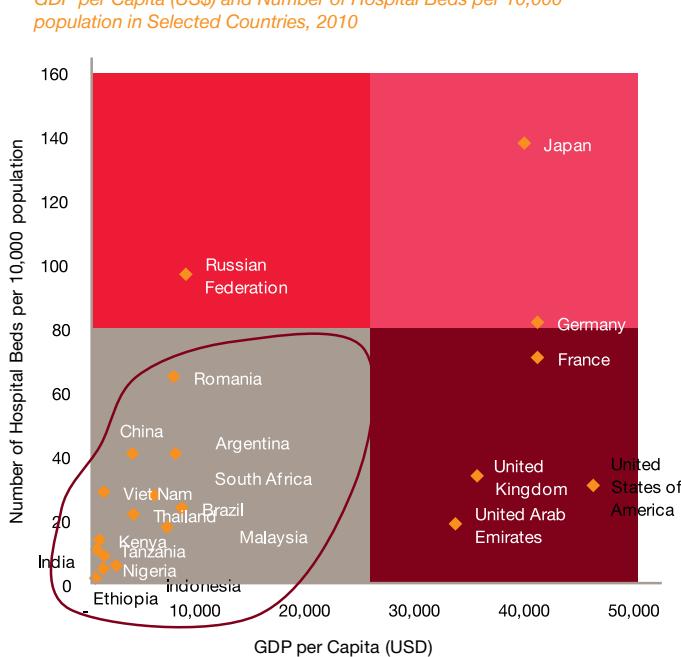
Healthcare challenges in developing markets

In contrast to developed markets, key healthcare challenges in developing markets are significantly different at the moment. While developed markets are primarily challenged with escalating healthcare costs, developing countries face challenges on account of poor healthcare delivery infrastructure. They also face the double whammy of managing the rising incidence of chronic diseases and the traditionally prevalent communicable diseases.

Poor Healthcare Delivery Infrastructure and Lack of Trained Personnel

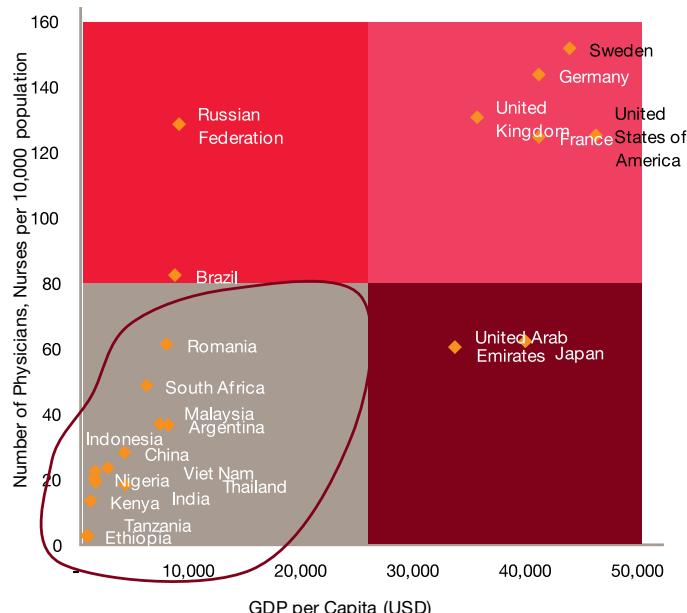
There is significant disparity between developed and developing markets in terms of healthcare access to citizens. For instance, developing countries typically have significantly lower penetration of hospital beds, physicians, nurses, and mid-wives per 10,000 people as compared with developed markets. For instance, the number of physicians per 10,000 people in Africa and South-east Asia were 2.3 and 5.4 respectively in 2010. In contrast, the corresponding value was 33.3 in Europe and 22.5 in Americas¹⁰. The situation is similar when the availability of hospital beds is compared. For instance, in 2009, there were ~62 hospital beds per 10,000 people in Europe, whereas there were only ~9 hospital beds per 10,000 people in Africa¹¹.

GDP per capita (US\$) and number of hospital beds, physicians, nurses per 10,000 population in selected countries, 2010



Source: WHO, World Bank, PwC analysis

GDP per Capita (US\$) and Number of Physicians, Nurses per 10,000 population in Selected Countries, 2010

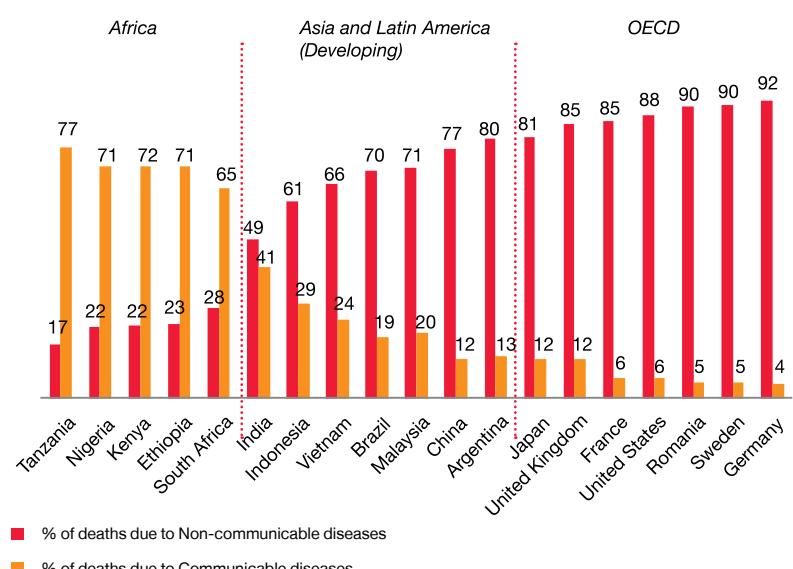


Source: WHO, World Bank, PwC analysis

Managing Non-communicable Diseases in addition to Communicable Diseases

The prevalence of communicable diseases is the highest in Africa, followed by Asia and Latin America. It is also interesting to note that countries such as India, Indonesia and Vietnam are in a transition phase where the burden of non-communicable diseases is increasing vis-à-vis communicable diseases. This will pose further challenges to countries in Asia, Latin America and eventually Africa as the healthcare delivery systems in these continents are primarily geared towards treating infectious diseases and will require significant upgrading to help combat non-communicable diseases.

Percentage of Deaths due to Communicable and Non-communicable Diseases in Selected Countries, 2002



Source: OECD, PwC analysis

¹⁰Source: WHO.
¹¹Ibid.

Mobile is poised to play a significant role in healthcare

In contrast to healthcare access, mobile access is becoming almost ubiquitous worldwide. Additionally, with increasing penetration of smartphones and the rising uptake of 3G and 4G services across the world, mobile devices and communication will play a far greater role in healthcare in both developed and developing countries going forward.

Nearly ubiquitous mobile access

Almost all developed markets such as South Korea, Australia, the US, the UK, Germany, Sweden and Japan already have mobile penetration (connections per 100 people) greater than 100%. Alongside, mobile penetration in developing markets has also risen steadily over the last few years. Mobile penetrations in Africa, Asia-Pacific and Latin America are expected to reach 82%, 98% and 120% respectively in 2014. In fact, some developing countries such as Algeria, Botswana, Brazil, Chile, Indonesia and Malaysia have already crossed the 100% mobile penetration mark¹².

In developing countries, the wide prevalence of mobile connections stands out in sharp contrast to the lack of access to basic services that provide wellness and health such as improved sanitation facilities. In South Asia, mobile penetration was 46% in 2009 whereas only 36% of people had access to improved sanitation facilities¹³. The situation is similar in Africa.

Thus, mobile devices, if effectively leveraged, can help address healthcare accessibility and affordability across the world.

Comparison of Penetrations of Improved Sanitation Facilities and Mobile Phones in Selected African and APAC Countries, 2014E



Source: UN, PwC analysis

Increase in adoption of smartphones

Another important development is the growth in the penetration of smartphones across the world. It is estimated that smartphones are likely to account for more than half the global sales of handsets by 2015¹⁴, enabled by rapidly falling prices. This means consumers across the globe will have increasing access to more complex and powerful platforms.

Increasing penetration of smartphones and consumer adaptability to smart devices will enable mobiles to play an important role in healthcare since delivering relevant and enriched services will become easier.

Increase in 3G and 4G networks creating data highways

With increasing 3G and 4G rollouts and with fibre to support, a whole new world of possibilities in using mobiles and the internet to address healthcare challenges has opened up. 3G networks support video-calling and high-speed data transfer that can help deliver telemedicine services. 4G networks would enable superior customer experience in terms of superior picture quality as well as reduced image distortions for video calls and quicker data transfer as compared with that offered by 3G networks.

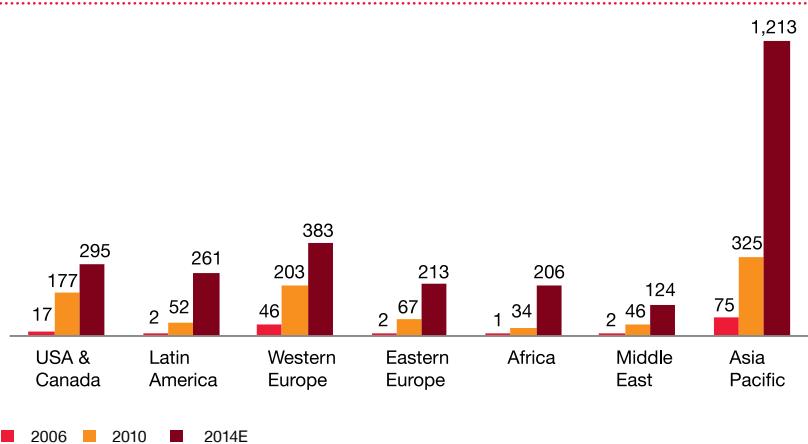
The uptake of high-speed broadband services is expected to increase rapidly across the world over the next few years. For instance, in Western Europe, the number of 3G and LTE subscribers is expected to increase almost two-fold from ~200 million in 2010 to ~380 million in 2014. In Asia-Pacific, the number of 3G and LTE subscribers is expected to increase from 325 million in 2010 to over 1.2 billion in 2014¹⁵.

There is also a marked shift in the way consumers are using mobile phones - the consumption of data services is increasing across the world. The expected widespread rollouts of LTE networks will further drive the deployment and consumption of solutions that leverage file and data sharing, video streaming and downloads as well as video calls.

Thus, the feasibility of mobile devices, services and applications that support healthcare is greater than ever before. Mobile health services and applications are set to gain from the favourable dynamics of the telecom market as much as the needs of the healthcare market.

Mobile health has already started taking root across countries and now stands at the cusp of rapid adoption.

Number of High-Speed Mobile Broadband Subscribers in Millions in Various Regions of the World, 2006, 2010, 2014E



Source: Wireless Intelligence

¹²Source: Wireless Intelligence

¹³Source: World Development Indicators, The World Bank, September 2011. Health Nutrition and Population Statistics, The World Bank, September 2011

¹⁴<http://www.mobile88.com/news/read.asp?file=/2010/11/23/20101123085035&phone=Smartphones-growth-Asia>

¹⁵Source: Wireless Intelligence

03

The global mobile health market has started taking shape

The key stakeholders in mobile health—mobile operators, device vendors, healthcare providers, content players, foundations and governments—have already launched services and applications focused on mobile health across several countries. In fact, the GSMA deployment tracker currently reports around 300 commercial deployments globally¹⁶.

Many mobile operators are active players in offering mobile health services and offer solutions beyond simple connectivity services. For instance, many operators offer content-based wellness information services to consumers. Some also offer sophisticated end-to-end solutions aimed at improving the efficiency of healthcare systems and workforce. Others facilitate mobile telemedicine and health call-centres by tying up with healthcare providers. They also provide real-time connectivity for devices as well as managed services for monitoring vital body parameters of patients.

Device vendors primarily offer equipment that gather body vitals and transmit them to back-end servers over mobile networks. Content and application players offer information-based services either in a stand-alone fashion or through tie-ups with mobile operators and other aggregators. Some have also developed applications that improve the efficiency of healthcare providers. Foundations and governments typically sponsor mobile health services aimed at spreading awareness and increasing the efficiency of healthcare workforce and systems.

Mobile health deployments till date have targeted issues such as tuberculosis, HIV¹⁷, diabetes, cardiac diseases, fitness, weight management, etc. and varied customer segments such as public healthcare institutions, physicians, healthcare workers and individuals.

Africa

Many current mobile health deployments in Africa are aimed at supporting remote healthcare workers in collecting and transmitting data on diseases and patients. In fact, almost 75% of current mobile health deployments in Africa focus on improving the efficiency of healthcare workforce and systems¹⁸. Services that distribute prevention and awareness messages aimed at reducing the spread of infectious diseases and helping patients constitute around 20% of total deployments¹⁹.

South Africa and Kenya lead African countries presently in mobile health deployments. Most of the applications in South Africa focus on improving the efficiency of healthcare workers, whereas Kenya has witnessed a large number of awareness/prevention solutions, especially around HIV/AIDS²⁰. Uganda, Nigeria, Mozambique and Malawi have also witnessed a number of mobile health deployments²¹ till date .



¹⁶<http://apps.wirelessintelligence.com/health/tracker/>; Extracted in December 2011

¹⁷Human Immunodeficiency Virus

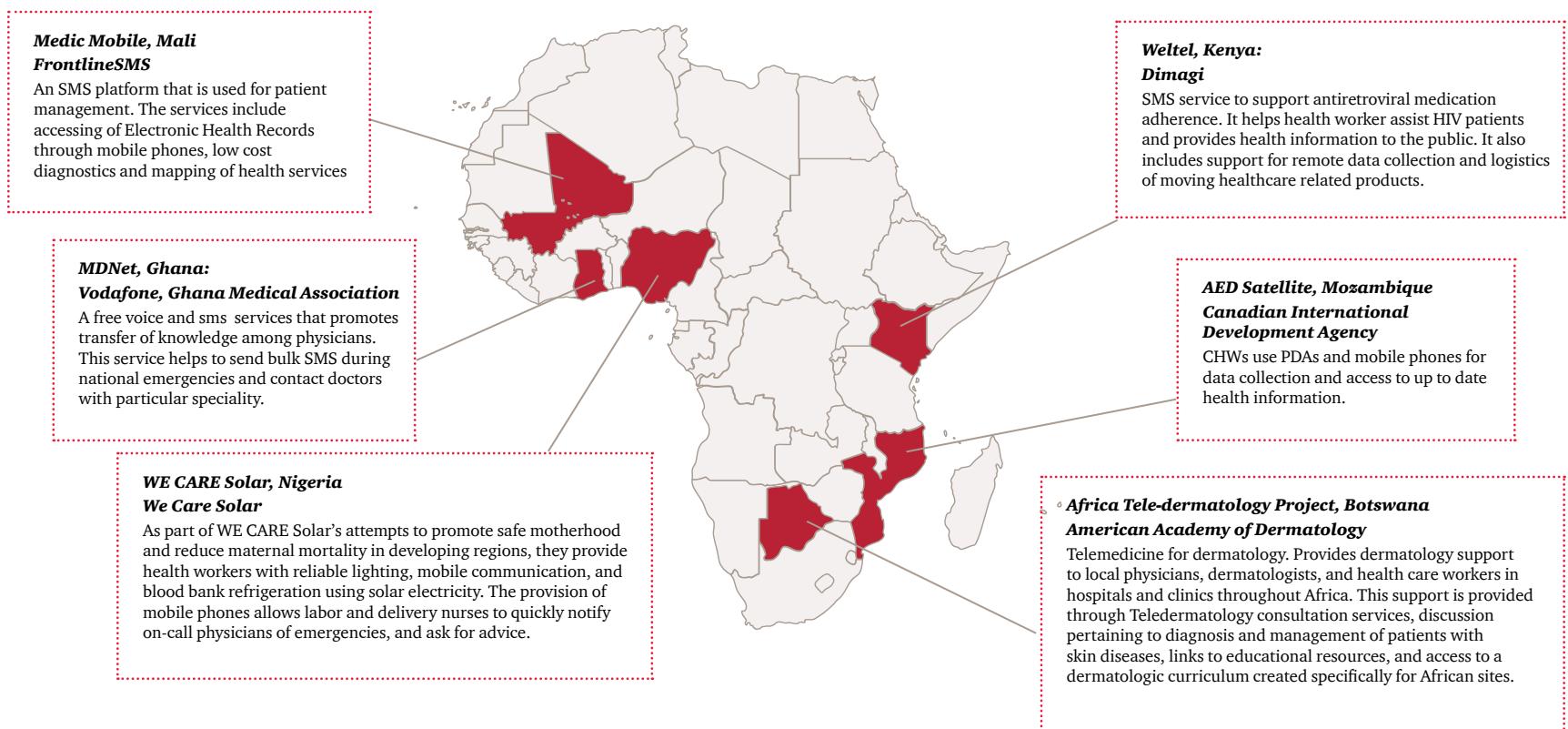
¹⁸<http://apps.wirelessintelligence.com/health/tracker/>

¹⁹Ibid.

²⁰Acquired Immunodeficiency Syndrome

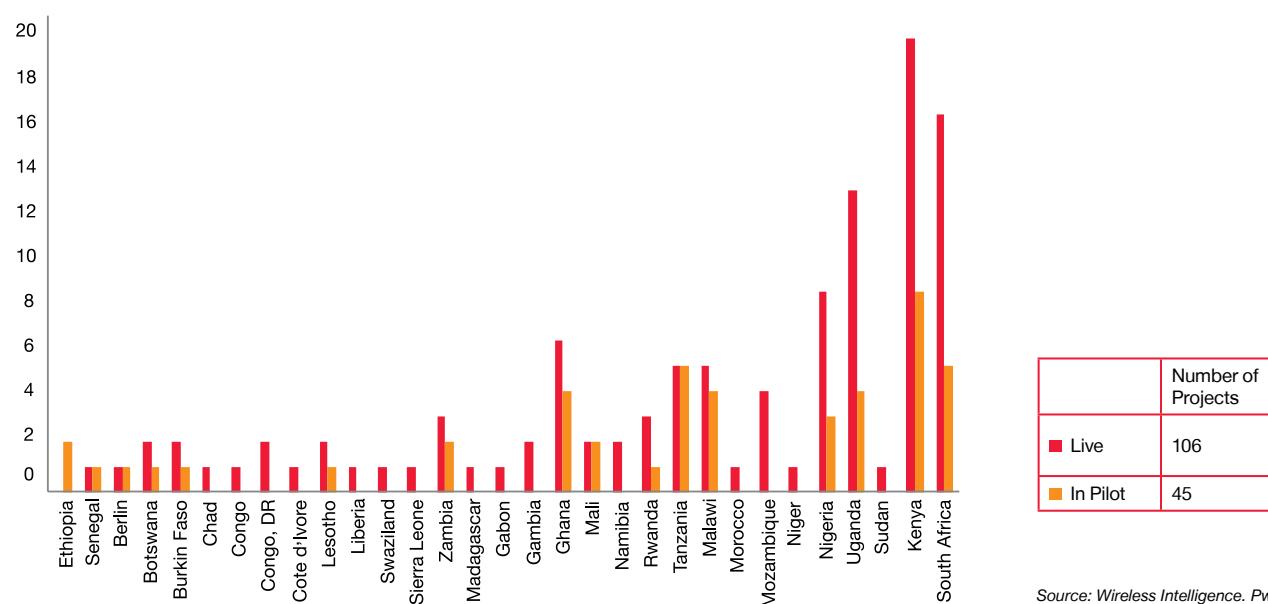
²¹Ibid.

Selected mobile health deployments in Africa, 2011



Source: Wireless Intelligence

Current status of mobile health projects in Africa, split by countries where they are implemented



Source: Wireless Intelligence. PwC analysis.

Asia Pacific

As in Africa, most of the current mobile health deployments in the Asia-Pacific region (APAC) focus on improving the efficiency of healthcare workforce and systems. Solutions that help spread prevention and awareness messages have also been widely deployed and comprise about 20% of the mobile health deployments in the region²².

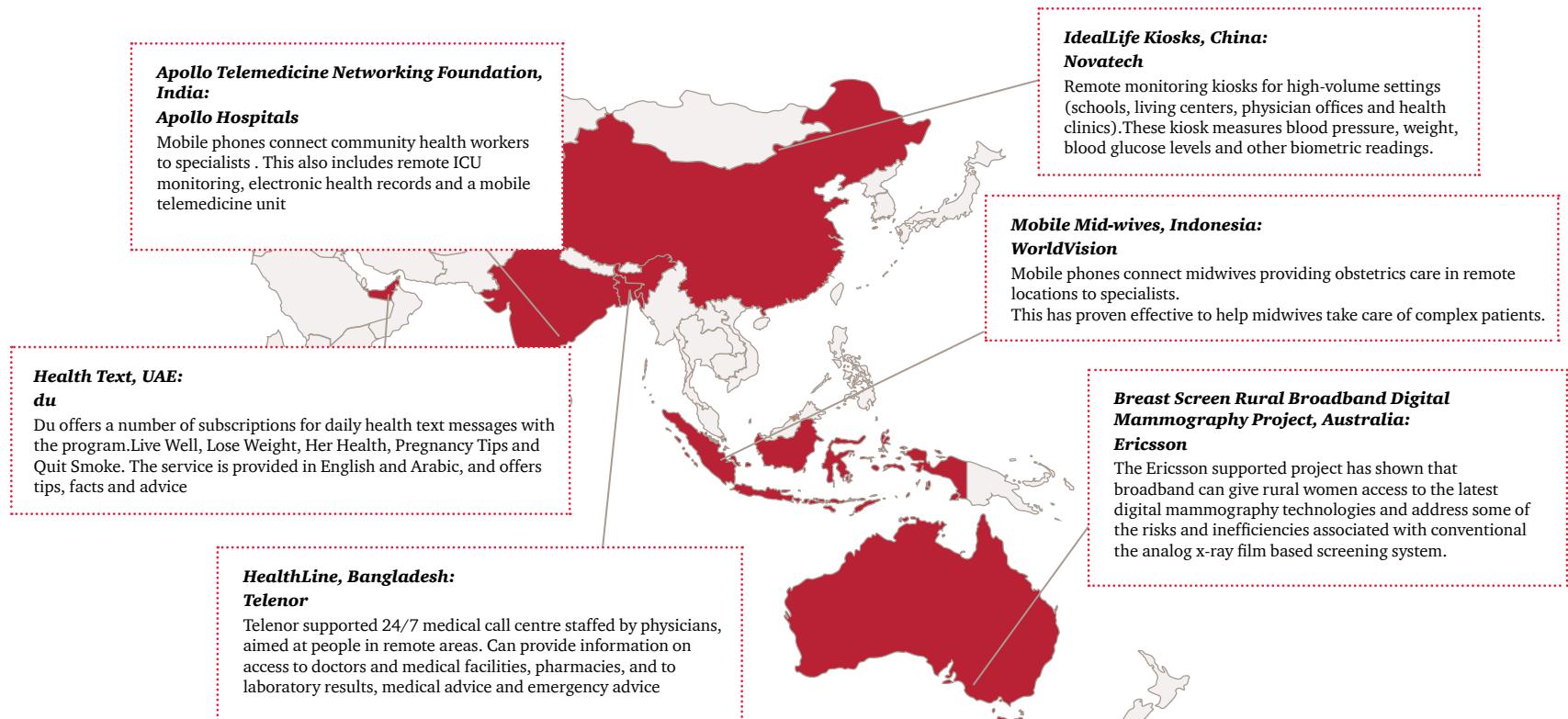
India has witnessed significant activity in the mobile health space with launches of different types of solutions although a majority of initiatives are focused on spreading prevention and awareness messages. In the Philippines, many mobile health deployments focus on improving the efficiency of community healthcare workers.

²²<http://apps.wirelessintelligence.com/health/tracker/>

The Middle East has also witnessed a modest amount of mobile health service deployments. Qatar and Kuwait lead here with the most deployments followed by the United Arab Emirates and Saudi Arabia. Most of the deployments are services that provide health information to consumers with a bunch of applications aimed at HIV/AIDS counselling and care.

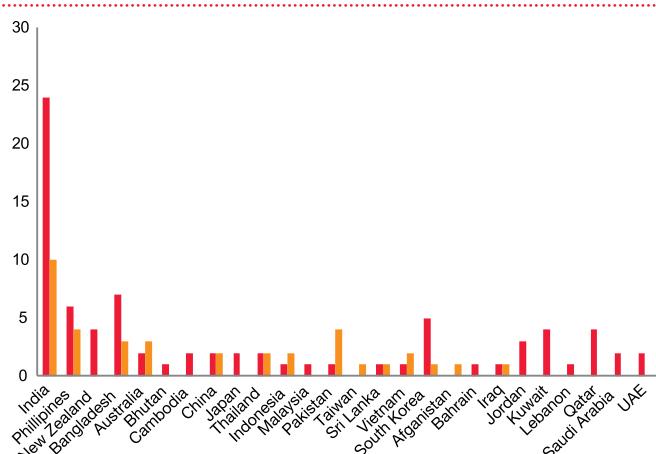
Mobile operators such as du in Dubai offer SMS-based information tips to consumers on health-related issues such as weight loss and pregnancy. Grameen Phone in Bangladesh offers 'doctor-on-call' services, wherein consumers can reach out to physicians for medical advice. China's Medical Link service offers remote consultation services over SMS and through call-centres. Pill-reminder services that help in treatment compliance have been offered in Thailand. There are also PDA/mobile-phone based services that aid remote healthcare workers in Bangladesh and Indonesia.

Selected mobile health deployment in the APAC, 2011



Source: Wireless Intelligence

Current status of mobile health projects in Asia-Pacific, split by countries where they are implemented



Source: Wireless Intelligence. PwC analysis

Europe

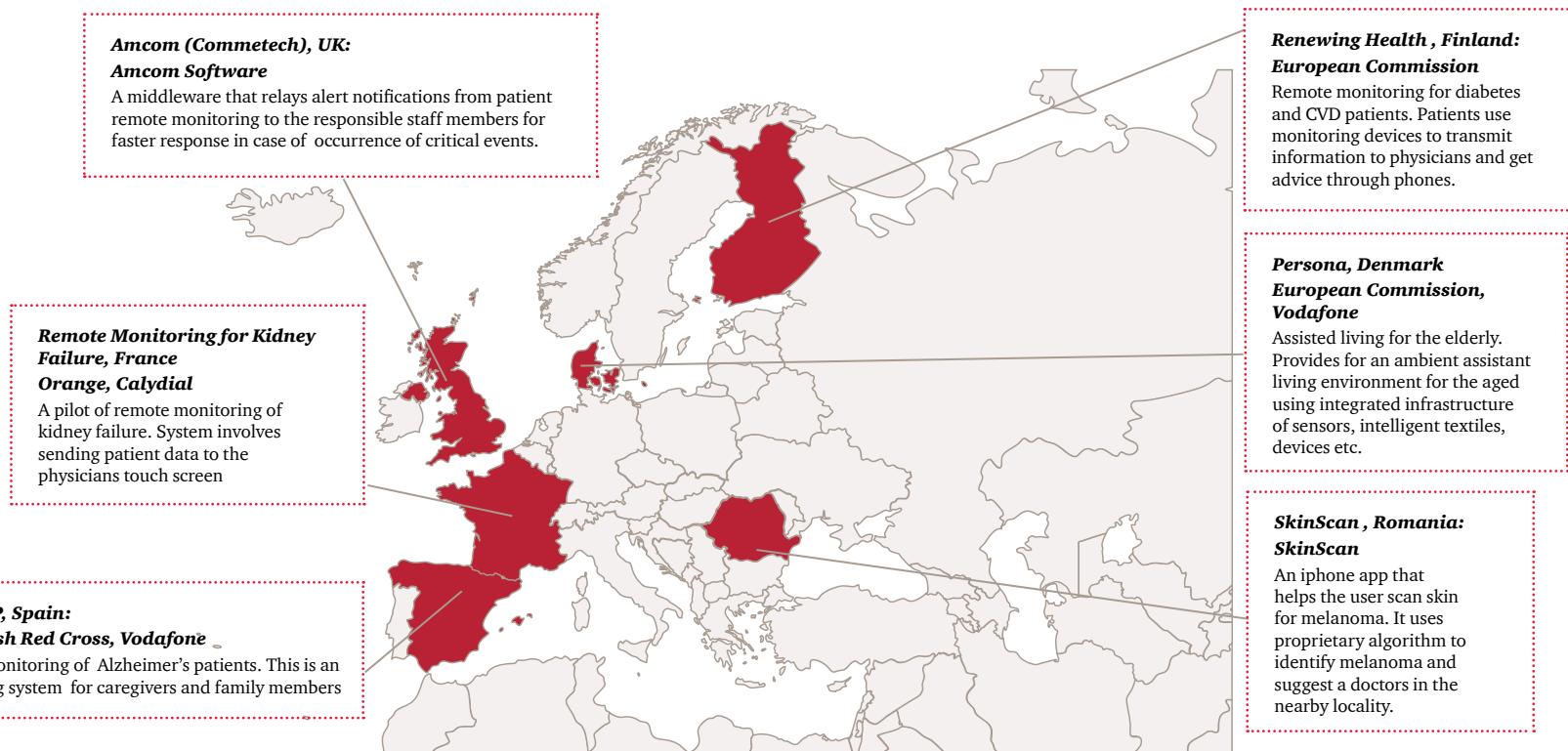
Most mobile health launches in Europe have focused on monitoring patients with chronic diseases and activities of the elderly with a view to aiding independent ageing. Patient treatment and remote monitoring solutions constitute almost 60% of the total mobile health deployments in Europe. There is also significant thrust on solutions that increase the efficiency of the healthcare workforce and systems, which constitute almost 15% of overall deployments²³. Further, driven by the increasing adoption of smartphones, health- and wellness-oriented mobile apps have also been launched.

²³<http://apps.wirelessintelligence.com/health/tracker/>

The UK leads in mobile health deployments in Europe, with different kinds of solutions being offered and services being delivered through varied means, from simple SMS to complex apps. Norway, Germany, Spain and Greece have also witnessed significant mobile health deployments, with primary focus on remote monitoring of patients suffering from chronic diseases.

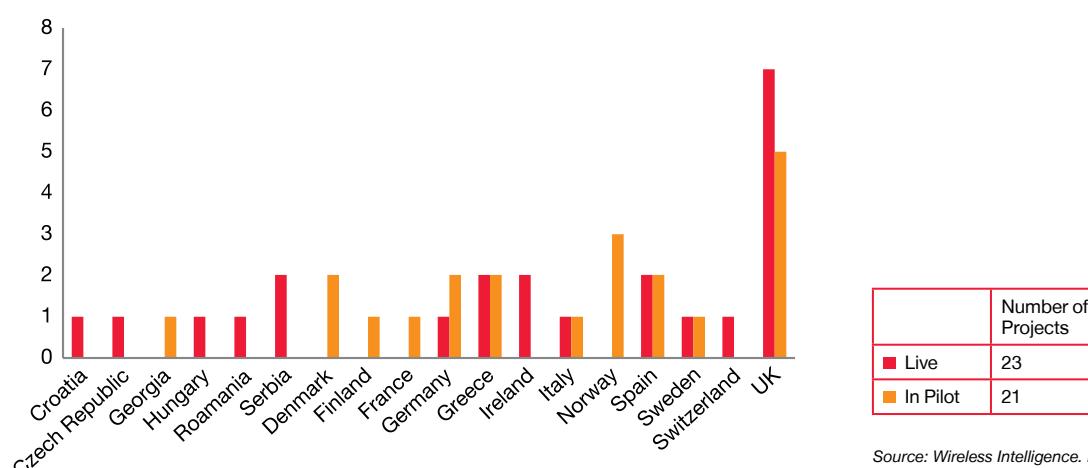
For instance, Orange has launched diabetes monitoring services in Spain, enabling remote monitoring of patients' blood glucose levels. Similarly, T-Mobile has a 'cardio messenger' service in Germany that provides remote cardiac monitoring. Telefonica's 'help at hand' service provides location information on dependent people (e.g. the elderly), coupled with tracking and geo-fencing. It also supports emergency and alert signals that are handled by its alarm receiving centre.

Selected mobile health deployment in Europe, 2011



Source: Wireless Intelligence

Current status of mobile health projects in Europe split by countries where they are implemented



Latin America

Latin America has also witnessed the gamut of mobile health services and applications. Almost 60% of the solutions deployed are targeted towards strengthening healthcare systems and include applications that aid healthcare practitioners in storing and retrieving patient records and supporting decision-making. An example is dosage recommendation. Solutions that aid monitoring and treatment constitute almost 27% of the deployment and include remote monitoring of chronic disease patients, aiding the elderly through devices and services, and pill-dispensers that remind users through SMS and generate adherence reports.

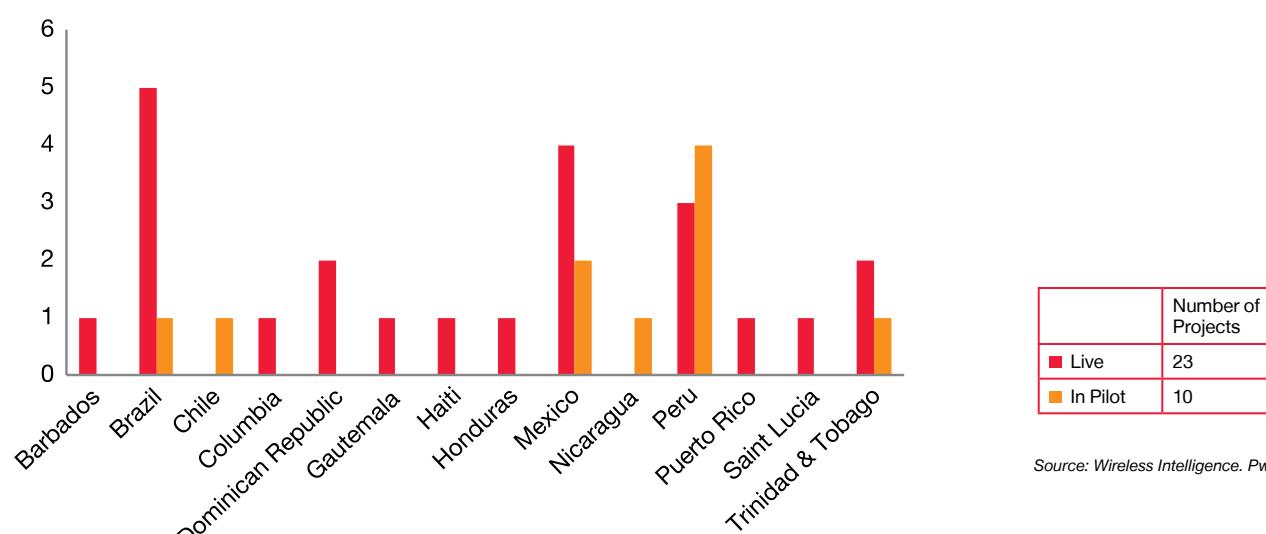
Significant mobile health deployments have happened in Brazil with solutions primarily aimed at supporting community healthcare workers in collecting and reporting data. In Mexico, solutions are primarily aimed at connecting patients and doctors through diagnosis services, whereas in Peru, the deployments are typically focused at supporting and training healthcare professionals.

Selected mobile health deployments in Latin Americas, 2011



Source: Wireless Intelligence

Current status of mobile health projects in Latin America split by countries where they are implemented



USA & Canada

The US has been at the forefront of mobile health deployments in the world. Almost 40% of the solutions deployed work towards strengthening the healthcare systems. Solutions that aid monitoring and treatment of patients constitute about 25% of the deployments. A number of mobile apps targeted at wellness and fitness are also being offered in the US and they constitute about 13% of the total mobile health deployments.

The US has witnessed significant activity in the mobile health space with solutions ranging from apps that aid achieving fitness goals to sophisticated patient monitoring systems. Canada has very few applications in place with most of them geared towards providing health information through text messages.

Mobile Health expected to drive major changes in healthcare delivery world-wide

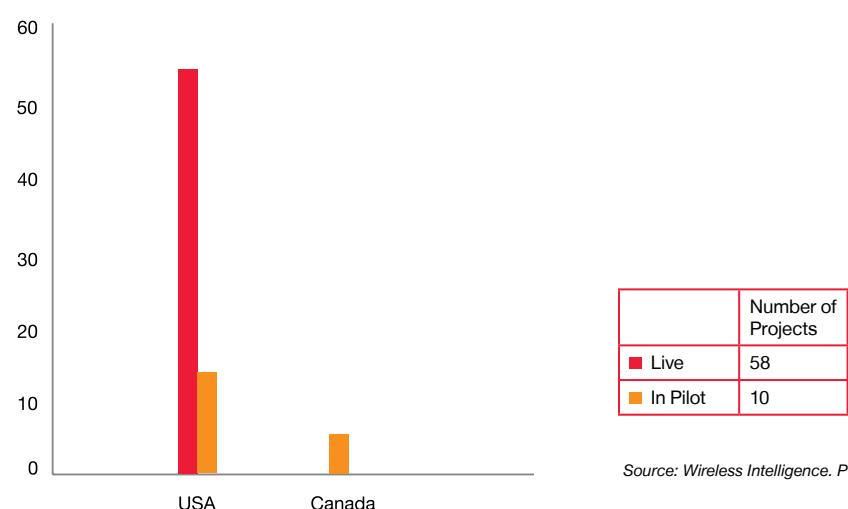
The current launches highlight the transformative nature of mobile health services. In developed countries, remote monitoring of patients can help reduce costs significantly by reducing the amount of time they spend in hospitals and also by reducing re-admissions. The services can also help reduce visits to physicians. In developing countries, diagnosis services delivered through mobile phones or telemedicine centres enabled by mobile connectivity can help bridge the deficit of healthcare personnel, especially in rural and remote areas. Thus, it is evident that mobile health is not only here to stay but also expected to drive major changes in delivery of healthcare worldwide. Furthermore, the inherent differences in various types of solutions that can be delivered through mobiles necessitate the development of a robust categorisation framework that enables a standardised approach of viewing various mobile health services and applications and is also broad enough to encompass current as well as future solutions.

Selected mobile health deployment in the US and Canada, 2011



Source: Wireless Intelligence

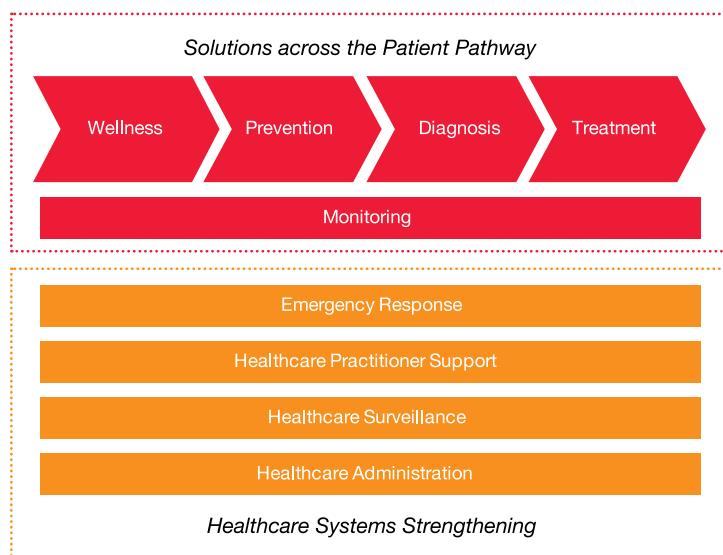
Current status of mobile health projects in USA and Canada



Distinct segments have started to emerge in mobile health

The mobile health market comprises a wide range of services and applications that leverage mobile communication and devices to provide healthcare services and achieve health outcomes. Based on the desired impact of the services and applications in achieving specific health outcomes and considering the skill-sets required to deliver these, mobile health services can be categorised into two distinct focus areas—Solutions across the Patient Pathway and Healthcare Systems Strengthening. The former entails services and applications that are used directly by individuals, typically patients. Healthcare Systems Strengthening comprises solutions that do not interact directly by patients, but are aimed at improving the efficiency of healthcare providers in delivering patient care.

Mobile Health Services Categorization Framework



Source: GSMA and PwC analysis

Solutions across the Patient Pathway

Patient Pathway refers to the route typically followed by a person suffering from a disease or at the risk of suffering from a disease. It includes taking steps for staying healthy, preventing disease occurrence / exacerbation, and seeking help from physicians / healthcare workers for diagnosing underlying diseases as well as treating the conditions. Monitoring of body vitals is also an important component and can help in various stages such as improving fitness, diagnosing underlying conditions and tracking patient recovery.

Thus, from a patient pathway perspective, most mobile health services and applications can be classified into five categories – Wellness, Prevention, Diagnosis, Treatment, and Monitoring. In all these categories, the patient or consumer is the prime end-user and interacts directly with the services and applications.

Wellness

This category primarily includes self-help services that encourage people to adopt or avoid certain behaviours and practices to maintain or improve their general wellness and fitness levels. It includes content-based wellness and fitness services such as information tips, interactive games, applications and fitness monitoring through devices that measure body vitals while exercising. Increasing awareness of healthcare in developed markets and affluent pockets in developing markets are expected to drive the growth of self-help wellness and fitness programmes. Wellness-based mobile health services and applications will cater to this space focussing on issues such as obesity management, healthy living, elderly care, child care, pregnancy tips and smoking de-addiction.

iQuit is an iPhone-based app, available in the US. It offers advice on routines that help users cease or reduce smoking cigarettes. MyFitnessPal apps, also available in the US, help track calorie intake of users, thereby aiding weight loss.

In Japan, NTT Docomo has launched the ‘wellness phone’, which includes a pedometer and health monitoring software. The data from the phone is analysed and insights provided to the user with advice on healthy lifestyle choices.

In Dubai, du offers SMS-based information tips to consumers on health-related issues such as weight loss and pregnancy tips.

Prevention

Prevention refers to services used by government and non-government agencies to spread awareness and encourage people to adopt or avoid certain behaviours and practices to prevent or control disease outbreaks. These services and applications aim to leverage the reach of the mobile platform to mobilise communities and promote healthy living.

Mobile health solutions around prevention are typically focused on reproductive health, child health, infectious diseases such as HIV/ AIDS and drug abuse. For instance, mobile technology can play an important role in improving child and maternal health through targeted messages to expectant mothers and parent(s) of young children, especially in rural and low-income areas, about best practices in diets, physician visits and vaccination schedules.

The Text4Baby SMS-based service in the US disseminates information for promoting maternal and child health and is primarily targeted at low-income communities.

The Wired Mothers programme in Tanzania uses mobile phones to link pregnant women to the health system. It involves SMS reminders and telephonic conversations between healthcare providers and patients.

Diagnosis

The Diagnosis category includes services and solutions that help healthcare professionals connect with patients geographically far away to provide diagnosis or triage.

For instance, health call-centres or help-lines can help those without access to a physician, to speak to qualified personnel for advice. Mobile telemedicine can also be used where both patients and healthcare professionals have access to high-speed mobile data transmission that enables video calls. In developing markets, where people in rural areas may not have access to 3G / BWA²⁴, mobile telemedicine can be implemented by setting up video calls between rural walk-in health centres and healthcare professionals located in district headquarters or cities.

Healthdirect, a health call-centre initiative in Australia, helps patients (particularly in remote areas) take informed decisions about healthcare. Teledoctor in Pakistan (from Telenor Pakistan) offers 24/7 access to qualified physicians and thereby enables primary health advice over the phone.

Treatment

The Treatment category includes services that help treat patients remotely and ensure adherence to the required treatment regimen.

Compliance with treatment protocols is paramount to the success of effectively managing chronic diseases such as HIV (ART - anti-retroviral treatment). Further, many illnesses (e.g. tuberculosis) require patients to take their medicines at a certain frequency to avoid disease relapse. Services that enable compliance rigour in a cost-effective manner will have applicability in both developed as well as developing countries.

eMedOnline, a compliance solution in the US, entails a mobile application that reminds patients to take pills at appropriate times.

Diabediario in Mexico provides a set of interactive tools for self management of diabetes by patients. It includes educational messages, a glucose diary and medication reminders.

SIMPILL, a medication compliance management offering in South Africa, uses pill boxes to send messages through wireless technologies to patients with chronic conditions to remind them to take their medication as prescribed.

Monitoring

Monitoring encompasses a broad set of services, applications and devices that help in periodic capture of important health parameters of chronically ill patients or those undergoing post-acute care. It includes monitoring patients to identify and confirm underlying illnesses and monitoring of the vital parameters of at-risk patients to track underlying conditions and take action in order to prevent exacerbation. Continuous monitoring is intended to assist in prevention, diagnosis, and treatment and after-care.

For instance, body and heart monitors can help track the heart rate of patients and transmit the data to central servers accessible to physicians, who can then diagnose the condition or monitor the success of treatment and rehabilitation. Algorithms are also being developed to study underlying trends and predict when a patient is on the verge of having a heart attack. Further, remote hypertension monitors can be used by doctors to monitor patients' blood pressure and decide whether the treatment or dosage needs to be changed.

Independent ageing services and applications that entail monitoring body parameters and activities of senior citizens are also included in this category. It includes elderly safety monitoring, fall detection, location tracking and tracking of daily activities.

AT&T Diabetes Manager in the US helps diabetic patients capture, store and transmit blood glucose data to their care-providers and provide clinically based automated coaching on how to manage their blood sugars.

T-Mobile's CardioMessenger Service in Germany helps perform remote cardiac monitoring. This involves the patient's heart device (a pacemaker or implantable cardioverter defibrillator (ICD)) sending regular messages to an external device, which in turn forwards the data to a central database through the GSM network so that a physician can evaluate it.

Homemonitor by Telenor in Norway has different sensors wirelessly connected to a medical alert system. Sensors are present for fall detection, location detection and identifying moisture levels.

²⁴Broadband Wireless Access

Healthcare Systems Strengthening

Healthcare Systems Strengthening comprises mobile health services and applications aimed at improving the efficiency of healthcare providers in delivering patient care.

Emergency Response

Emergency response services are primarily aimed at institutional healthcare providers such as hospitals and comprise solutions that enable rapid response in the case of emergencies and disaster situations. They include wireless systems in ambulances to help paramedics interact with physicians in hospitals and send the vital parameters of patients to emergency rooms while they transport patients in emergency situations.

National Taipei University of Technology (NTUT) and Taichung Hospital are working on an ambulance-support Emergency Response system, which will entail a wireless sensor system to enable the transmission of patient parameters to the emergency wards of hospitals while patients are en route.

Healthcare Practitioner Support

Healthcare practitioner support includes mobile access to IT (Information Technology) systems and databases of varying sophistication—from the simple look-up of information (e.g. medical encyclopedias) to intelligent decision-support systems that aid in diagnosis and treatment. It also includes the dissemination of medical information, training and updates to healthcare practitioners.

This category will be driven by institutional clients such as private and public hospitals.

Epocrates in the US offers a number of health information applications for smartphones. They include references for essential drugs, disease and lab information, medical dosage calculator solutions and continuing medical education.

SK Telecom's Mobile Health Assistant in South Korea links smartphones of doctors to the EHR systems of hospitals. Physicians can then view patient records on their smartphones.

Scottish Intercollegiate Guidelines Network (SIGN) in the UK is a smartphone application that enables physicians view up-to-date Scottish NHS guidelines for 11 illnesses.

Healthcare Surveillance

Healthcare surveillance comprises services and tools that help healthcare workers collect health-related information of people and track the outbreak of diseases and epidemics.

Most countries track the outbreak of diseases, especially in rural and remote areas, through geographically dispersed healthcare workers. Arming them with smartphones and PDAs with mobile connectivity can help furnish timely information to the central planning authorities about disease outbreaks. This will help them take timely action to treat affected patients and prevent further outbreak of diseases.

NHS Rotherham Project in the UK improves the workflow at NHS Rotherham by leveraging mobile phones for the data collection process.

EpiSurveyor, a mobile phone based solution, has been used in Vietnam to enable data collection for disease surveillance and monitoring. The application enables creating forms for mobile devices. They can be filled up by practitioners on the ground.

Healthcare Administration

Healthcare Administration services automate or streamline administrative and back-end processes related to the provision of healthcare and positively impact the efficiency of the overall delivery system. This category includes services such as appointment reminders, which can help reduce non-attendance rates and also improve patients' experience of the outpatient care process.

GomoText.com is a US-based company that offers an appointment reminder service. It enables pre-setting appointment reminders for specific dates and sending automated SMS to patients.

ResultsSMS is an open source SMS-based platform used in Uganda and Rwanda for appointment reminders and treatment adherence.

Snapshot of Mobile Health Service categories

Category	Sub-category	Client / Beneficiary Profile	Focus Area	Content type	Key Platforms	Key Players
Solutions across the Patient Pathway	Wellness	<ul style="list-style-type: none"> • Individuals 	<ul style="list-style-type: none"> • Obesity Management • Healthy Living • Elderly Care • Child Care • Pregnancy Tips • Smoking De-addiction 	<ul style="list-style-type: none"> • Information Tips / Interactive Services • Fitness Monitoring 	<ul style="list-style-type: none"> • ISMS (including USSD) • IVR • Apps • Devices 	<ul style="list-style-type: none"> • Mobile Operators • Device Vendors • Content Developers
	Prevention	<ul style="list-style-type: none"> • Individuals exposed to Diseases / Epidemics / Other Health Concerns 	<ul style="list-style-type: none"> • Infectious Diseases • Drug Abuse Prevention • Reproductive Health • Child Health 	• Information Tips	<ul style="list-style-type: none"> • SMS (including USSD) • IVR 	<ul style="list-style-type: none"> • Mobile Operators
	Diagnosis	<ul style="list-style-type: none"> • Individuals -Low Income / Low Reach -Primarily Rural Areas 	<ul style="list-style-type: none"> • Health call-centers / help-lines • Tele-medicine 	• Interactive Consultation	<ul style="list-style-type: none"> • Voice / IVR / SMS • Telemedicine Centers 	<ul style="list-style-type: none"> • Healthcare Providers • Mobile Operators
	Treatment	<ul style="list-style-type: none"> • Individuals 	<ul style="list-style-type: none"> • Treatment Compliance 	<ul style="list-style-type: none"> • Reminders / Compliance Trackers 	<ul style="list-style-type: none"> • SMS (including USSD) • IVR • Apps 	<ul style="list-style-type: none"> • Content Developers • Mobile Operators
	Monitoring	<ul style="list-style-type: none"> • Individuals suffering from chronic diseases or recovering from acute conditions • Elderly 	<ul style="list-style-type: none"> • Chronic Disease Management • Independent Aging • Post Acute Care 	<ul style="list-style-type: none"> • Trackers for Body Vitals and Activities • Reporting and Alert Messages 	• Device-linked	<ul style="list-style-type: none"> • Mobile Operators • Device Vendors
Healthcare Systems Strengthening	Emergency Response	<ul style="list-style-type: none"> • Institutional – Hospitals 	<ul style="list-style-type: none"> • Ambulance based Solutions 	<ul style="list-style-type: none"> • Trackers for Body Vitals • Interactive Consultation 	• Device-linked	<ul style="list-style-type: none"> • Device Vendors • Mobile Operators
	Healthcare Practitioner Support	<ul style="list-style-type: none"> • Institutional – Hospitals • Physicians 	<ul style="list-style-type: none"> • Information Lookup and Decision Support Systems 	• Medical Information	<ul style="list-style-type: none"> • Apps • Internet-based 	<ul style="list-style-type: none"> • Content Developers • Mobile Operators
	Healthcare Surveillance	<ul style="list-style-type: none"> • Institutional - Government - NGOs • Healthcare Workers 	<ul style="list-style-type: none"> • Health Surveys & Surveillance 	<ul style="list-style-type: none"> • Data Collection and Reporting Support 	<ul style="list-style-type: none"> • Apps • Internet-based 	<ul style="list-style-type: none"> • Mobile Operators • Content Developers
	Administration	<ul style="list-style-type: none"> • Institutional – Hospitals • Physicians 	<ul style="list-style-type: none"> • Appointment Reminders 	• Reminders	• SMS (including USSD)	<ul style="list-style-type: none"> • Content Developers • Mobile Operators

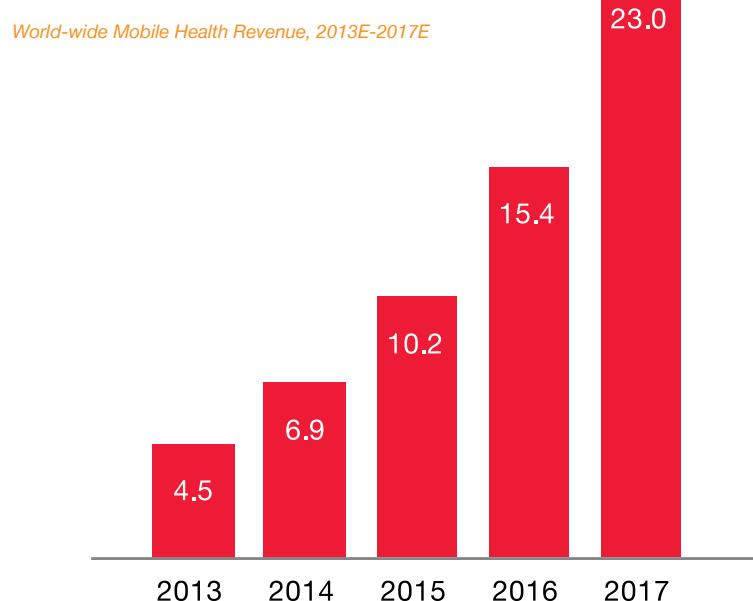
Source: PwC analysis

Mobile health revenues are expected to grow significantly worldwide

The global mobile health market is expected to reach US\$ 23 billion by 2017. The opportunity, calculated here, includes charges paid for mobile calls, special devices with mobile connectivity (e.g. for monitoring), data connectivity, telemedicine services, and licence and usage fees for applications and value-added services (VAS) such as SMS, USSD and IVR. It does not include the expenditure on smartphones or ordinary mobile phones. It also excludes incremental expenditure on medicines that arise due to use of mobile health services.

The market has been estimated by examining the current gaps in healthcare delivery and opportunities for specific mobile health services and applications in several representative countries across all regions of the world—Africa, Asia-Pacific (APAC), Europe, Latin America and developed North America (the US and Canada). The results have then been extrapolated to other countries in the region using a top-down index that takes into account macro-economic, demographic, healthcare and telecom indicators to arrive at regional estimates. Europe and the APAC are expected to have about 30% market share each of the global mobile health market in 2017, followed by the developed markets of North America (about 28% share). Latin America and Africa will comprise about 7% and 5% share respectively in 2017.

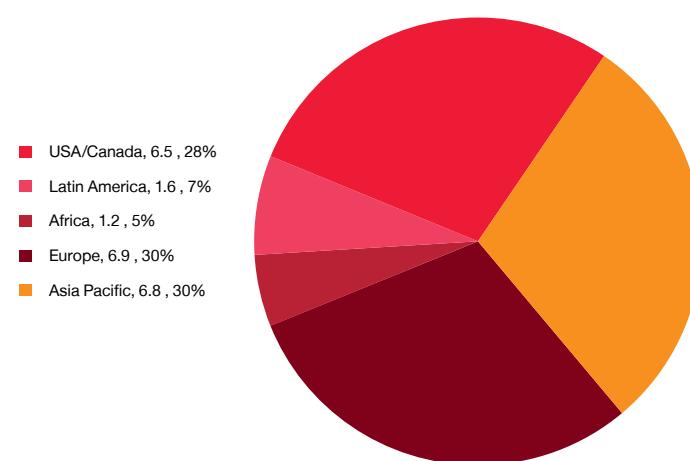
Worldwide mobile health revenue and Global mobile health market opportunity by regions (US\$ billion) and percentage of overall market, 2017²⁵



Source: PwC analysis

Global Mobile Health Market Opportunity by Regions, US\$ Billion and % Share of Overall Market, 2017E

Total Market Size: US\$ ~23 Billion



Source: PwC analysis

Of the various mobile health service categories, Monitoring services and applications are expected to drive the market significantly and account for about 65% of the market, corresponding to US\$ 15 billion, in 2017. The Monitoring market will be driven primarily by chronic disease management and independent ageing applications in developed markets, albeit they will find applicability in developing markets as well. Chronic disease management and post acute care monitoring services will comprise a large proportion of the opportunity with nearly US\$ 10.7 billion in revenue in 2017, with a majority of revenues contributed by the former. Independent ageing solutions also offer a large opportunity with potential revenue of US\$ 4.3 billion in 2017.

Key opportunities in chronic disease management will also vary across countries depending on the prevalence of various diseases. For instance, monitoring of patients with metabolic conditions such as obesity and diabetes is expected to comprise about 39% of the chronic disease management segment in revenue terms in the US. The corresponding value is expected to be about 23% in Germany, 20% in Brazil, and as low as 12% and 10% in Japan and China respectively. Similarly, monitoring patients with cardiovascular conditions such as hypertension, coronary artery disease and congestive heart failure is expected to contribute about 47% to chronic disease management revenues in the US and about 79% in China.

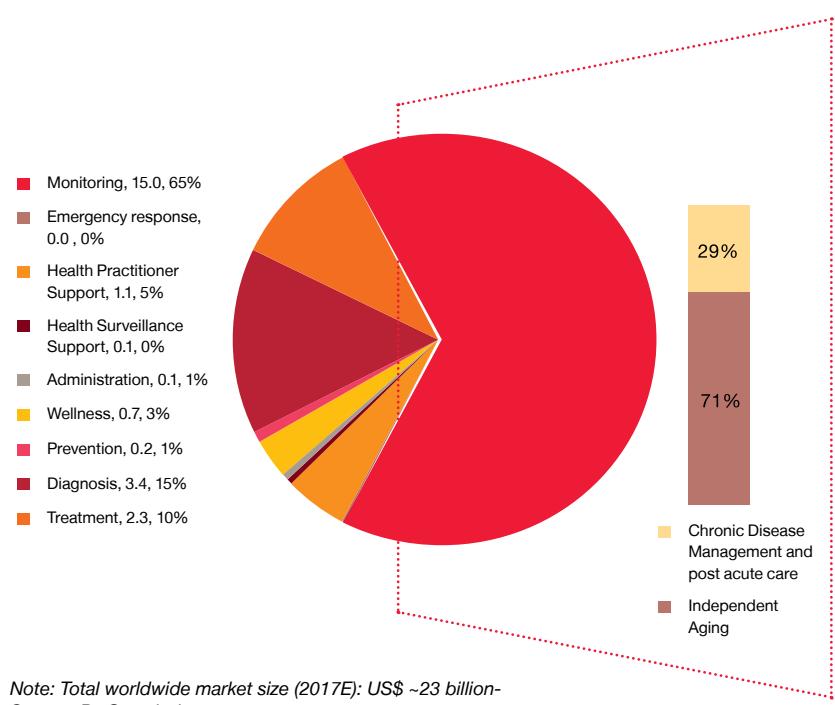
²⁵The Asia-Pacific region includes the Middle East, South Asia, South-Eastern Asia, Eastern Asia, and Oceania. Europe includes CIS countries. Latin America includes South America, Mexico, and the Caribbean Islands.

Diagnosis services are expected to comprise nearly 15% of the mobile health market with US\$ 3.4 billion in revenues in 2017. The adoption of Diagnosis services is expected to support developing markets in bridging their healthcare access challenges. The services covered under this category include simple interactive messages that help patients self-diagnose minor ailments, medical call centres manned by healthcare professionals, and telemedicine solutions that enable doctors to ‘see’ patients through wireless broadband. A majority of the revenues from Diagnosis services are expected to come from call-centre and mobile telemedicine solutions with approximately US\$ 1.7 billion and US\$ 1.6 billion in revenue in 2017.

Treatment will be the third largest revenue opportunity with around 10% of the total mobile health market share. Wellness and Prevention will comprise approximately 3% and 1% respectively of the total mobile health market.

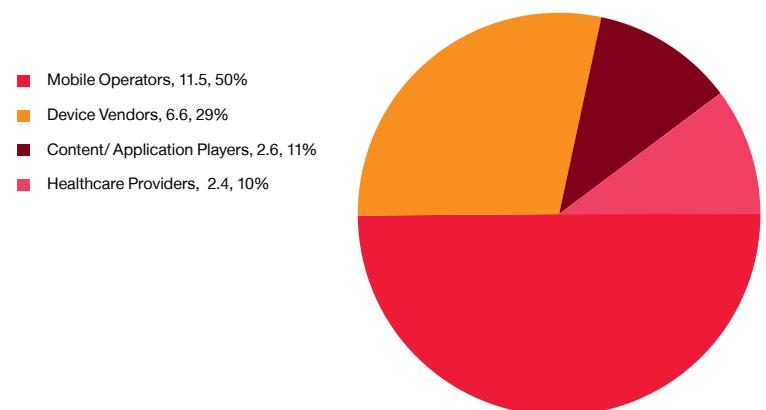
Healthcare Systems Strengthening services and applications are expected to contribute about 6% to the overall mobile health market (corresponding to US\$ 1.4 billion) in 2017. Among opportunities in Healthcare Systems Strengthening, Healthcare Practitioner Support will have the largest share with about 5% of the total mobile health market opportunity (US\$ 1.1 billion), followed by Administration, Healthcare Surveillance Support, and Emergency Response.

Global mobile health market opportunity by service categories, US\$ billion, 2017E



Mobile operators are expected to be the key beneficiaries of the expected growth in the mobile health market and command about 50% share of the overall market, corresponding to US\$ 11.5 billion, in 2017. Further, the pie is large enough to incentivise other ecosystem players to innovate and participate in the mobile health market, thereby driving it forward. Device vendors, content /application players and healthcare providers can expect to garner revenues of approximately US\$ 6.6 billion, US\$ 2.6 billion and US\$ 2.4 billion respectively, in 2017.

Potential global market opportunity for various ecosystem players, US\$ billion and %, 2017E

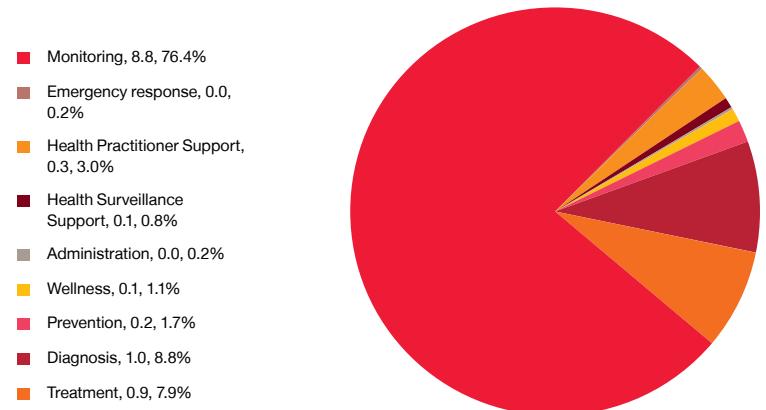


Note: Total worldwide market size (2017E): US\$ ~23 billion

Source: PwC analysis

For mobile operators, a majority of the revenue, nearly US\$ 8.8 billion, will accrue from their revenue share from Monitoring services. Diagnosis and Treatment solutions will also be attractive opportunities for operators, and contribute US\$ 1 billion and US\$ 0.9 billion to operator revenues.

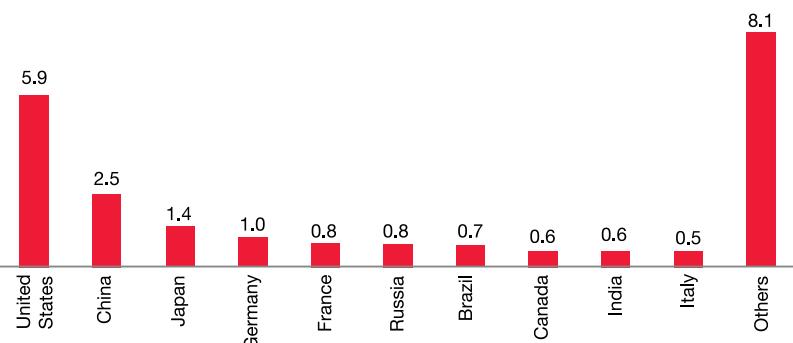
Break-up of Expected World-wide Mobile Health Revenues of Mobile Operators by Service Categories, US\$ Billion and %, 2017E



Note: Total opportunity size for mobile operators (2017E): US\$ ~11.5 billion
Source: PwC analysis

The top two mobile health markets by spend are expected to be the US and China. Between them, they are expected to account for more than one-third of the global opportunity.

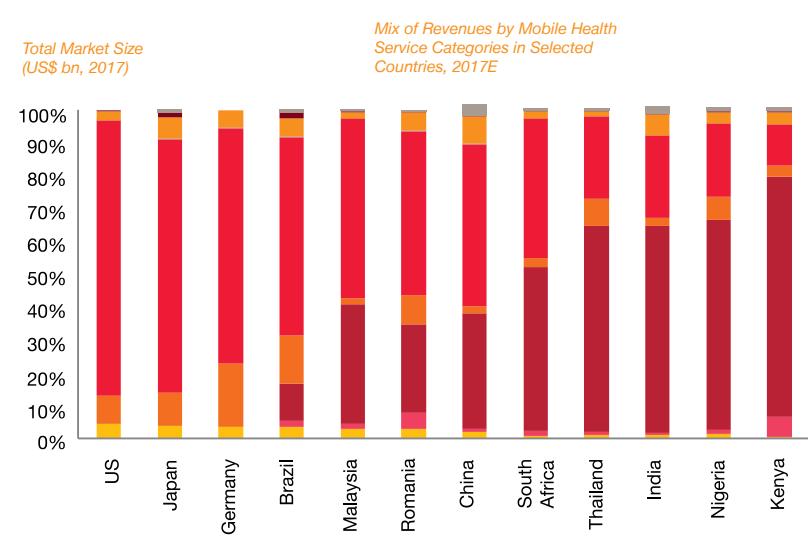
Top 10 countries based on mobile health revenue (US\$ billion), 2017



Source: PwC analysis

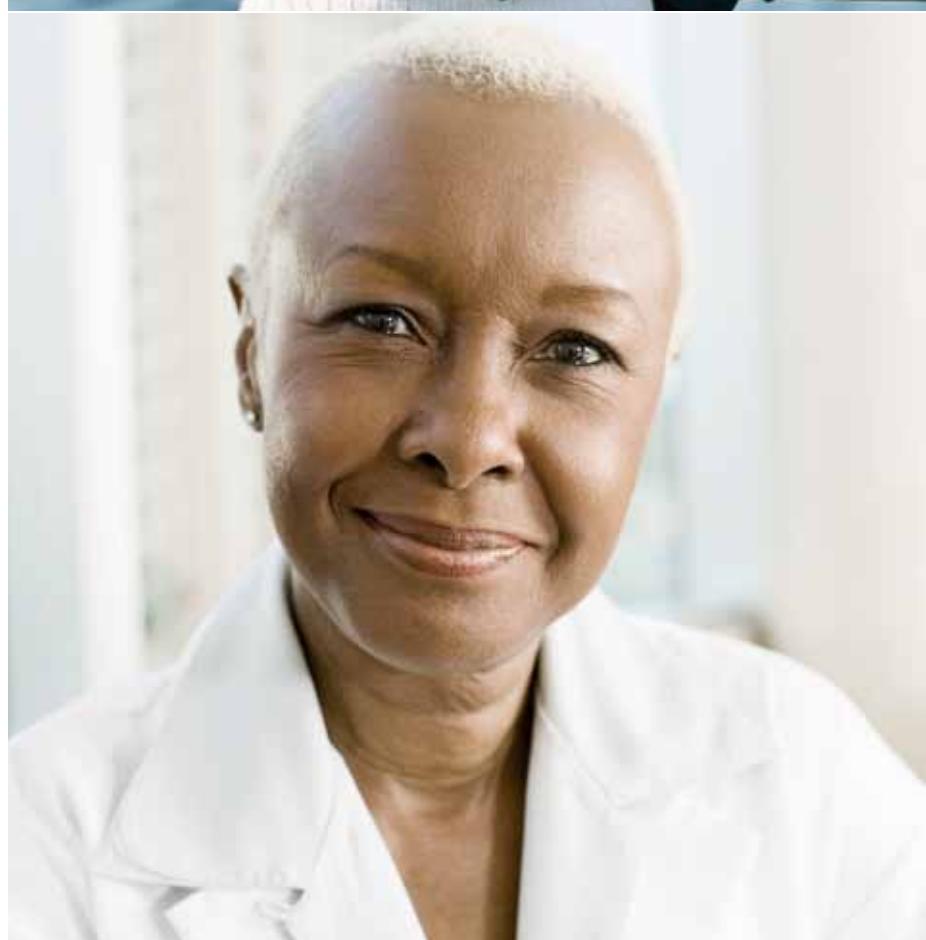
At a regional level, the opportunities are shaping up differently as the key drivers such as healthcare access, mobile penetration, rural-urban divide, disease profiles, dependent population and income levels vary across countries at both inter-regional and intra-regional levels. Consequently, the adoption rates and pricing of various mobile health services and applications are expected to vary across regions. For instance, the contribution of Monitoring services to overall mobile health revenues will typically be greater in countries with higher income levels, whereas the contribution of Diagnosis services will be higher in countries with lower income levels (which typically have low physician and hospital densities). This will also be reflected in the variation of mobile health spend per capita. The highest per capita expenditure²⁶ on mobile health is expected to be observed in the USA and Canada at about US\$ 18 in 2017.

Mix of revenues by mobile health service categories in various regions and mobile health spend per capita (in US\$) in various regions of the world, 2017E



Source: PwC analysis

- Monitoring
- Emergency response
- Health Practitioner Support
- Health Surveillance Support
- Administration
- Wellness
- Prevention
- Diagnosis
- Treatment

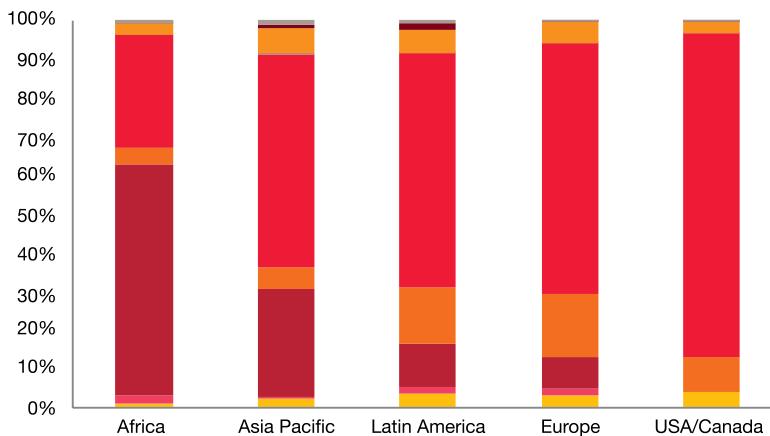


²⁶Expected total expenditure divided by projected population of the region/country



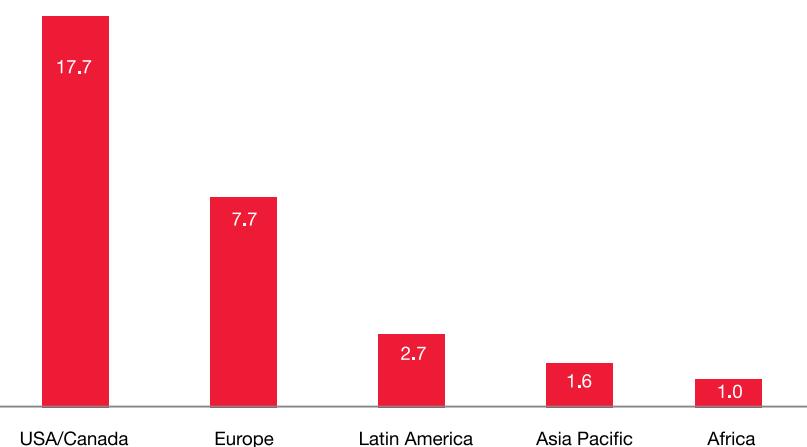
Mix of revenues by mobile health service categories in various regions and mobile health spend per capita (in US\$) in various regions of the world, 2017E

Total Market Size
(US\$ bn, 2017)



Mix of Revenues by Mobile Health Service Categories in Various Regions, 2017E

Mobile Health Spend per Capita (in US\$) in Various Regions of the World, 2017E



Source: PwC analysis

Source: PwC analysis

- Monitoring
- Emergency response
- Health Practitioner Support
- Health Surveillance Support
- Administration

- Wellness
- Prevention
- Diagnosis
- Treatment

Each of the regions offers significant revenue opportunities for various Mobile Health players. We now discuss the key opportunities and revenue potential in each of the regions.



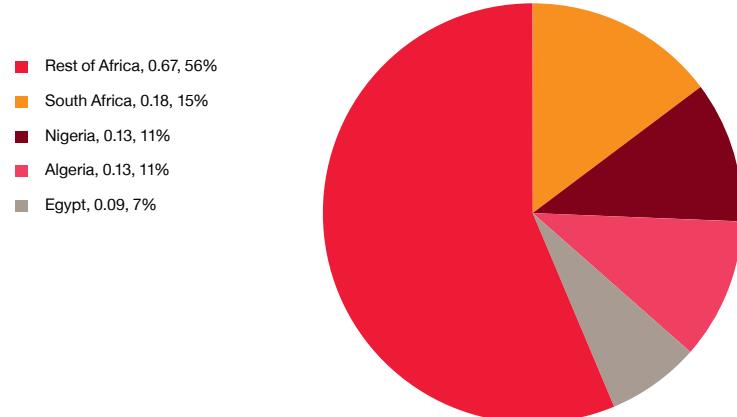
Africa

Mobile health is likely to make a significant difference in Africa in terms of bridging the healthcare access deficit. Africa has already witnessed significant mobile health deployments and going forward, the market is expected to grow robustly. However, even though currently most mobile health deployment are focused on Healthcare Systems Strengthening, the real opportunity in Africa will be in Solutions across the Patient Pathway due to the much larger addressable market arising from large populations and relatively low penetration of physicians.

The mobile health market in Africa is expected to be around US\$ 1.2 billion, corresponding to mobile health spend per capita of about US\$ 1, in 2017.

South Africa is expected to be the largest market in Africa with expected revenues of about US\$ 180 million in 2017, with most of the revenues arising from Diagnosis (around US\$ 90 million) and Monitoring (around US\$ 75 million) services. The second largest African market for mobile health will be Nigeria with potential revenues of about US\$ 130 million in 2017. Diagnosis (around US\$ 85 million), Monitoring (around US\$ 30 million) and Treatment (around US\$ 10 million) will be the key opportunities in Nigeria.

Contribution of Various Countries to the Mobile Health Market Opportunity in Africa, US\$ billion and %, 2017

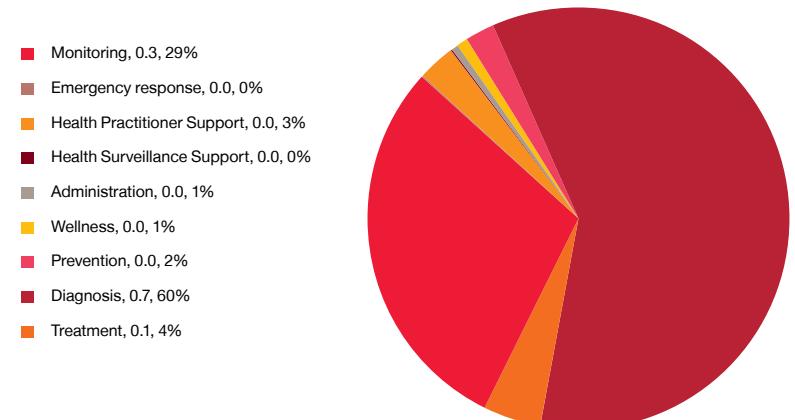


Source: PwC analysis

There will also be significant variation in per capita expenditure across countries in the continent due to differences in current healthcare reach and income levels. The expenditure will be higher in north African countries and South Africa as compared with countries in the sub-Saharan belt. For instance, South Africa, Nigeria and Kenya will witness mobile health spend per active user²⁷ of approximately US\$ 14, 3 and 1.5 respectively in 2017²⁸.

Diagnosis and Monitoring services are expected to be the two largest opportunities in the continent with market shares of about 60% and 29% respectively²⁹.

Mobile health market opportunity by service categories in Africa, US\$ billion, 2017



Source: PwC analysis

²⁷Total expected expenditure divided by projected number of service packages across all mobile health categories

²⁸Source: PwC analysis

²⁹Ibid.

Opportunity in Diagnosis Services

The key opportunity in Africa is Diagnosis services, with around 60% share of the market and over US\$ 700 million in revenues in 2017.

The Diagnosis market in Africa will be driven by healthcare access issues owing to too few physicians, exacerbated by a large rural spread. African countries in general lack trained healthcare professionals. For example, except for a few countries such as Egypt and South Africa, the number of physicians per 10,000 people in African countries is less than ²⁰. Further, 60% of Africa's population resides in rural areas that are difficult to reach. This will drive the uptake of remote diagnosis solutions such as telemedicine and health call centres and help-lines.

The opportunity in Diagnosis services is expected to be split almost evenly between call-centre-based and mobile telemedicine solutions with approximately US\$ 380 million and US\$ 320 million in revenue expected in 2017.

Opportunity in Monitoring Services

Monitoring services with about 29% share and US\$ 350 million in revenues (in 2017) will be the second largest opportunity in Africa. However, since monitoring solutions are relatively more technology-intensive and consequently more expensive as compared with other mobile health services, the penetrations and revenues will be significantly greater in North African countries and South Africa, which have significantly higher income levels as compared with the sub-Saharan belt. Six countries³¹ in Africa are expected to contribute over 60% to the Monitoring revenues from the continent.

This segment will be driven primarily by chronic disease management solutions, with over 95% share of Monitoring service revenue, corresponding to US\$ 340 million in 2017. This is because the relatively low average age in Africa will lead to lower demand for independent ageing solutions (which will comprise less than 5% of revenue from Monitoring services).

Other Mobile Health Opportunities

Mobile health is also expected to assist in treatment compliance in countries such as Nigeria that suffer from a high incidence of communicable diseases such as malaria, tuberculosis and HIV (for instance, 71% of all deaths in Nigeria are due to communicable diseases). Treatment compliance in Africa is expected to be mostly delivered through message-based services in countries such as Nigeria and Kenya, whereas it will also be supported by mobile apps in countries such as South Africa.

The market share of prevention services in value terms is relatively less as these are mostly purchased by institutional clients such as government agencies at relatively low bulk rates. But the role that prevention-based services could play in Africa, where information received at the right time can save lives, should not be underestimated. We see governments and non-government agencies / foundations using this as the primary means of educating people and spreading awareness in Africa.

Share of Revenues among Ecosystem Players

Mobile operators and healthcare providers are expected to be the key participants in the mobile health opportunity in Africa. Mobile operators are likely to garner a major share in the revenues of about 45% (US\$ 540 million), with Monitoring and Diagnosis services contributing the bulk of revenues (US\$ 260 million and US\$ 210 million respectively). Healthcare service providers are expected to have about 42% share (US\$ 500 million) of overall revenues, mainly due to the large Diagnosis opportunity in the African market. Device vendors and content players are expected to garner US\$ 90 million and US\$ 70 million respectively.

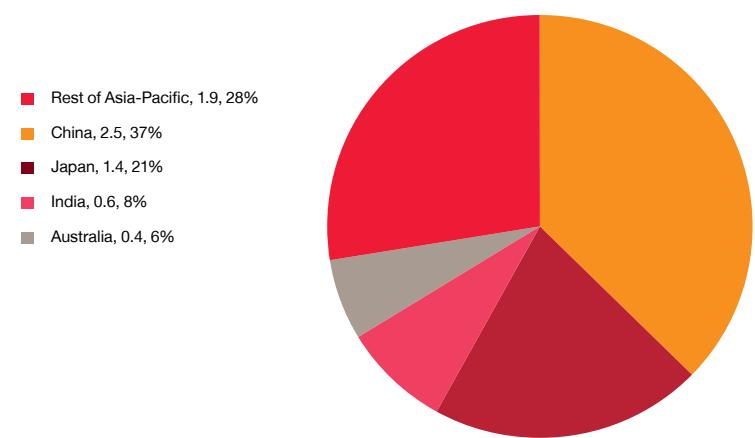
Asia-Pacific

The Asia-Pacific region (APAC), along with Africa, has been at the forefront in the development of basic mobile health solutions that touch the medically under-served population. This, coupled with growing population and rising income levels, positions the region as a very large opportunity for mobile health services and applications.

The mobile health market in APAC is expected to comprise almost 30% of the global market and reach US\$ 6.8 billion, corresponding to mobile health spend per capita of about US\$ 1.6, by 2017. As in Africa, mobile health can play a key role in improving healthcare access to vast populations that live in developing countries of the region.

The mobile health market opportunity in APAC will be driven by the eastern region, in particular China with 37% share of the market and Japan with 21% share of the market. India with 8% market share and Australia with 6% market share respectively are also expected to contribute significantly to the mobile health opportunity in APAC³².

Contribution of Various Countries to the Mobile Health Market Opportunity in Asia-Pacific, US\$ billion and %, 2017



Source: PwC analysis

²⁰Source: WHO.

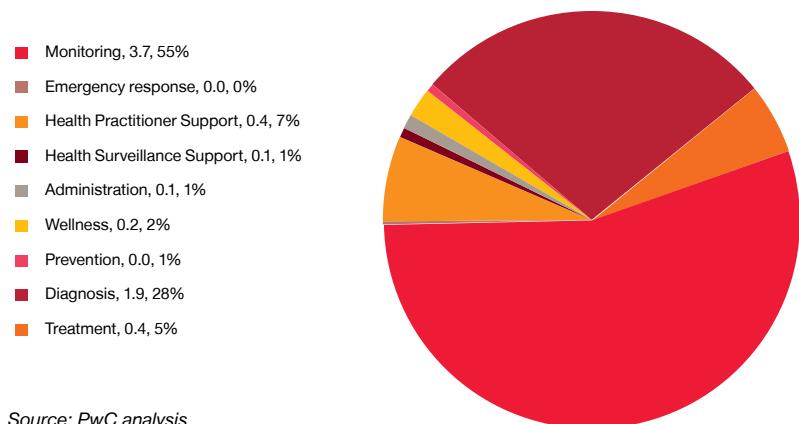
³¹Algeria, Egypt, Libya, Morocco, South Africa, Tunisia

³²Ibid.

The APAC region has the largest contrasts and shows little homogeneity, containing a variety of markets spanning from highly urbanised, developed and prosperous countries such as Japan, South Korea and Singapore, to low-income and highly populated countries such as India and Bangladesh. Thus, opportunities in mobile health differ across countries here. Consequently, the spend per active user is expected to differ significantly as well. The average spend per active user on mobile health is expected to be around US\$ 50 in Japan (a developed country in APAC) in 2017, while in China and India, it is expected to be US\$ 9 and US\$ 2 respectively in 2017³³.

Monitoring and Diagnosis services will dominate the APAC mobile health market with market shares of approximately 55% and 28% respectively (corresponding to US\$ 3.7 billion and US\$ 1.9 billion) in 2017³⁴.

Mobile health market opportunity by service categories in APAC, US\$ billion, 2017



Source: PwC analysis

Opportunity in Monitoring Services

The rising number of chronic disease patients in countries such as China, Japan and India is expected to drive the uptake of Monitoring services. Further, the ageing of populations, especially in countries such as Japan (23% of the population in Japan is above 65³⁵) will lead to high uptake of independent ageing based monitoring services.

The Monitoring services market in APAC is expected to reach about US\$ 3.7 billion in revenue in 2017. Independent ageing solutions are expected to account for almost 30% of the Monitoring services market in APAC, corresponding to US\$ 1.1 billion. The remaining 70% (US\$ 2.6 billion) will accrue primarily from chronic disease management services.

China alone is expected to become a US\$ 1.2 billion market for Monitoring services in 2017, with over 90% revenues accruing from chronic disease management solutions. Japan will also be a large market for Monitoring services with expected revenues of about US\$ 1.1 billion in 2017, with over 50% revenues accruing from independent ageing solutions. The Monitoring services market in countries such as India, Malaysia and Thailand is expected to reach revenues of approximately US\$ 139 million, US\$ 44 million, and US\$ 29 million respectively.

Monitoring of patients with cardio-vascular diseases is likely to comprise approximately 80% and 65% of the chronic disease management opportunity (a sub-segment of Monitoring services) in revenue terms in China and Japan respectively. Revenue contributions of monitoring of patients with metabolic, respiratory and neurological diseases to the chronic disease management opportunity are expected to be about 10%, 8%, and 3% in China and 12%, 18%, and 5% in Japan in 2017.

Opportunity in Diagnosis Services

There is also a significant opportunity in providing Diagnosis services over mobiles in the APAC region.

The low penetration of physicians and high rural population along with a high incidence of communicable diseases will shape the mobile health Diagnosis services market in APAC, especially in countries such as China, India and Thailand. According to the WHO, the number of physicians per 10,000 people in China, India and Thailand were 14, 6, and 3³⁶. These numbers indicate a significant latent need for physicians as the WHO recommended standard is 22 doctors per 10,000 people in order to cover 80% of the population. In India and Bangladesh, 'call the doctor' initiatives have already been launched for people who do not have access to doctors.

Health call-centres and IVR-based response systems can be expected to contribute nearly US\$ 1 billion in revenues and mobile telemedicine services can potentially contribute a further US\$ 0.9 billion in revenues in 2017, thereby resulting in a total opportunity size of about US\$ 1.9 billion for the wider region.

China, once again, is expected to contribute the most to regional revenues from Diagnosis services with nearly US\$ 0.9 billion in 2017. India is also expected to be a large market for these solutions with a potential revenue of about US\$ 0.35 billion in 2017.

Other Mobile Health Opportunities

Treatment services in APAC will transition from simple SMS-based services to mobile apps based services as smartphone penetration increases over time and people get more comfortable with apps. This could lead to a decrease in the average price for treatment solutions as the prices of apps-based services are much less compared to messaging-based services. Increase in revenues will be driven by volumes as more and more people start using treatment solutions.

The Wellness market in Asia will be supported by increasing urbanisation and affluence together with rising incidence and awareness of non-communicable diseases. Wellness services that provide tips for healthy living have already been launched in countries such as India and the UAE. Wellness services will also follow a similar pattern of movement from text-based solutions to app-based ones. Prevention solutions will tend to play a similar role as in Africa.

The Healthcare Practitioner Support market is expected to grow in Asian countries such as Japan, South Korea and Australia. These countries have a large number of doctors and a significantly high number of hospitals and primary and secondary healthcare centres.

Share of Revenues among Ecosystem Players

Overall, the mobile vendors in APAC will have nearly 47% of the overall revenue share with a bulk of the revenues (about 69%) coming from Monitoring services. Device vendors and healthcare providers are expected to have approximately 24% and 20% share of revenues respectively. Content and application players will garner about 9% of the revenues in 2017.

Mobile operators (52% market share) and healthcare providers (25% market share) will be the biggest beneficiaries of the Chinese mobile health market in 2017, the largest mobile health market in APAC. While in Japan, device manufacturers (44%) and mobile operators (44%) will have large revenue shares in 2017. In India, healthcare providers with 44% market share will lead the revenue share, followed by mobile operators with 41% market share of the country's mobile health market opportunity in 2017. A high revenue share for the healthcare providers in India will be due to the relatively higher market share for Diagnosis services opportunity in 2017. A high revenue share for the healthcare providers in India would be due to the relatively higher market share for Diagnosis services.

³³Source: PwC analysis

³⁴Ibid.

³⁵The World Bank

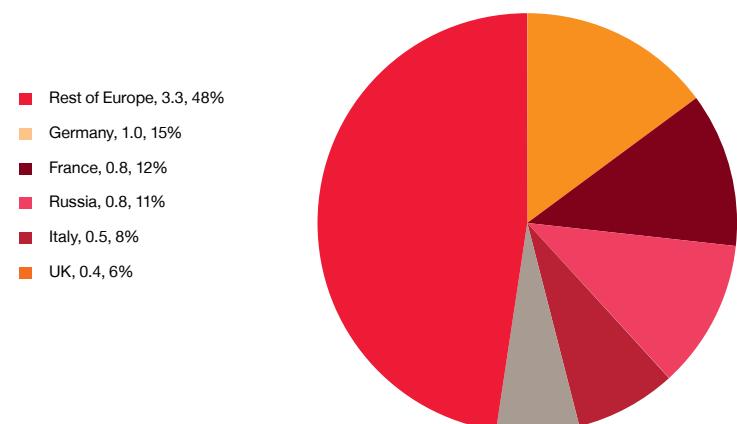
³⁶The number of physicians per 10,000 people in China, India, and Thailand were 14, 6, and 3 in 2009, 2006 and 2004 respectively; Source: WHO

Europe

With rising incidence of chronic diseases, ageing populations and the high ability to pay for services, Europe is expected to be the leading market for mobile health over the coming years.

The opportunity in Europe is expected to reach US\$ 6.9 billion, corresponding to mobile health spend per capita of US\$ 7.7, in 2017. About 70% of the revenue is expected to come from countries in Western Europe, with the remaining 30% from countries in Eastern Europe and CIS countries. Germany is expected to be the largest market in Europe with revenues of about US\$ 1 billion in 2017. The key opportunities in Germany will be Monitoring (72% share), Treatment (19% share), and Healthcare Practitioner Support (5% share). Other large markets for mobile health in Europe will be France, Russia, Italy and the UK.

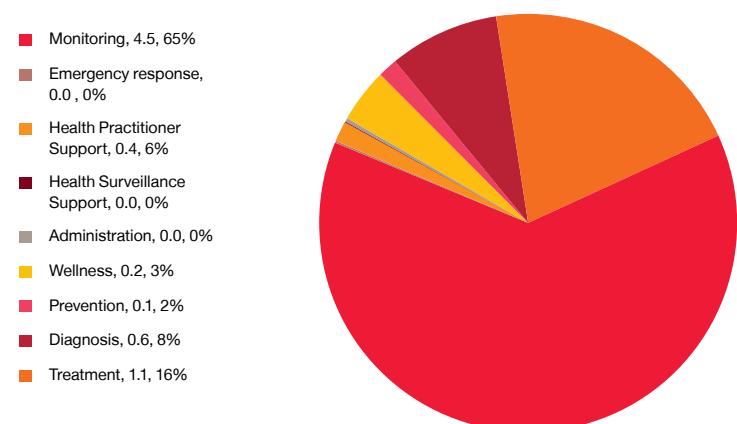
Contribution of various countries to the mobile health market opportunity in Europe, US\$ billion and %, 2017



Source: PwC analysis

The European mobile health opportunity will be led by Monitoring (65%) and Treatment (16%) service categories. Healthcare Practitioner Support (5.5%) is also expected to find significant adoption.

Mobile health market opportunity by service categories in Europe, US\$ billion, 2017



Source: PwC analysis

Opportunity in Monitoring Services

Monitoring is expected to be the largest market for mobile health services in Europe with about US\$ 4.5 billion revenue expected in 2017. US\$ 3.4 billion are expected to accrue from countries in Western Europe and US\$ 1.1 billion from those in Eastern Europe and CIS.

A large number of chronic disease patients in most European nations is expected to result in the increase in the adoption of Monitoring services. Independent ageing is also expected to significantly drive the adoption of Monitoring services. The ageing of Europe is likely to pose a challenge with the expected median age of 49 years by 2050³⁷, leading to a much greater adoption of such services beyond 2020. The contribution of independent ageing to monitoring solutions is greater in the Western European countries than in the Eastern European ones. For instance, almost 45% of revenues from Monitoring will be attributable to independent ageing in Germany while it will be only around 20% for Romania.

At an aggregate level, independent ageing solutions are expected to account for about 37% of Monitoring service revenues in Europe in 2017, corresponding to US\$ 1.7 billion. Chronic disease management solutions will comprise the bulk of the market with nearly US\$ 2.8 billion in revenue.

The chronic disease management sub-segment will be dominated by the monitoring of patients with cardio-vascular diseases, followed by the monitoring of patients with metabolic and respiratory diseases. For instance, monitoring of patients with cardio-vascular diseases is likely to comprise about 54% of the chronic disease management opportunity in revenue terms in Germany. Revenue contributions of monitoring of patients with metabolic, respiratory and neurological diseases to the chronic disease management opportunity are expected to be approximately 24%, 18%, and 4% in Germany in 2017.

Opportunity in Treatment Services

The rising incidence of chronic diseases is also expected to drive the growth of treatment services in Europe. For instance, the prevalence of diabetes among the 20 to 79 age group in Germany was almost 9% in 2010 and it has been inching up over the last few years³⁸. Similarly, in the UK, almost 25% of the population suffer from hypertension (identified and unidentified)³⁹. Treatment compliance services delivered over the mobile platform will find high applicability due to the potential to prevent exacerbation of long-term conditions in a cost-effective manner. Treatment services will mostly be delivered through apps in Europe by 2017.

Treatment services are expected to contribute about US\$ 1.1 billion in revenue in 2017, with US\$ 0.9 billion accruing from countries in Western Europe and the remaining US\$ 0.2 billion being generated from those in Eastern Europe and CIS.

Other Mobile Health Opportunities

Interestingly, the Diagnosis and Prevention opportunities in Europe are quite small because of the well-penetrated healthcare services market. According to a ranking of the best health systems in the world by the World Health Organisation in 2000, 21 out of the top 25 countries were from Europe⁴⁰. Opportunity in Diagnosis services (9% of the total mobile health revenue of Europe) is present primarily in Eastern European and CIS countries where the availability of healthcare personnel is not as high as in their Western European counterparts.

In Western Europe, fitness monitoring solutions are expected to contribute to more than 75% of the revenues of the Wellness segment. For instance, fitness monitoring will contribute about 80% to the revenues of the German mobile health wellness segment.

There are already some deployments in the European market in the Healthcare Practitioner Support category, wherein some hospitals have implemented solutions that disseminate patients' vital parameters to concerned physicians' mobile phones on a real-time basis. This has proven to improve the quality of life of physicians as they do not have to be physically present at the hospitals at all times.

³⁷<http://www.britishcouncil.org/networkeffect-berlin.pdf>

³⁸Source: Health Nutrition and Population Statistics, The World Bank, September 2011

³⁹<http://www.dh.gov.uk/en/Healthcare/Longtermconditions/tenthingsyouneedtoknow/index.htm>

⁴⁰<http://www.photius.com/rankings/healthranks.html>

Share of Revenues among Ecosystem Players

Mobile operators (about 48% revenue share), device vendors (31%), and content players (15% revenue share) are the ecosystem participants expected to lead the revenue market shares in Europe. Mobile operators are expected to derive most of the revenues from Monitoring (74%) and Treatment (13%) services. Healthcare providers have a smaller share (~6%) of the Mobile health revenue due to the limited Diagnosis opportunity available in Europe.

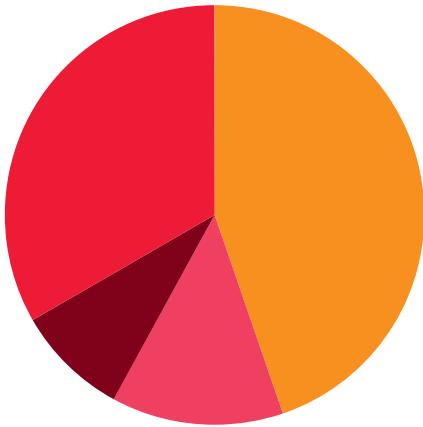
Latin America

Latin America's mobile health opportunity is expected to be US\$ 1.6 billion in 2017. Mobile health spend per capita would be US\$ 2.7 in 2017. Brazil, Argentina and Mexico are expected to be the three largest mobile health markets in Latin America with market shares of approximately 45%, 13% and 9% each respectively.

Contribution of various countries to the mobile health market opportunity in Latin America, US\$ billion and %, 2017

- Rest of Latin America, 0.5, 33%
- Brazil, 0.7, 45%
- Argentina, 0.2, 13%
- Mexico, 0.1, 9%

Source: PwC analysis

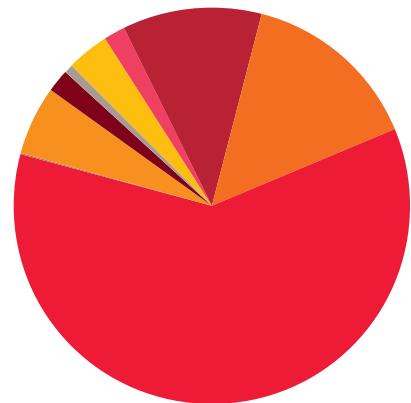


Countries in Latin America have relatively better healthcare access and income levels as compared with countries in other developing regions such as APAC and Africa. Therefore, the Diagnosis opportunity is relatively smaller in Latin America. The rising incidence of chronic diseases coupled with relatively increasing income levels will lead to significant opportunities in Monitoring and Treatment markets, which are expected to dominate with about 60% and 15% shares respectively.

Mobile Health market opportunity by service categories in Latin America, US\$ billion, 2017

- Monitoring, 1.0, 60%
- Emergency response, 0.0, 0%
- Health Practitioner Support, 0.1, 6%
- Health Surveillance Support, 0.0, 2%
- Administration, 0.0, 1%
- Wellness, 0.1, 3%
- Prevention, 0.0, 2%
- Diagnosis, 0.2, 11%
- Treatment, 0.2, 15%

Source: PwC analysis



Opportunity in Monitoring Services

A majority of the revenues from Monitoring are expected to come from chronic disease management solutions as the prevalence of chronic diseases increases. With increasing earnings, more people can be expected to use the costlier monitoring solutions thereby increasing their share in the overall mobile health market.

Independent ageing solutions will contribute to a small part of the monitoring revenues as the percentage of population above 65 years is small. For instance, less than 7% of the population in Brazil is above 65 years of age and only 3% of the population is aged above 75 years.

Over 90% of Monitoring services revenue, corresponding to nearly US\$ 0.94 billion, will accrue from chronic disease management solutions and US\$ 0.06 billion will accrue from independent ageing solutions for a total market size of about US\$ 1.0 billion in 2017. Brazil, the largest overall contributor in the region, is expected to have a chronic disease management monitoring services market of US\$ 420 million with independent ageing solutions contributing a further US\$ 30 million in revenues in 2017.

Monitoring of patients with cardio-vascular diseases will lead the chronic disease management opportunity followed by the monitoring of patients with respiratory and metabolic diseases. For instance, Monitoring of patients with cardio-vascular diseases is likely to comprise about 55% of the chronic disease management opportunity in revenue terms in Brazil in 2017. Corresponding contribution from monitoring of patients with respiratory and metabolic diseases is expected to be approximately 25% and 20% respectively.

Opportunity in Treatment Services

The increasing prevalence of chronic diseases is also expected to propel treatment compliance solutions to the second largest market opportunity in Latin America. For instance, the prevalence of diabetes among the 20 to 79 age group in Mexico was around 11% in 2010 as compared with the world average of approximately 6%. In terms of delivery of treatment compliance services, it is expected that the platform of choice will shift over time from SMS to apps as the penetration and users' comfort levels with smartphones increase.

The overall revenue opportunity in treatment services in Latin America is expected to reach about US\$ 240 million in 2017. Brazil alone will contribute approximately US\$ 110 million.

Other Mobile Health Opportunities

Diagnosis opportunity in Latin America is less compared to the other developing countries as access to healthcare is much better in the region. The number of physicians per 10,000 people in Latin America was 22 in 2009 as compared to the world average of 13 and the developing East Asian and Pacific countries' average of 11⁴¹. However, there is some opportunity (11% of the total mobile health market share) for Diagnosis solutions as there are certain pockets in the continent where healthcare reach is not adequate. Countries such as Brazil have already taken steps in the provision of Diagnosis services through telemedicine to tribal areas where healthcare reach is low. Argentina has also instituted pilot telemedicine programmes that give patients access to the best doctors without them having to travel long distances.

The revenues for Wellness solutions will be almost equally provided by information services and fitness monitoring. For instance, in Brazil, about 48% of Wellness revenues will come from information services.

Share of Revenues among Ecosystem Players

Mobile operators, with about 60% share of overall revenues, are expected to lead the revenue market shares in Latin America, with a bulk of their revenues coming from Monitoring and Treatment services (approximately 74% and 10% contribution to operator revenues respectively).

Device vendors are expected to have about 17% share, with revenues arising primarily from Monitoring services. Wellness applications are expected to result in opportunities for content and application players, who are likely to nearly 15% share. The share of healthcare providers is relatively lower (around 8%) due to the low contribution of Diagnosis services in the region.





The US and Canada

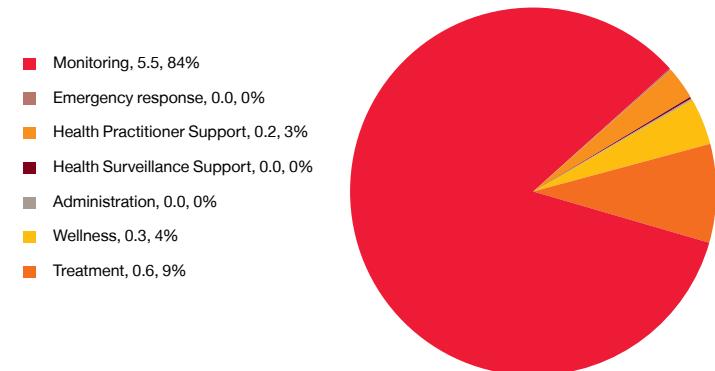
As in European countries, the US and Canada face rising incidence of chronic diseases and also have high ability to pay for services. Therefore, this region is also expected to contribute significantly to the global mobile health market.

The mobile health market in the US and Canada is expected to grow to US\$ 6.5 billion by 2017. Mobile health spend per capita will be US\$ 17.7 in 2017.

The US mobile health market is expected to be the largest in the world and is expected to reach about US\$ 5.9 billion in 2017. Alongside, Canada is also expected to be among the top 10 markets in the world with US\$ 570 million in revenues in 2017. This region is expected to be the third largest regional market for mobile health services.

Monitoring and Treatment services are expected to be the two largest contributors to the mobile health market in the US and Canada.

Mobile health market opportunity by countries and service categories in North America, US\$ billion, 2017



Source: PwC analysis

Opportunity in Monitoring Services

Monitoring, with nearly 84% share of revenues in 2017, is expected to dominate the mobile health landscape. It will be driven primarily by the rising incidence of chronic diseases. For instance, over 30% of the population in the US is expected to suffer from hypertension by 2017. The percentage of population suffering from obesity is also expected to be more than 30%. The incidence rates for other cardiovascular (e.g. coronary artery disease), metabolic (e.g. diabetes), and respiratory diseases (e.g. chronic obstructive pulmonary disease) are also on the rise.

Further, around 14% of the total population in the US and Canada are expected to be over the age of 65 by 2017 and with rising healthcare costs, relatively cheaper alternatives for elderly care are being looked at. This will lead to significant opportunities in independent ageing services and applications, further driving the Monitoring services market.

Revenues from independent ageing solutions are expected to reach US\$ 1.5 billion in 2017 and comprise over 27% of the Monitoring services market. In the chronic disease management segment, the largest opportunity will be in monitoring patients with cardio-vascular diseases (47% of revenues), followed by monitoring patients with metabolic diseases (39% of revenues).

Opportunity in Treatment Services

Treatment solutions are expected to provide the next largest share of revenue for this region and will be driven by the rising incidence of chronic diseases. For instance, the prevalence of diabetes among the 20 to 79 age group in the US and Canada was about 10% and 9% respectively in 2010 as compared with the world average of 6%. Also, similar to other developed markets, the services will be delivered primarily through mobile apps in 2017.

The revenue opportunity in treatment services is likely to reach nearly US\$ 0.6 billion in 2017.

Other Mobile Health Opportunities

Wellness will constitute about 4% of the total mobile health revenue. This will be mainly driven by devices that capture wellness-related statistics such as the heart rate and miles run while jogging, calories burnt during exercising, etc. In addition to these wellness devices, there is also a market for wellness information services. Almost all of the wellness services in the US are expected to be delivered through smartphone applications.

There also exists a market for Diagnosis services in the USA. According to the Health Resources and Services Administration (HSRA) there are 5,754 Primary Care Health Professional Shortage Areas (HPSAs) with 58.4 million people living in them. Thus, parts of the US might seem to be perfect candidates for the implementation of Diagnosis solutions. Yet, there are stringent rules when it comes to medical practice in the US. For instance, doctors are licensed on a per state basis, making telemedicine between states a difficult proposition. Further, the high proliferation of fixed broadband would also limit the uptake of Diagnosis services delivered over the mobile platform.

Share of Revenues among Ecosystem Players

Mobile operators are expected to garner a major part of the revenues (53%), with almost 90% of it coming from providing Monitoring services. Device vendors and content players are expected to have revenue shares of about 37% and 10% respectively. Again, the high expected market shares of mobile operators and device vendors are due to the higher contribution of Monitoring services.

Thus, it is evident that mobile health is likely to be a large value creation opportunity for multiple stakeholders—mobile operators, device vendors, content and application players and healthcare providers—across the world. The huge market opportunity for mobile health makes a strong case for all stakeholders to come together and collaborate to develop relevant services and applications. However, while there are several mobile health deployment across the world, only a handful have been able to scale up successfully. This indicates that a number of enablers need to be in place for mobile health to become the US\$ 23 billion opportunity.



Ecosystem players need to focus on key scaling factors to enable the mobile health opportunity

Mobile health is expected to be an important component of healthcare delivery in the future. However, it is unlikely to take off without a concerted effort from governments, mobile operators and device vendors across the globe.

Government thrust

This will be a key factor in scaling up the mobile health opportunity as governments are not only important stakeholders in the overall ecosystem but also in the position to influence mass uptake of mobile health solutions by healthcare providers, especially physicians.

Governments are important stake-holders in the overall ecosystem

Governments are key stakeholders in mobile health as they can be the buyers (for example, spreading prevention and awareness messages) as well as the providers and facilitators (for example, walk-in mobile telemedicine centres in rural areas). They also function as regulators, catalysts and influencers (through policy initiatives).

Therefore, when governments across the world embrace constructive policy agenda for mobile health, the market will start scaling up rapidly to its potential.

Government policies can encourage mass uptake of mobile health among healthcare providers, especially physicians

As a first step towards creating the thrust needed for scaling, governments must understand the transformative potential of mobile health in terms of reducing the overall spending burden of healthcare as well as promoting greater access for citizens, and mandate its use by public healthcare providers. It is also important for governments to incentivise private players through the formulation of policies and regulations that encourage the adoption of mobile health.

Further, government policy will most likely be the key positive influencer for encouraging mass physician uptake of mobile health. Governments have the authority to drive policies that will compel uptake. They also have the reach and funding needed to drive awareness and training among physicians on a mass scale.

Governments need to also engage proactively with industry players to build the confidence of all stakeholders, especially physicians, on the benefits of using mobile technologies for achieving healthcare outcomes. This will significantly help drive market growth.

For instance, the UK's Department of Health is planning to initiate a 'Three Million Lives' campaign, wherein it will provide leadership and advice to UK's National Health Service (NHS) as well as other social care organisations and work with industry players to reach 3 million people through 'telehealth' and 'telecare' solutions (Monitoring services)⁴². This initiative can be expected to provide a significant growth spurt to the UK's mobile health market. Similar initiatives, when launched by other governments, will provide a tremendous boost to the mobile health market globally.

Regulatory support

Currently, mobile health is not under significant regulatory scrutiny in many countries since it has not scaled up significantly yet. Many players remain unsure about when relevant policies and regulations may be introduced and what might be addressed by such measures. On the other hand, some countries seem to be following a 'one-size-fits-all' approach, wherein the rigorous standards of healthcare are also being applied to non-intrusive, non-critical mobile health services and applications. Such onerous standards will significantly dampen the growth of mobile health.

Rather than regulate work in a way that may hamper the market growth of useful services, regulators across the world must be careful to address the issues that can inhibit the growth of mobile health. In particular, regulations should be pro-innovation and aimed at introducing measures that enable affordable and ubiquitous healthcare. The key areas that need regulatory attention are the certification of devices and applications as well as standardisation and inter operability.

Certification of Devices and Applications

Regulators should facilitate speedy approvals for vendors and software developers. The intent of governments and regulators should be to enable the rapid creation of a healthy mobile health ecosystem that benefits both patients and market players.

Also, it is important for regulators (e.g. in the US and Europe) to follow a harmonised approach to ensure greater applicability of certified devices and applications across regions. This will encourage greater participation of device vendors and solution developers.

Standardization and Inter operability

Regulators will also have to work together to ensure that inter operability and standardisation guidelines are established for various mobile health ecosystem participants such as device vendors, content creators and healthcare providers. This will encourage multiple players to enter the market with their offerings, thereby encouraging innovation and increasing choices for physicians and patients. Further, the confidence and trust of both physicians and patients will increase due to well-defined and consistent ways in which they interact with various components of mobile health solutions.

Lastly, ensuring standardisation and inter operability among solutions will help develop plug-and-play solutions, making it easy for end-users to adopt mobile health services and thereby facilitate scaling.

⁴²<http://www.dh.gov.uk/health/2011/12/wsd-headline-findings/>; http://www.number10.gov.uk/wp-content/uploads/2011/12/8971-BIS-Life-Sciences-Prospectus-BMK_Spreads.pdf; http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_131689.pdf

Physician acceptance

The acceptance of mobile health solutions by physicians will be a key enabler for scaling up the market as physicians will also facilitate user adoption through recommendations. However, physicians' typically slow adoption of new technologies, along with the 'fee-for-service' mindset, could act as a dampener for the rapid adoption of mobile health.

For mass physician acceptance, government initiatives coupled with efforts from other players in the ecosystem will be crucial. Government policy will serve as the initial push for physicians to adopt mobile health solutions and once the comfort levels of physicians increase, they will start integrating mobile health into healthcare delivery.

Mobile health solutions can help reduce risk for physicians

It is important for the various players in the ecosystem to highlight the benefits of mobile health services and applications to healthcare providers such that the latter view mobile health as a complement rather than as a substitute. Mobile health can help reduce risk and errors. Around 33% of physicians feel they have incomplete information to base their decisions for around 70% of the patients⁴³. Mobile health can offer higher visibility to periodic data and more frequent patient interaction to enhance the efficacy of treatment.

Mobile health solutions can also improve the efficiency of healthcare providers and help treat more patients

Further, mobile health can also help improve the efficiency of physicians and other healthcare providers, allowing them to diagnose, treat and monitor more patients than the traditional face-to-face and in-patient route, thereby freeing up their time and resources to treat more patients and give better attention to more complex and higher value cases.

Ecosystem players should engage with healthcare providers and jointly run pilots

Well-established fact-bases on the impact of mobile health interactions are not available in many countries and regions. The creation of such fact-bases, through pilots and trials, may help allay doubts about its potential usefulness. Therefore, ecosystem players in various countries should engage with both governments and physicians to jointly drive pilots and demonstrate the efficacy of mobile health solutions.

This is required especially for opportunities such as Monitoring, Diagnosis, and Treatment solutions. While these solutions have massive potential, they need physicians to have greater belief in the ability of mobile health solutions to deliver health outcomes, for wider adoption. Feedback from leading players in the ecosystem also suggests that it is relatively easier to convince healthcare providers about the efficacy of Healthcare Systems Strengthening solutions but far more difficult to convince them of the transformational benefits of mobile health solutions focusing on Monitoring, Diagnosis and Treatment. Therefore, ecosystem players in various countries must engage better with healthcare providers, especially bodies and forums representing physicians, run joint pilots, and seek their inputs for developing and refining solutions to ensure greater buy-in.

User Adoption

Widespread user adoption will be the final factor that will drive the ultimate, long-term growth of mobile health.

Affordability, availability, and acceptability of solutions will drive user adoption

Apart from physician recommendation, affordability and availability of both content and devices will play a key role in achieving greater uptake. In developing markets, access to mobile health devices and content for wider sections of population can be supported by government policy. Besides availability and affordability of content and devices, another important determinant affecting the future adoption of mobile health services will be the acceptability of the platform and devices among consumers. For instance, chronically ill and elderly patients may be initially reluctant to manage their care through Monitoring solutions. Convincing users of the value of mobile health services and applications as opposed to visiting a physician might entail significant behaviour modification challenges. Therefore, it is imperative to create comfort and trust amongst end-users to utilise mobile health solutions focused on the Patient Pathway.

User-friendly, plug-and-play, localised solutions are needed to drive scale

Content players and device vendors must address patients' ability to operate mobile health devices. Many of the discussed challenges can be mitigated with easy-to-use interfaces and simple plug-and-play devices. Further, stakeholders need to also address literacy and language barriers as well as socio-cultural disparities. Additionally, for services, applications and devices aimed at the elderly, ease of use will be a significant driver (or barrier) towards adoption. The format of content must also cater to specific ailments such as amnesia, physical and mental dexterity, medications, or the complexity of the patient's medical condition. The focus should be on ensuring that users are able to safely operate and maintain in-home devices.

Partnering with healthcare providers will help overcome initial apprehensions

Further, tying up with major healthcare providers would also help mitigate initial anxiety or reluctance among individuals in adopting mobile health. Tie-ups can be in the form of co-branded services and applications or even in the form of healthcare providers certifying or attesting to the quality and effectiveness of solutions being offered.

Abbreviations

BWA: Broadband wireless access

CAGR: Compound annual growth rate

GNI: Gross national income

IVR: Interactive voice response

OECD: Organisation for Economic Co-operation and Development

PDA: Personal digital assistant

PPP: Purchasing power parity

SMS: Short message service

UN: United Nations.

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About GSMA

The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators, as well as more than 200 companies in the broader mobile ecosystem. To accelerate the development and adoption of embedded mobile health devices and solutions the GSMA's Mobile Health team is working with key players in the industry, including regulators, to understand the needs and reduce the barriers to mobile health adoption.

For the latest information on our Mobile Health programme please visit www.gsma.com.

We are delighted to hear from any players in this space so please email mobilehealth@gsm.org if you would like to join our programme or tell us about your mobile health solution or device.

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