

Vice Presidency of Sectors and Knowledge
Science and Technology Division

Innovation Note

Mobile Health

The potential of mobile telephony to bring healthcare to the majority

Mexico. Gabi is a teenager living in Benito Juarez. She doesn't know who to ask for information on sexually transmitted diseases.

The Bahamas. Lewis is an ambulance nurse in Nassau and he's just picked up two casualties from a car accident. On the way to the hospital he has no systematic way of communicating important details of his casualties to the staff that will meet them on arrival

Honduras. Larissa lives in Tegucigalpa and hasn't been feeling at all well. She finally decides to make the trip to the urgency room but she has to wait over two hours to see the doctor. Larissa didn't know that she would only have to wait 40 minutes at the primary care unit.

Peru. Andrea lives in the northern area of Piura, and has to take a trip into the city in order to get advice and checkups on her pregnancy. Andrea already missed several appointments last trimester.

Brazil. Lucas lives in Cuiaba and is a keen footballer –he recently had surgery on his knee and is supposed to go to the doctor to get his sutures checked, but the clinic is about 50km from home.

Bolivia. Felipe is 65 yrs old and lives north of Potosí. Felipe often makes a long and costly journey traveling to his doctor, just to get advice on how to control his blood sugar levels and medication.

Lucas, Larissa, Gabi, Andrea and Felipe are 5 of the 355 million people across Latin America and the Caribbean who own a mobile phone.

Why not harness the power of this mobile network for health?

Executive Summary

Acute and emerging epidemiological and demographic challenges to healthcare systems are encouraging the public sector to welcome and support the development of increasingly innovative approaches and initiatives in healthcare. Given that mobile penetration in the region is estimated at near 70%, if the easy-to-use mobile platform can be applied to healthcare to contribute to increased equity, this could contribute to improved clinical outcomes and productivity, as well as better public health monitoring and education.

Several positive factors support the development of m-services in Latin America today. Latin America enjoys high population coverage by the mobile phone network. Moreover, technology trends and usage culture are enabling. Indeed, there is potential for immense growth of more sophisticated 3G-based mobile services to be rolled out across the region. With better technology more mobile health services become possible. And as user charges go down, users will tend to use their phones more, for more functions. Currently, Latin America is home to several areas of good practice, including initial efforts to link its research institutions/universities with international centers. If this collaboration is supported and deepened, technology transfer from the more mature markets can encourage local innovation in the longer term. Development partners can lend support to mobile health initiatives through targeted interventions: a combination of diagnostics, technical assistance for market development, and pilot projects which together will demonstrate the impact and scale of m-health, enable market development and strengthen linkages across the value chain.

The remainder of this paper examines the current and emerging trends in mobile health, considering particular emphasis on lessons learned and potential opportunities for Latin America to apply mobile services to healthcare in an effort to bring health to the majority.

Category	Driver	Examples
Surveillance	Health System	Public health survey, PDA based data collection, Disease monitoring.
Information	Health System	Doctor appointment reminders, Primary healthcare information reminders.
Consultation	Citizen	Information on waiting times, Questions on STDs.
Education	Health System	Primary care behavior information.
Monitoring	Health System	Chronic disease severity information or testing, Drug reminders.
		Administration performance.
Diagnostic	System/ Citizen	Clinical diagnostic support.
	Health System	Ambulance to hospital early report.

What is the buzz about mobile health?

Innovation in development matters. It matters because applying new ideas to persistent problems can allow countries an alternative or complement to longer gestating reforms that may be vulnerable to political capture. Innovation is as imperative to productivity and competitiveness as human and financial capital; it can provide additional services and channels to conduct transactions. However, it is in developing countries where innovation can have a transformational as well as additional impact, providing novel ways to conduct business and enable financial and social systems to work better.

There is no invention that has provided more distinct opportunities in innovation for development than the mobile phone. The mobile phone has traditionally offered voice and data transfer tool to connect people. With improving capabilities and cheaper rates, it is a domain that provides a powerful space for innovation and, as it is subject to lower financial and educational barriers, provides a potentially wider sphere of influence than the internet has to date¹. As mobile phones reach increasingly remote populations, they are beginning to have a big impact outside their traditional service arena. Recent research infers that even the act of carrying a mobile phone increases feelings of safety in case of health emergencies, allowing connection when needed to the health system and others². But mobile phones can do more than that for health care today. And as technology essentially renders the mobile phone a mobile computer, enabling georeferencing and consumer centric adaptation, the mobile phone will do more still.

There are several distinct facets of mobile health today: the possibility for almost real-time communication and two-way information, the access capabilities that effectively jump the distance barrier between patient and doctor and the widening of the health sector to leverage public and private sector, allowing new roles to emerge and non traditional actors such as mobile network operators, to become involved in the value chain to provide innovative ways to develop healthcare.

Mobile health is a recent term, largely defined as health practice supported by mobile devices. For purposes of this note, such mobile health practice includes public health, clinical medicine and wellbeing, supported by mobile phones, and Personal Digital Assistants (PDA). Currently active m-health applications include the use of PDAs in collecting community health data, using the mobile phone to deliver healthcare information to practitioners, patients and non patients, and real-time monitoring for citizens, both patient and non patient alike.

Within the broader mobile-enabled development agenda (m-development), mobile technology is recognized as a resource for social development. An increasing number of pilot projects are testing m-health applications across the

1 Partly due to cost of internet- Internet access is still very expensive; establishment and maintenance of lines or wireless links is expensive.

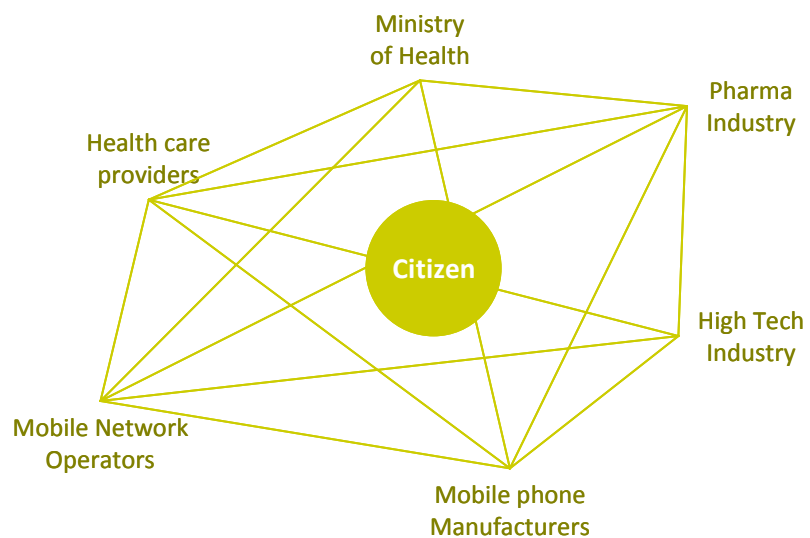
2 Research on the Economic and Social Impact of Mobile Communications in Developing Countries. The GSMA Development Fund Top 20. 2008. GSM Association.

globe. However, a strategic approach to scalable and sustainable m-health activities could potentially reap greater financial and social rewards. Further, within the context of development opportunities for the majority, since anyone can carry a mobile phone regardless of financial and social strata, it is the traditionally marginalized areas of society who can benefit most.

Acute and emerging epidemiological and demographic challenges to healthcare systems are pressing the public sector to welcome and support the development of increasingly innovative approaches and initiatives. Emerging fields in healthcare include biotechnology (gene therapy, etc), nanotechnology (instrumental in drug delivery, etc), as well as information technology (m-health). Together these offer a basket of new tools to address healthcare issues. That m-health is rapidly evolving as an industry is due in part to market conditions. Private sector companies, e.g., Telefónica and other mobile network operators (MNO), are responding to strategic and competitive issues, changing the shape of the traditional healthcare industry. One of the driving factors is a saturated mobile communications market; as a result, MNO companies are looking for optimal new ways to stay competitive by combining attractive bundles with the implementation of innovative mobile services which reduce churn and help the MNOs keep their clients and also increase revenue³.

In response to the public and private pressures, M-Health is emerging as a fresh sub sector. Integrating players and changing the responsibilities and hence working relationships between traditional categories of supplier and consumer, ultimately encouraging entry and growth of new players such as systems integrators and Mobile network operators (MNO), and partnerships in delivering services.

Figure 1: Citizen centric approach



³ Churn rate, the average number of customers that leave a subscription service during a year, is most sensitive in emerging markets.

A patient can now monitor his/her own health; a mobile network operator has become part of diagnostic and monitoring processes, a healthcare practitioner in some senses, and healthcare providers have become technology investors, and mobile phones have become monitoring tools. In this way, as with other mobile services, the value chain for health, both public and private sector, is changing.

Mobile health can add efficiency/efficacy to existing systems, facilitate new systems, and ultimately transcend healthcare benefits across society. Along the mobile health continuum, potential benefits include the following key aspects: increased equity, improved clinical outcomes and productivity, as well as better public health monitoring and education. The health benefits are not limited to active phone users - patients and those whose doctors carry a mobile phone – non mobile phone users can also benefit passively, from improved public health information and community awareness.

Table 1: Shared benefits of M-Health

Stakeholder	Potential Benefit
Citizens (patients and non patients)	Allows greater and interactive care services and information
	Awareness of benefit of healthcare may increase demand
	Allows information flow for better decision making
Healthcare professionals and management	Allows reallocation of resources away from duplicate or inefficient channels
	Allows greater decision support amongst clinicians
	Allows standardization and tracking of public health data
	Allows greater information on disease outbreaks to improve disaster and disease management/coordination

Finally, m-health figuratively mobilizes health care and health responsibilities by allowing the consumer more control, direct interaction and interconnectedness with the health system. It can lead to feelings of inclusion amongst traditionally isolated and disenfranchised populations. The remainder of this paper examines how Governments in Latin America can realize this potential for greater health access and quality, in particular for those in more remote, dispersed and poor pockets of the country.

Latin America and the Caribbean: what's going on in healthcare?

Health and health care are improving. Latin America and the Caribbean are making headway in achieving key health outcomes with few available resources, which is reflected in an increased life expectancy across the region. Life expectancy at birth was 51.4 years in the 1950-5 period. By 2000-5, this had increased to 72 years, a gain of more than twenty years.⁴

Figure 2: Maps of life expectancy at age 60 for the period 1950-2025⁵



Latin America and the Caribbean have prioritized the Millennium Development Goals in their health agenda. At this midway point, good progress has been made. Under-five mortality rate per 1,000 live births went from 82 in 1990 to 35 in 2006 and maternal mortality rates per 100,000 live births have decreased from 180 in 1990 to 130 in 2006. Looking at access indicators, the percentage of births attended by skilled health care personnel went from 68% in 1990 to 86% in 2006, and an increasing number of pregnant women are receiving prenatal care⁶. The proportion of children 12-23 months old who received at least one dose of measles vaccine went up from 76% in 1990 to 93% in 2006.

4 Sources: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2005 Revision, <http://esa.un.org/unpp>, Sunday, September 28, 2008; 12:33:51 PM; United Nations Department of Economic and Social Affairs (DESA): The Millennium Development Goals Report 2008. August 2008.

5 International Journal of Epidemiology at <http://ije.oxfordjournals.org/cgi/content/full/31/4/762/F2>

6 The proportion of women (15-49 years old) attended at least once during pregnancy by skilled health personnel increased from 77% in 1990 to 95% in 2005.

Table 2. Progress towards attaining the Millennium Development Goals for health

Goal	Target	Progress to date	Issues
Reduce child mortality	Between 1990-2015, reduce the under-5 mortality rate by two thirds.	Reduced number of deaths per 1000 live births by 50% since 1990, from 57 to 27.	Still approximately four times higher than in developed regions.
Improve maternal health	Between 1990 and 2015, reduce by three quarters the maternal mortality ratio.	The region has on the whole managed to reduce the rate by about one third, from 180 to 130 (2005). One key influence over this ratio is the presence of skilled health workers at delivery. Amongst those who give birth in healthcare institutions, 79%, versus 45% in 1995, are now attended by skilled personnel. Antenatal care improved with 95% women attended at least once during pregnancy by skilled health personnel, an improvement of almost 25% since 1995.	The majority of countries across the region still lie in the "moderate" range, between 100-299 per 100,000 (2005).
	Achieve universal access to reproductive health.	Adolescent fertility is fairly stagnant in the region, static while the total fertility of the region has declined.	There remains an unmet need for family planning which undermines achievements in this area - over 10% married women have unmet needs.
Combat HIV/AIDS, malaria and other diseases	Have halved by 2015 and begun to reverse the incidence of malaria and other major diseases.	Increase in proportion of those living with HIV/AIDS who are receiving ART, up from 57% 2006 to 62% in 2007. Concerning TB, the incidence rate per 100,000 (excl. HIV-positive populations), has almost halved since 1990, from 99 to 53. Prevalence rates have also declined, from 152 per 100,000 in 1990 to 67 in 2005.	Worryingly, the ratio of women: men who are affected is increasing. In TB, as elsewhere, the prevalence rate is decreasing faster than the incidence rate.

The combination of an ageing population, ongoing challenges to attaining Millennium Development Goals (MDG), and changes in the pattern of diseases is an acute emerging challenge. Making headway in key health outcomes is in of itself, a double edged sword; for example, the increase in life expectancy across the region will put additional burden on society.

The region is witnessing an epidemiological shift, characterized by a reduction of deaths and new cases attributed to Tuberculosis⁷, infectious diseases, malnutrition, diarrhea, and maternity complications in parallel with an increase of degenerative and lifestyle diseases such as cardiovascular disease, diabetes and cancer. Over the next ten years, deaths from chronic diseases are predicted to increase by 17%, and the major culprit is diabetes which may increase by as much as 80%. Research into causes point to lifestyle choices as the driving force, risks that will only increase with age⁸. Prevalence rates can be as high as 17-18% in the Caribbean. Certainly this represents one of the region's leading public health challenges⁹.

Disparities within the region also persist. Improvements have been uneven across countries and within society, and it is the indigenous and African descent populations as well as the general poor who are worst off. In terms of basic access to healthcare indicators, almost all births are assisted by skilled health care personnel in Argentina, the Bahamas, Barbados, Chile, Cuba, and Uruguay, while in Bolivia and Central America this happens only in 70% of the cases and in Haiti only in 26%. In Ecuador, indigenous mothers are less likely to give birth assisted by a professional health care provider and to receive prenatal checkup their pregnancy¹⁰. Looking at the millennium development goal in reproductive healthcare, the most pronounced needs persist in the poorest regions – 27% of women in the region's poorest households have unmet demand for reproductive healthcare, versus a regional average of 12%.

These differences are ultimately reflected in life expectancy figures both across the region and within countries. Life expectancy at birth in Haiti is 58.1 years, while in Barbados, Cuba, Chile and Uruguay it is above 75 years. Differences between social groups within country have in some cases widened. For example, in 2000, life expectancy at birth was 71 years for the Brazilian population as a whole, but only 65.7 years for people of African descent. In Mexico too, the non-indigenous population has a life expectancy of about 5 years longer than for that of the indigenous population.

Combating these problems requires a well managed health care system. However, the region is allocating to healthcare fewer resources than required and it is not using them in the most effective way. Spending on healthcare in the region is low, representing US\$536 per capita or 6.4% of GDP in 2005; thus the population's healthcare relies heavily on out of pocket expenditure, which represents 34% of total health spending¹¹. Similarly, resources designated to the sector are often not used effectively nor are new health technologies always adopted. For example, epidemiological surveillance is poorly organized and paper based in the majority of countries, which doesn't allow for timely identification of disease outbreaks and continuous monitoring. Under the

7 From 152 cases per 100,000 population in 1990 to 67 in 2006.

8 In 2005 for example, almost half of all women in Guatemala were rated as obese or overweight, with elderly populations at highest risk. In Brazil the number of women classified as obese doubled in the last 20 years, according to the Ministry of Health.

9 WHO Facing the facts: the impact of chronic disease in the Americas, Geneva: WHO 2005.

10 Giuffrida A. et al. Racial and Ethnic Disparities in Health in Latin America and the Caribbean. Country Department Andean Group, IDB. Washington DC. October 2007.

11 Source: <http://www.who.int/nha/country/en/>. In the year 2005, health expenditure in OECD countries was of US\$2,749 or 8.86% of GDP and OOP expenditure represented only 20% of total health spending.

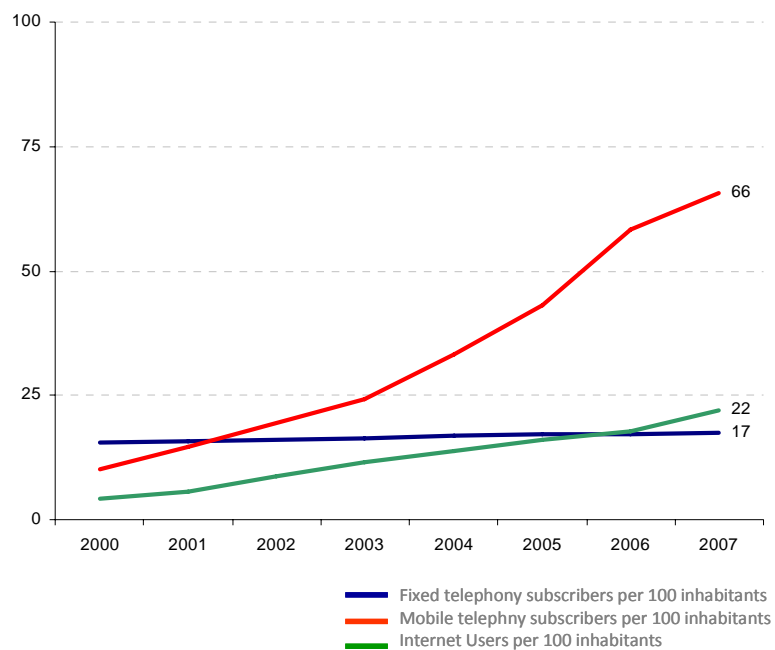
current paper system in Peru for example, it can take one month for a notification of tuberculosis (TB) and other disease outbreaks to reach the central database from Piura¹².

Health systems in the region are pressured to consider how best to use the new technology to face the new and old health challenges. As the Millennium Development Goals embody, the challenges posed to the health systems of Latin America and the Caribbean by changing epidemiological profiles and large social inequities are multifaceted. Infectious diseases, malnutrition, and disabilities associated with reproductive health continue to be serious problems among the region’s poor populations, indigenous groups and people of African descent. At the same time, degenerative and lifestyle diseases are pervasive among the entire population.

So why would M-Health work in Latin America and the Caribbean?

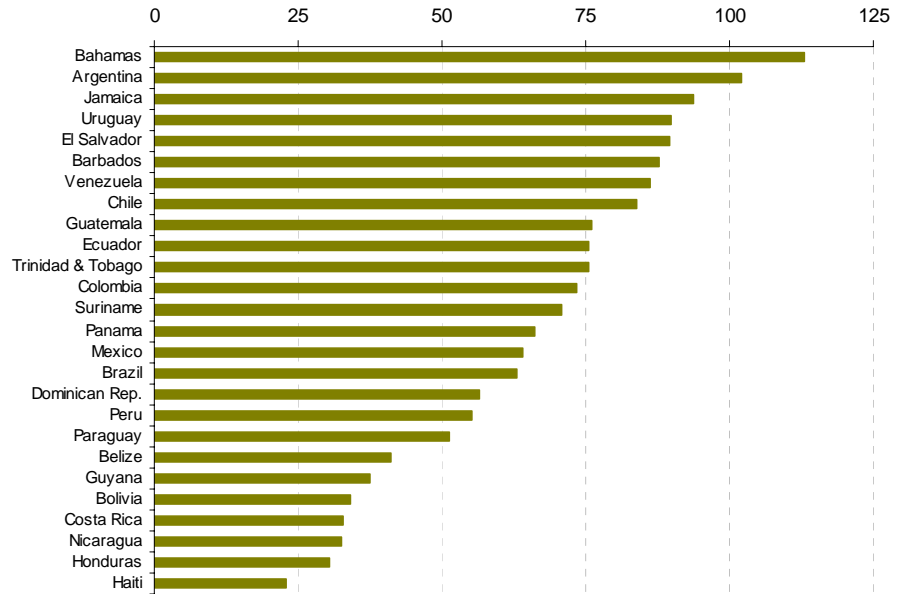
The potential benefit of the mobile phone as a tool in health care reform is evident. This is because of the combination of increasing penetration records, widening possibilities for communication and the easy-to-use platform which allows access to less technology-literate groups.

Figure 3: Evolution of fixed and mobile telephony subscribers and Internet users in the Region. Source: International Telecommunications Union (ITU).



12 Walter Curioso

Figure 4: Mobile telephony subscribers per 100 inhabitants. ITU 2007



Though this penetration rate differs throughout the region, with just 23% in Haiti, on average we can estimate that rates are above 65%. The mobile phone can offer these groups four ways to link up and interact with the network: voice, SMS, which provides almost real time channel, MMS, allowing multimedia content in a single message, and cell broadcasting, which allows geo-referenced bundles of messages.

How could this impact people’s lives? Of the 360 million who live on less than US\$300/month (the "majority"), 160 million are mobile phone subscribers. This allows direct interactive access capabilities to these groups for the first time. Though not a panacea, this is a real opportunity to improve health systems and benefit the majority. Getting m-health right will require an understanding of what is happening and what is possible across the globe. Table 3 provides examples of current and emerging practice.

Table 3: Selected Current practice

User Group	Application	Mobile technology	Example	Results
Health System	Disease incidence reporting and surveillance Disease surveys on PDAs for field data collection	Smartphone or PDA	Voxiva Alerta, Perú	Pilot results include faster collection time over paper collection (instantaneous versus up to one month).
	Public Health data Disease surveys on PDAs for field data collection	Smartphone or PDA	Nokia, Brazil	Pending. Anticipated results include faster collection time over paper collection.
	Public Health awareness Game applications to teach youth and target groups	Entry level phone	ZMQ India, New Delhi	Increased awareness of HIV/AIDS amongst youth groups. Now looking to expanding to Latin America.
	Public Health Information Gateway SMS questions regarding sexually transmitted infections (STI)/HIV sent to PC center and answers sent as SMS: in conjunction with e-learning system in schools	SMS	Learning about Living, Nigeria	Regularly 200 texts received per day.
	Public Health Disease management Aims to increase level of drug compliance and reduce the need for daily health monitoring. Patient uses special litmus paper to test urine- if in compliance the paper shows a certain number which is texted via SMS as Proof of drug compliance. The SMS are monitored by doctors and nurses. - in return patient then receives free minutes.	Smartphone	X out TB, Nicaragua	Conditional minute transfer scheme : achieved higher compliance of patients taking TB drugs in trial stage.
Healthcare Provider	Remote diagnosis decision support Program of decision making tree to support clinician diagnoses.	Java enabled phones or PDA	Commcare	Reduces isolation and increases professional confidence/motivation and credibility of community health workers.
	Ambulance-hospital pre-diagnosis detail Application whereby ambulance nurse transmits data through smart phone on casualty condition and history to hospital where staff have access and can then prepare arrival needs.	Smartphone	Athens trial	Reduced time before an ambulance patient is seen by a doctor.

User Group	Application	Mobile technology	Example	Results
	Health administration management Forms uploaded onto handheld device which can be sent to central database	Smartphone	RIM	Reduced time to fill in forms 5-3 min per patient; Saved \$25,000 per review nurse pa. Time allocation shift to more patient care. Reduced errors. Time allocation shift to more patient care.
	Patient recording: Charge capture and rounds Forms uploaded onto handheld device which can be sent to central database	Smartphone or PDA	IQMAX	20% increase in revenue and saving of 90 minutes per round per day. Physicians report their quality of work higher since allows greater organization
	Interactive access to patient records/lab tests Handheld device with connection to central server and e-health system	SMS	Torre vieja Hospital, Spain	Jumps distance barrier between doctor and patient- allows doctor instant and anywhere access to patient results. Patient healthcare goes mobile. Requires e-health system.
Patient	Chronic disease management Self management application uploaded with connection to server on nutrition regime. Reports on the patient are also sent to a physician.	SMS	Bewellmobile, USA	In diabetes the average blood sugar level dropped 1% in one year. Involved patient in own care more and provides patient centric flexibility as program can be loosened or tightened according to monitoring needs and risks.
	Chronic disease management Placing a litmus paper stained with one's blood on the device shows one's blood-sugar level.	Smartphone	LG, Korea	Design/Pilot phase. LG said that the phone will be helpful for busy people to keep their body in check against obesity, stress and diabetes.
	Chronic disease management Nurse based telephone care service, linked with key clinical events and outpatient visits	Voice	Ministry of Health, Chile	Successful results in glycemia levels, healthy eating, blood pressure, self care perception and perception of health ¹³ .

13 The case of Chile. Control group trials in Chile's largest commune have shown pretty impressive clinical results, in glycemia (aggregate of how doing over last 3 months), blood pressure, perception of efficacy and perception of health as well as possible cost savings: Eg Healthy eating: increase the number of days a week that they ate healthily from 3 to 5-5.9 days. Blood pressure: expected 13-70: significant difference at 12 months. Analysis also being conducted regards potential cut costs by lowering visits to the emergency room.

User Group	Application	Mobile technology	Example	Results
	<p>Remote diagnosis Patient can send responses to survey or photos of the affected area to the hospital server for the doctor to download and send SMS medical advice through a PC.</p>	Smartphone	Dermamóvil Telefonica, Spain	Reduced number of visits to the specialist Perceived augmentation of quality of healthcare. The patient also received continuous on demand monitoring.
	<p>Hospital performance communication Patient can SMS to a central number to receive notifications of waiting times.</p>	SMS	Torre Vieja Hospital, Spain	Reduced waiting times to less than 40 minutes.
	<p>Hospital patient communication Patient enrolls in system to receive SMS notifications of upcoming appointments.</p>	SMS	Texts for Health, Vodafone and Imperial college, UK	Reduces missed appointments with family doctors by 26- 39%, and hospital visits by 33 up to 50%. Annual savings of GBP 300 million.
	<p>Hospital Patient Communication Weekly notifications and advice throughout pregnancy. Patient signs up online or through kiosk at the hospital.</p>	SMS	Mobile Milestones, University Hospital South Carolina	Can lead to increased patient awareness and also less missed appointments which can result in safer deliveries.
Non patient use	<p>Self wellness check and progress in nutrition Nutrition balance to measure one's fat level. After entering one's name, weight, and height, a slight touch of the finger on the measuring device displays one's body fat level. The measured data can be estimated by daily, weekly, and monthly units in a graphical chart.</p>	Smartphone	Samsung, Korea	Piloting
	<p>Self wellness checks Use embedded device in phone to check your vital signs eg blood pressure, BMI Index</p>	Smartphone	NTT DOCOMO, Japan	Predicted to come out 2008

Along the continuum of technology in healthcare, different m-health applications are being used in different ways, depending on the specific country health demands – In general terms more developed health care systems are concerned about increasing cost pressures brought on by ageing populations and wastage of care more than urgent access issues which are the primary burden in less developed systems. Here, m-health services tend towards preventive care and support for wellness- essentially helping individuals take care of their health before they become patients. For example,

in the US m-health applications are emerging out of necessity to make overburdened systems more efficient. On one side of the spectrum, there are some smart devices and borderline sci fi applications that exist currently in the lab and testing grounds – IBM is working towards the “smart medical home”, aiming to personalize medicine for the consumer. NTT Docomo is on the verge of launching a “wellness handset”, complete with a built in sensor which can measure body fat, heart rate, halitosis, pedometer, plus onscreen applications. This allows the user to build up their own “mobile” medical record and give access to health care professionals as necessary. Let’s face it, given that the private sector in areas such as transport (GPS), entertainment (iPod) and even government services, are becoming more consumer centric, allowing consumers to adapt services for their specific needs/demands, there will be no reason why our healthcare service delivery mechanisms cannot be more flexible and personalized also.

Further, the first 'ubiquitous health care' service, which manages disease with the mobile terminal including the cellular phone, was introduced in September 2005 in Daejeon, South Korea. This ‘Mobile Healthcare’ system connects a patient with the medical treatment center using a mobile terminal connected to wireless internet, and the remote medical treatment service without the temporal / spatial restriction – this enables citizens to check and manage their own health condition.



Enabling efficiency for hospitals: The case of Torrevieja

Torrevieja Hospital, located on the south coast of the ‘Comunidad Valenciana’, in the Alicante, Spain, opened its doors in October 2006, serving a population of 200,000 habitants which swells to a maximum of 600,000 during the holiday season.

To manage the fluctuating demand, Torrevieja developed an electronic medical record- Florence - created by the internal systems management team at low cost. This system was created to suit the organization needs of the hospital, and catered to suppliers software requirements, enabling full synchronization between different management area systems. Florence, a computer health management system covering all the business of a hospital, is the key success factor in this initiative.

Technology used by patients. Patients can text the word ‘URGENCIAS’ to 5013, and receive information on the waiting time of the different emergency points; Patients can receive reminders about their general appointments and receive alerts about radiology tests by SMS. Another important function is georeferencing- allowing relatives to follow the whereabouts of the patient (eg operating room or emergency room) by means of a code from any of the computers located at the hospital access points.

Technology used by doctors. Doctors use SMS for receiving lab test results; surgeons use the surfable, a mobile table-computer, which allows them to access patient clinical history from the surgical table. Finally, doctors and managers receive alarms via SMS regards hospital performance.

Technology used for management. Florence is also used for management purposes and offers information about waiting time in emergencies, surgery performance, appointment performance, etc. All of this information contributes to evidence based decisions making. But this system does not just involve hospital management. All hospital executives receive a personalized balanced scorecard by SMS on their mobile phones every morning.

Results

- Significant drop in waiting times after first year implementation of SMS service: reduced time to less than 40 mins. on average
- Patient satisfaction: in 4 surveys 9 of 10 points were obtained, which is the highest result among Spain's national hospitals.
- Efficiency: highest in Spain healthcare and cost efficiency rates, 4.2 days of hospitalization average time, 57% outpatient surgery acts, 17,000 surgery acts made during first year.
- Shareholders satisfaction due to above projection cash flow and profit margin performance

For Latin America, which applications are most likely to accelerate access and address key health issues for the majority?

Current pilot applications in m-health across the region have focused on data monitoring and voice based disease management; now it is time to move on to applications which take full advantage of the technology available to the region for health.

Different healthcare priorities will lead to different approaches to using mobile telephony in healthcare. However, it is important to emphasize the following applications which could be easily implemented with low upfront investments and demonstrate value in the short term, to achieve better and more accessible healthcare for the majority. These services focus on health education, in particular on prevention, information and monitoring:

- Games to teach youth and target groups
- Messages with tips on preventive health habits
- Messages with tips on precautions to reduce exposure to diseases
- Messages with tips for pregnant women, baby care, hygiene, and nutrition, among others
- Early alerts on pollen and other issues (location specific alert delivery may be possible)
- Medical appointment reminders
- Drug intake reminders

Apart from using SMS, MMS or voice messages, one cheap option in delivering information to mobile phones is Unstructured Supplementary Service Data (USSD), which is the standard for transmitting information over GSM signaling channels. USSD's main characteristics include advantages such as real-time interaction, response times that are quicker than SMS in general, and no overhead/additional usage costs; however, there is no store and forward capability and remains network dependent.

What are some of the issues to consider in supporting m-health in the region?

Figure 5: Is Latin America ready to absorb the benefits of m-health?

Positive factors	Technology trends Technology transfer Usage culture
Context issues that require attention	Some services require existing e-Health systems to be in place Fragmented smartphone markets may hamper smarter applications ¹⁴ High percentage of prepaid users, which could limit options to provide some data-based services
Enabling environment issues	Security and privacy Interoperability Sustainability of business models

Several factors suggest that Latin America and the Caribbean may be ready. Latin America and the Caribbean enjoy high population coverage. Coupled with this, unlike in Africa where many users share mobile phones, 81% of mobile users in Latin America and the Caribbean own their own mobile device. Technology trends and usage culture are also encouraging. As Figure 6 shows, GSM is the dominant technology in the region, being present in 80% of handsets in South American by end 2007.¹⁵ Research predicts that there is potential for immense growth of more sophisticated 3G mobile services to be rolled out across the region.¹⁶ With better technology more mobile health services become possible. And as rates go down users tend to use their phones more. In addition to this, handsets are becoming cheaper and smarter and, though the global replacement cycle is lengthening, this is not the case within the ‘young adult males’ segment¹⁷ and in this area throughout the region, there is growing replacement demand, increasingly replacing entry level phones with middle of the range handsets providing more functionality – which serves to expand the future m-health application frontier.¹⁸

14 The smartphone market is fragmented in several technologies: Symbian, Windows Mobile, BlackBerry, PalmOS, and most recently Android.

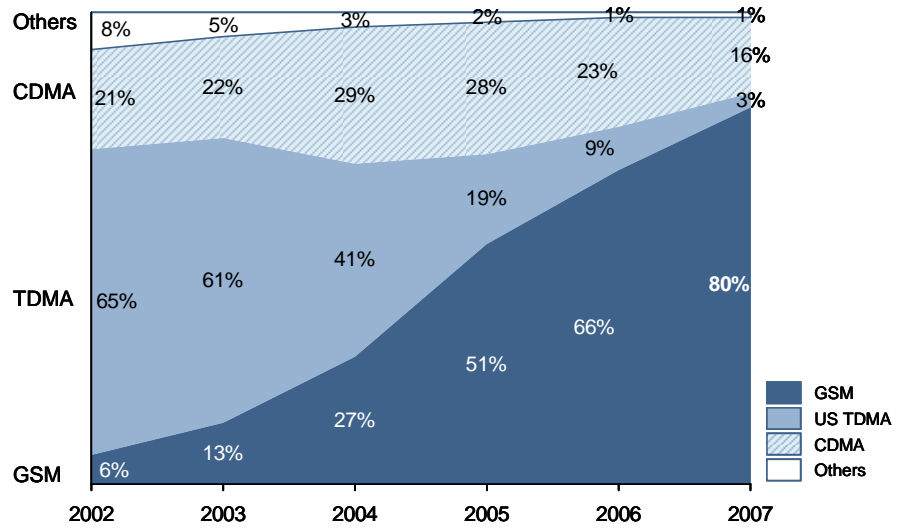
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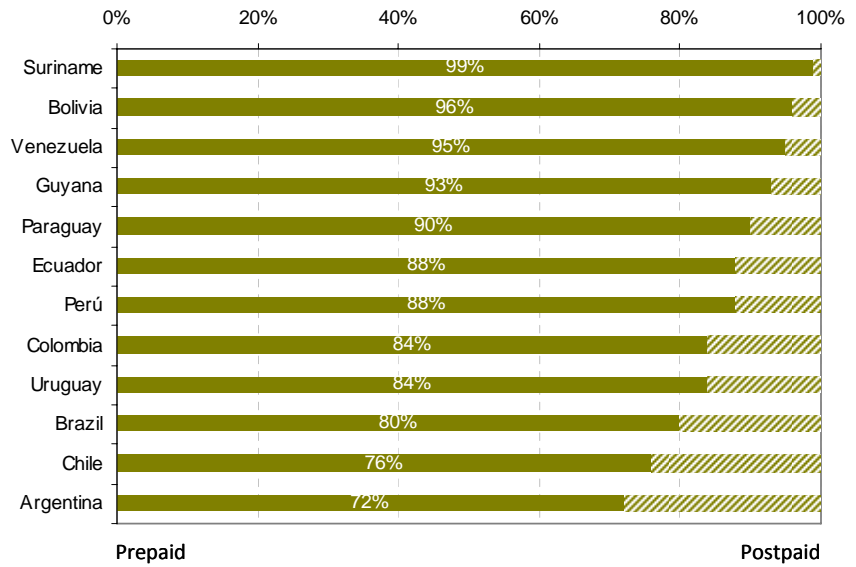
18 3G for all project to offer cost effective from 3G Americas

Figure 6: Mobile Network Technologies in South America



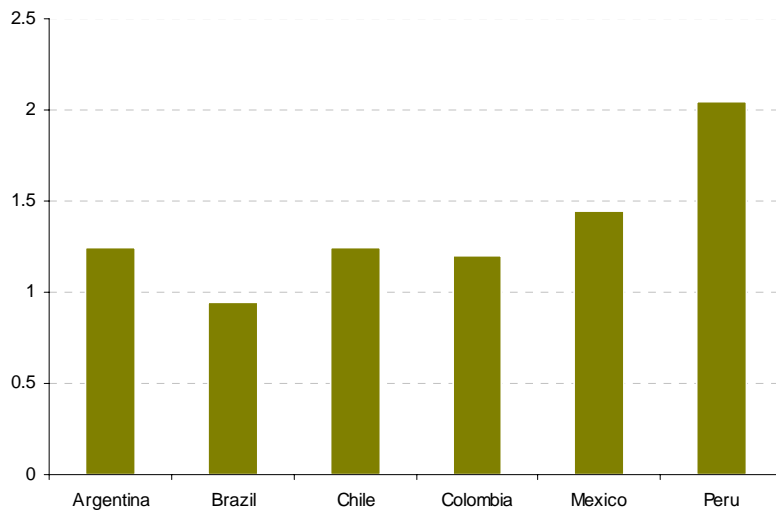
Latin America presents some specific issues of debate for the m-health industry which affect the potential for complex mobile health applications. There are some m-health applications, especially regards administrative efficiency, where implementation of e-health systems is a necessary precondition. Though some applications such as SMS notification and PDA enabled data collection bypass e-systems requirements, other applications require adequate back end systems, such as demonstrated by Torrevieja’s experience with *Florence*. Latin America and the Caribbean suffer from an absence of integrated ICT systems, and one of the causes is lack of capacity in locally driven technology development. Without software developers and systems integrators it will be difficult to produce homegrown solutions making the applications more costly, with the consequence of lower chance of acceptance and success. Lastly, mobile phone usage may also create future hindrances to m-health development. This is because the majority of mobile phone users in the region are prepaid subscribers (82.5% of all mobile lines in Latin America and the Caribbean are prepaid).

Figure 7: Distribution of postpaid and pre-paid mobile subscribers



According to one recent study, prepaid users pay up to 29% more for their services¹⁹. Moreover, MNOs cannot currently bill prepaid users for data transfer, thereby restricting available functions for prepaid to just voice and SMS – a future constraint for smarter applications.

Figure 8: ARPU as % income per capita. Source: GSMA and World Bank 2006



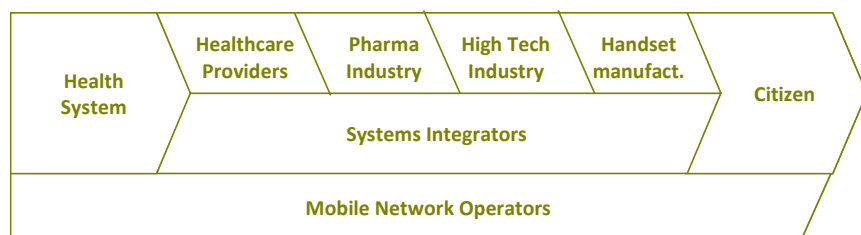
19 Nokia

Issues of current debate. Currently debated topics in m-health include the enabling environment , that is, the set of conditions necessary to have the greatest chance of success in market development. And in a new industry where business models are not yet stabilized and demonstration of commercial feasibility is required to attract the private sector, the enabling environment is particularly key. Both the public and private sectors are grappling with some fundamental issues surrounding business models, standardization of technology, and regulatory issues, including security of information.

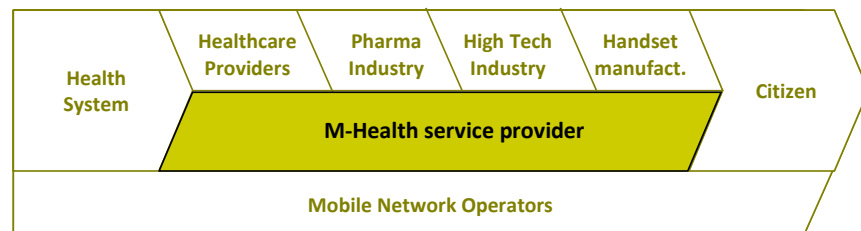
As with all ICT enabled services, privacy and security are paramount. Any m-service field which comprises mobile telephony *plus* sensitive data transmission straddles several regulatory domains of payments, telecommunications and consumer protection. Further, the cross national aspect means that services are subject to differing laws and standards. Given this, coordination to ensure security of networks is difficult and the risk of breakdown is high. Ultimately service providers can and must turn to general data protection and privacy principles in countries where they do business as a starting point. Building on this, where e-services exist, these will provide further guidance.

Private sector companies are currently grappling with the issue of identity-what are they trying to achieve -new customers, additional revenue streams, or new approaches to customer retention? what is their business model? Do they act as a channel, do they invest in software development and license this, or do they invest and sell to their customers alone? Many Mobile Network Operators are conducting their own research through demand analyses and pilots, as well as looking to similar more developed m-services fields, such as m-banking, for guidance. The following diagram provides a framework for thinking of the different options for partnership along the m-health value chain, to deliver healthcare to the citizen.

Figure 9: Value chain of mobile health



The m-Health value chain creates space for a new actor



As you can see, currently there are three real options: the public sector, private sector or a hybrid (most likely a public-private partnership), who can drive the service. The **M-Health service provider** is a new technology-based actor in this space. It can be public-funded, private or a PPP. It would offer value-added services by connecting the health system and health care providers with the citizen's mobile phone over mobile networks. This option would guarantee interoperability across health care providers and MNO with different network technologies.

How to do it? What are the salient factors for success?

Innovation is just invention unless it enjoys practical application – it has to work in reality to have an impact. It's all very well to prove the technology - but it is not only technology which drives change; rather innovation in management and other processes that together drive the adoption of beneficial technologies for good. Those projects that have achieved particular success or scale have done it through an integrated locally drive initiative, with high political support, good public-private partnerships and a pervasive communication strategy across the value chain.²⁰

Countries who want to use mobile health to extend healthcare need to develop strong partnerships. There are two main elements at play. Firstly, along the chain, complex actors have different foci/motivation e.g. mobile health has to make commercial sense for the mobile network operator and social sense for the healthcare provider, and strategic sense for the Ministry of Health. Second, the end users must be factored in from the very start, since they can often make or break an application. In order to mitigate this risk a high degree of consensus building is needed from the start.

Issues and the future from a Handset Manufacturer's viewpoint: Partnerships across the value chain are key

Mobile service providers must build applications that work across a wide range of handsets. Services must be transferable across devices over time.

An m-Health architecture, therefore, cannot be reliant solely on the power of the handset but must also include a centralized (or series of decentralized) repository and/or service backbone system. This is particularly necessary in order to provide services across handsets with differing processing capabilities. M-Health services are unlikely to be able to sustain high transaction or subscription costs.

Taken together, these factors indicate the tremendous possibility of m-Health services; however, there are significant challenges to resolve before such services will enjoy widespread distribution and usage. As part of its consumer Internet services strategy, Nokia is seriously considering where and how to enter the m-Health value chain.

²⁰ During research, the team spoke with many practitioners to identify critical factors for success/failure of their initiatives and these were prioritized in the majority.

Among other ideas, a common, global platform that supports a number of connected healthcare and/or wellness services is under consideration; however, the consumer-facing services built on such a platform and offered to the market would almost certainly differ by region. There does not appear to be any one-size-fits-all approach to healthcare in the mobile space (or any other).

Nokia has not ruled out the possibility of integrated devices; however, this decision has not yet been made. Irrespective of whether a product, a product plus services, or a stand-alone services approach is chosen, Nokia expect to approach the market from a partnership stance rather than an isolated effort by Nokia. The healthcare value chain demands an element of trust and expertise that is not core to the current business of Nokia; therefore, Nokia expect to partner with well-respected private healthcare entities (and perhaps others) in order to successfully address this market.

Successful programs require clarity and realism of what can be achieved and therefore it is paramount not to lose sight of the strategic vision of the whole health agenda. Secondly, don't begin with the technology- begin with the problems you are trying to use technology to help solve. Lastly, Governments cannot apply global good practice models without adjustments to the environment and the peculiar health issues of the country. Therefore, decisions regarding using mobile health as a tool in healthcare should be based on policy relevance, value chain feasibility, and the potential for wide dissemination.

Enough Technology for the Sake of Technology

In the mid-1990s, with the dot.com boom in high income countries, dialogue and action towards minimizing the digital divide in low and middle income countries favored bringing computers and Internet connectivity to the masses in an effort to achieve development objectives without serious consideration for what those objectives were.

Key sectors that could benefit from connectivity were named, such as Education, Health, Agriculture, etc. But it is difficult to explicitly identify what aspects of those sectors might benefit most from the use of information and communication technology (ICT). Ministries of Health, including Egypt, in an effort to keep up with the technology trends, prioritized the acquisition of computers for their staff and clinics. A decade later, they are now posing the question, "Technology for what?"

More recently movements by the WHO Global Observatory for e-Health and other key e-Health policy makers have emerged towards the development of National e-Health Strategies. Many of the computers, purchased in the 1990s, however, remained covered on the desks of their original recipients due to the lack of training in how to use them, lack of capacity in upgrading software and maintaining hardware, and lack of vision for how these devices could be used to influence the attainment of key strategic health objectives. These conversation pieces have become the archeological remnants of development investments.

These early failures to leverage technology to support health have yielded great hesitation among health policy makers. But, it is not the technology that is to blame. It is the lack of planning for all of the other moving parts that need to be in place to ensure that the technology can do what it is meant to do, namely automate processes, create efficiencies, create standards, improve access to information, enhance communication, and ultimately improve access to healthcare, quality of care, and health outcomes.

The lack of strategic vision, planning, and appropriate budgeting have hampered the ability for e-Health to gain traction in low and middle income countries where resources are already spread too thin.

Fast forward to 2008, when the technology that was disregarded in the digital divide discourse, the mobile phone, is attracting interest within the health sector. A few recommendations that will help ensure the success of m-Health are: 1) study how members of the general population and the health sector are already using mobile phones to support health and leverage these patterns through the creation of standard protocols, 2) clearly identify target health objectives (particularly those contributing to the Millennium Development Goals for health) and how the mobile phone and relevant software applications can best be leveraged to achieve them, 3) involve users and target beneficiaries in software design/development processes, 4) set clear measures of success and evaluation systems to help establish the evidence base needed for scale up and policy making, and 5) allocate the necessary resources to support overall implementation, infrastructure, software adaptation and development, maintenance, training, and upgrading.

While there are a growing number of m-Health pilot projects, studies, and reports that provide learning for those new to the field, the work of SatelLife in the use of PDAs for data collection and improving access to health information for health workers in Africa provides a solid case study of a strategic approach to the use of mobile technology. The focus on monitoring and evaluation throughout the implementation process is a welcome contribution to the evidence base for m-Health and has positioned the organization well to scale up an enhanced version (Gather) that incorporates lessons learned from early experiences.

Using a slightly different strategic approach, the Millennium Villages Project in partnership with Ericsson and mobile phone operators in 10 African countries has prioritized key m-Health interventions that specifically target the achievement of the MDGs for health, including improving access to emergency transportation through a toll-free number, improving real-time monitoring of births and deaths for enhanced planning and service provision, and improving service delivery through decision support tools and systems for health care workers- including telehealth.

Technology is a tool and a means to an end, but it is only as good as the structures within which it is integrated. Over half the world's population has a mobile phone. Not only is m-health an increasingly critical component of e-Health, it is part of a growing body of m-Services. It is now up to the health sector in partnership with mobile phone industry partners to identify how best to leverage it to improve health and well-being and establish a business case that will ensure its sustainability.

Table 4: What stops projects from getting to scale?

Project	Implementation	Critical obstacles to scale-up
<p>Nigeria. Learning About Living project.</p> <p>SMS based Question and Answer service for HIV/AIDS awareness and prevention program</p>	<p>Implemented nationally with much initial success. Complemented e-based learning in schools.</p> <p>Implemented in partnership with NAC (content provider) and MTN network.</p> <p>Finances: Project pays for all texts.</p> <p>Results: 28,000 texts received since November 2007. Average 200 per day plateau. Feedback survey to be arranged October 2008. The project is trying to gain Rockefeller grants to introduce this in Mexico.</p>	<p>Network rates: Had negotiated a reduced rate tariff from MTN but now they want to open the service to Celtel and Star comm. They face financial negotiation difficulties.</p> <p>Project funding: In addition to network rates, they aim to keep the service free which would allow them increased reach to more remote and poorer youth, and so are trying to find funding from Government ministries et al including underwriters such as MTN foundation to support the project.</p> <p>Technology and network difficulties: During this first year the service has faced occasional network problems including company charging premium rate of 50 naira a text, which had volumes at an all time low. In addition, customer retention dropped because the networks experienced sporadic delays of 3 days in responses/lost messages.</p> <p>Customer feedback: Difficult to monitor the feedback with those who do not report problems – so no idea of the numbers lost due to technical difficulties.</p>
<p>Western Europe.</p> <p>Chronic disease management</p>	<p>Nokia feasibility trials (sugar monitoring).</p> <p>Plug sensors and monitor into the phone and upload details which provide a read out of blood sugar levels.</p>	<p>Wrong time in the market (1993). Complex and expensive devices were not commercially viable according to a customer demand survey conducted in Western Europe. Too many special devices were necessary, and public had little education on the benefit to them of this mobile based m-health application. Also, was device-centric.</p>
<p>Nicaragua. MIT Innovations in international Health initiative.</p> <p>Public Health management: X-out TB: TB therapy adherence.</p>	<p>Feasibility trial conducted whereby patients more in control using MIT based technology and those in compliance of less than 5 times forgetting a month received phone based credit.</p> <p>Implemented by MIT I in IHI.</p> <p>Finance: MIT grants.</p> <p>Costs of this therapy are only 45% of standard healthcare. Another pilot currently being implemented in Pakistan. Again funded by MIT although agree that Government and Health care provider should be funding the program.</p>	<p>Marketing: (i) Cost-Benefit Awareness: difficult to increase active awareness or the benefits of investing in new technology to integrate into current system ie difficult to communicate and justify initial investment.</p> <p>(ii) Cultural acceptance of technology to complement traditional system: Difficult to change the current community based system to a completely remote based system.</p> <p>(iv) some technical problems with litmus testing paper.</p>

Project	Implementation	Critical obstacles to scale-up
<p>South Africa. On cue. Patient Management and Care.</p>	<p>SMS reminders. Run since 2002 in partnership with Cape Town Health Directorate.</p>	<p>Cultural Acceptance: Lack of ownership at clinic for implementation meant that there was no proactive participation of staff who didn't see the benefit to their routine of using this new system. Cost effective for clinic and patient but benefit to staff not clear. Staff were also frustrated since they were not involved nor consulted on the project from the beginning.</p>
<p>Peru. Data collection project.</p>	<p>Pilots in real-time disease surveillance, with PDA based data collection in 3 cities across Peru. University in Lima, supported by National Institute of Health in Peru and also research support from University of Washington in St Louis.</p>	<p>Funding.</p>
<p>Peru. Information exchange between health centers.</p>	<p>Information exchange between health centers re mother and child health at the Amazonic basin.</p>	<p>Internal political reasons and bureaucratic issues at the implementing agency which ended in financial sustainability issues. Also, there were technical issues: models being used there only supported very short SMS which were limiting, as only very short questionnaires could be sent.</p>

What opportunities do the Donor partners have to support this?

A combination of reforms is needed to protect and further the health gains in the region but m-health can be a tool. The Latin America and the Caribbean region is well positioned to take advantage of lessons learned from abroad, and to build on what has worked to make m-health work for the region’s future. So why has it not developed? Research infers that a combination of reasons persist, including lack of awareness of the potential benefits, risk aversion on the part of government, unclear role of private sector actors, and lack of capacity for m-health oriented software development. There is thus a strong case for donor support, but how can donors best get involved? Table 5 below lists three main areas of need, based on analysis of cases to date:

Table 5: Needs and Recommended action

Gap	Need	Why?	How?
Diagnostics	Successful environment and business models	Two of the problems in the nascent sector are scale and sustainability- the value chain needs to work out how to approach mobile health to achieve clinical outcomes with scale and which are sustainable. First, the public and private sector need to understand what is needed to support an enabling environment for m-health to grow. Further, if the MNO cannot see its bottom line they will not be able to scale up services commercially.	Support continued regular dialogue between value chain actors to broker discussion on complex regulatory issues, analysis of business models and give specific support to the R&D+i work of the MNOs and other High Tech companies.
	Systematic information collection to increase knowledge on cost-benefit of m-health applications	The state of knowledge and awareness on m-health is fragmented across the region and across value chain actors. By helping public and private sector decision makers tap into global good practice donors can disseminate knowledge and enable technology transfer to the region.	Donors may support coordination amongst value chain actors to strengthen dialogue on m-health. Donors can carry out research to disseminate knowledge on global good practice in M-Health. Donors may partner with Government to match m-health applications to address key challenges and pilot cases to demonstrate the potential impact and cost effectiveness of applications.

Gap	Need	Why?	How?
	Sufficient understanding of commercially viable applications	There is a need to understand the key bottlenecks and whether there is real demand (willingness to pay). ²¹	Several MNOs are investigating this as part of their business model study. Donors can partner to support regional analysis.
	Enabling strong value chain actors	Diagnostics which identify weaknesses in the value chain eg lack of capacity for local software development, etc, will enable targeted intervention to help strengthen the capacity for m-health.	A systematic analysis of the value chain can identify gaps; donors can target capacity building activities to help strengthen.
Demonstration	Small businesses and universities play a key role in the innovation process . Development banks can further this progress more so than domestic actors, taking the initial risks others cannot, to help scale up some of this work. It's important to support entrepreneurial and for-profit activities aimed at advancing our knowledge base on how mobile technologies can assist the poor.	Development partners can provide specific capacity building and other technical support to build up the market. Donors can provide technical and funding to pilots. In this way the IDB is committed to supporting at least 3 pilot projects during 2009. Amongst other factors, attention will be given to those projects addressing severe health constraints, reaching wide numbers of beneficiaries.	
Linking the Value Chain	The mobile services industry is characterized by uncertainty about the future direction in m-health, and is just now discussing strategic focus. The timing is now to broker dialogue and alleviate some of the structural problems to mobile health. Further, there is a need for development partners to stop duplicative efforts but rather come together to provide a clearly strategic approach. Lastly, efforts to strengthen international institutional ties will allow long lasting direct channels of technology and knowledge transfer from more mature markets to the region.	Development partners are establishing global alliances which will allow comprehensive and strategic approaches to supporting M-Health. There is a network structure to the learning processes that increasingly includes multiple countries. ²² Regional development agencies can therefore make efforts to leverage their regionalism to contribute to this learning process and encourage productive links and collaborative efforts of international and local institutions.	

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22 Caroline Wagner, George Washington University.

Additional Resources

For further information on m-health or other m-services activities and events supported by the IDB, please email the team at mhealth@iadb.org

The following links may also be useful resources on m-health:

<http://www.iadb.org> (Topics: Health, Science and Technology, ICT)

<http://www.ehealth-connection.org>

<http://mobileactive.org>

<http://www.shareideas.org>

<http://www.itu.int>

<http://www.paho.org/>

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