



MOBILE FOR DEVELOPMENT:

TRANSFORMING GLOBAL HEALTHCARE
THROUGH MOBILE TECHNOLOGY

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TRANSFORMING GLOBAL HEALTHCARE THROUGH MOBILE AND DIGITAL TECHNOLOGY FOR THE CONNECTED WORLD

With the ascent of mobile technology and increased connectivity across the globe, the digital divide is slowly closing. As technological changes and solution-based innovations forge ahead in the next few years, the mobile landscape will be transformed. This is certainly the case for the health sector, which is increasingly adopting mobile health interventions as it strives to meet patient demand and have the latest medical developments literally at its fingertips. As mHealth becomes better understood, accepted and integrated into public health systems, the advantage of personalised medicine and population health management will become more desirable, building greater momentum and investment in technological developments for health. In the current climate, concerns are focused on unsustainable consumer businesses around mHealth and a highly regulated healthcare market that may restrict the use of mobile devices for healthcare purposes.

The Aid & International Development Forum (AIDF) Mobile for Development report attempts to address

these challenges, together with recommendations and next steps to take the mHealth into the next innovation stage. AIDF's Mobile for Development report shows that simplicity is the best approach. Introducing and expanding mHealth solutions to be sufficiently scalable to deliver on expectations and provide true benefits will ensure market demand is sufficiently met and safeguard the long-term sustainability of mobile health solutions.

This first report highlights the global scale of mHealth adoption, latest trends, economic impact and the increasing preference for remote monitoring with patients.

TECHNOLOGY SOLUTIONS FOR DEVELOPING COUNTRIES

mHealth technology covers all initiatives aimed at enhancing health and wellbeing of individual patients through the adoption of mobile communications devices, such as mobile phones, tablet computers, patient monitoring devices and other wireless devices, which are all targeted towards those working in the medical field and patients.

As the Millennium Development Goals come to an end this year, to be succeeded by the Global Goals for Sustainable Development at the beginning of 2016, renewed focus has been on how development challenges can be overcome on a long-term sustainable basis by 2030. Global Goal 3 on health and wellbeing is a priority for countries to ensure that all people have access and the means to fulfil their right to health and, in the mantra of the Global Goals, "leave no one behind."





Global Goal 3: Health and Well-being Targets

By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births

- By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births
- By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases
- By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being
- Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol
- By 2020, halve the number of global deaths and injuries from road traffic accidents 3.7
- By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes
- Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all
- By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
- Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate
- Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all
- Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States
- Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

mHealth technology has its greatest potential in the developing world. mHealth is opening new ground here by responding to the healthcare and disease prevention needs within these countries by focusing on solutions-based response to promoting access to healthcare in rural and remote areas where health services, resources and institutions are either lacking or inadequate to cater to patient demand. In developing countries, as mobile devices become more accessible due to affordability, mHealth becomes more accepted. Given the fact the most people have access to mobile phones it is a ready vehicle through which to approach and promote healthcare communication.

With the expanding role of mHealth in national healthcare systems, ensuring the sustainability of innovative healthcare solutions and thereby the efficient delivery of care will require adequate training of mHealth services in order to adapt and develop digital skills. The rapid uptake of mHealth programmes is due to the overwhelming necessity for these services. Most doctors and other medical personnel are concentrated in urban areas, which has even greater impact in developing countries where there are limited numbers of doctors overall, especially in India and China where a majority of the population live in rural and remote areas. Here, the lack of resources and inadequately trained medical staff means that efficiency and the quality care remain severely wanting.

The greatest drive behind mHealth acceptance and adoption is largely due to the high cost of medical care that excludes the poor. In many of these countries, mobile technology has become the only means to reach people and ensure the continuation of healthcare in remote areas. For instance, Bangladesh's Grameenphone in cooperation with the Telephone Reference Center, established Healthlink to allow its customers to talk to a doctor at any time of the day or night. Given that Bangladesh has less than one doctor per 4,000 people, this service has been widely received bringing in more than 3.5 million calls in the last six years. Increasingly, such cases are evidencing how mHealth technology is fast becoming the only platform providing health solutions. By comparison, technological innovation in mature markets is aimed at convenience and substitution for other technology.

In India mHealth innovation is helping the rural poor with the technical expertise and efficiency of the medical sector in the major cities. India's healthcare industry is currently valued at \$99 billion, growing at the rate of 12% annually, to reach \$139 billion by 2017. However, while the healthcare industry continues to grow the healthcare space is under immense pressure to cater to the healthcare needs of a country with a population of 1.25 billion people, significant majority in rural areas. The ratio of doctors per 1,000 people is just 0.6 in India whereas in Brazil and China, it is 1.8. India has only 1.3 hospital beds per 1,000 people—significantly lower than the guideline



of 3.5 beds defined by the World Health Organization (WHO) (The Economic Time, 2013)

To meet WHO's base guidelines and ensure the medical manpower is in place the sector would require an investment of around US\$ 245 billion over the next 20 years. This is where mHealth has brokered major ground to leverage innovative solutions to support and ensure the optimal productivity of the healthcare sector already in place.

According to Deloitte, the telemedicine market in India was valued at \$7.5 million, and it is expected to rise 20% annually, to \$18.7 million by 2017 (The Economic Times, 2013). Technology is seen as a strategic element of healthcare delivery to greatly enable healthcare access and provision in the remote and rural areas of India.

CROSSING THE URBAN-RURAL HEALTH DIVIDE THROUGH MHEALTH

Health disparities between urban and rural areas are often more pronounced in developing countries, where challenges on delivering effective and efficient healthcare are undermined by lack of resources, facilities and trained medical staff. Health care providers and consultants are located in the cities where modern hospitals, expertise and advanced equipment are concentrated.

Two case studies demonstrate methods towards creating smooth access to quality and time-sensitive health care, to cross the urban-rural divide. In Malawi, Josh Nesbit of Medic

Mobile developed software that enabled health workers to text in medical information for rural patients, which delivered real-time diagnosis on routine symptoms and suggested treatments. It also enables patients to seek a second opinion by sending through relevant medical test and allows doctors to videoconference with patients where necessary. According to Nesbit, *"within six months of the system going live, the number of patients being treated for tuberculosis doubled, more 1,200 hours in travel time eliminated, and emergency services became available in the area for the first time."*

In South Asia, one of the major problems in rural areas is that births often take place outside of hospitals or health care clinics. In Bangladesh, 90% of childbirths take place at home. However, the mobile birth notification system has transformed this scenario by calling health clinics at the point of labour to notify a midwife. Since its launch, 89% of births now take place with skilled birth attendants. This has now been expanded by researchers at Johns Hopkins University through an mCare initiative, which timetables prenatal care visits for pregnant mothers, assists during childbirth, and provides post-natal care with any health issues. To ensure the long-term sustainability of these initiatives, governments can support business models through providing adequate subsidies and tax benefits to the companies operating in rural healthcare.

Mobile technology has helped overcome the geographical limits that inhibit life-saving healthcare for those in rural areas.



CREATING ACCESSIBLE MHEALTH SOLUTIONS FOR AT-RISK GROUPS AND THE UNSERVED

If the foundational premise of mHealth is to improve patient care, it must also look at the demographic of patients that do and will be using mobile devices. mHealth solutions must provide needs-based solutions to at-risk groups in the Global North and South, specifically addressing healthcare concerns of the elderly, women, and children. The success of many of these solutions is premised on the understanding that these groups have access to mobile devices.

Older generations: Bridging efficiency with ease of use



The major challenge for elderly patients is ensuring that they take their medical prescriptions correctly since they often forget to take their prescribed drug at the right time or dosage set by their doctor. This leads to further complications for patients and costs the health system billions in negative health outcomes. Older generations are often less familiar with technological developments and how to use them in a way that benefits their lifestyle. The elderly are also more likely to be deterred by concerns over privacy and security. Firstly these concerns will need to be overcome while also recognising that older generations may need lessons on how to use mobile medical devices. Empowering the older demographic to manage their own health and wellbeing will bring back control over their medical care, while ensuring that they are proactive in their own health promotion and disease prevention.

Start-ups are contributing towards medication adherence among the elderly. TowerView is a new tech company with an end-to-end solution consisting of a digital pillbox that helps consumers manage daily medication regimens; including sending an alert if the user misses a dose. Those using the device are mailed pre-filled medication trays on a regular basis from their pharmacy. The company is now partnering with health plans and providers with the goal of making the platform available free-of-charge to patients.

Recently, IBM and Apple announced a partnership with the health and life insurance company Japan Post to offer iPads to elderly citizens with an aim to improve their health, wellness and overall independence. The mobile health devices will have an application that reminds patients when to take

their medication as well as enable them to FaceTime with family members and book appointments. The data stored on these mobile health devices will be held in a secure cloud platform and thereby protect the privacy of personal patient information. This solution will also help family members stay in touch with their elderly parents or grandparents and thereby have additional oversight over the health of Japan's elderly citizens. While this model of healthcare delivery is fully capable of operating in Japan's healthcare sector, such a model is not easily adoptable for other countries, for instance it would face more implementation challenges in the United States where the healthcare sector is more fragmented.

Mothers and children: Promoting gender equality through technology



Technology can boost the progress made on the Millennium Development Goals, and help support momentum on the Global Goals, specifically on maternal, newborn and child healthcare (MNCH). Global successes here include a 45% reduction in maternal mortality since 1990. However, the UN reports that nearly 300,000 women died from complications due to pregnancy and childbirth worldwide in 2013. Maternal health remains a huge challenge in developing countries, demonstrating the continued need to tackle unequal access to healthcare and poor service provision for women.

Women in the developing world, particularly those living in rural, remote areas, often do not own or have access to mobile phones. Therefore, the ability of women to access and receive quality healthcare in line with their needs is directly linked to the entrenchment of gender inequality in traditionally conservative societies, in which men and boys are provided the tools and economic resources to invest in ways to improve their own lives. Yet, when women have access to new technologies that facilitate access to medical information, care and monitoring, then women, their families and communities are healthier and more productive. In Bangladesh, where women have the highest rates of maternal mortality, only 44% of Bangladeshi women own mobile phones, compared with 72% of Bangladeshi men, meaning that only 13% of Bangladeshi women have used mobile money, compared with 33% of Bangladeshi men. The launch of a Mobiles4Health initiative provides information for patient awareness, including how to take care of expectant mothers, early warning signs on infant problems, family planning, and breast feeding best practices.



Yvonne MacPherson, BBC Media Action USA, spotlights BBC Media's own mHealth services designed for India that have become "one of the most adopted, of the not the largest, scalable mobile health solution for frontline health workers in the Global South." Since the launch in mid-2012 of Mobile Kunji, a job aid, and Mobile Academy, a training course, nearly 300,000 CHWs have used 30 million minutes of audio content in just the Indian state of Bihar alone. The government is now looking to scale up the programmes in five other Indian states to ensure that scalable solutions are offered to CHWs and health departments. This shows the correlation between mobile health services and the increase in the duration and quality of CHW interactions with beneficiaries, with improvement in CHWs' knowledge and confidence and in beneficiaries' knowledge and attitudes towards CHWs.

mHealth is also important for monitoring quality assurance over healthcare provided through data collection, which then allows patients to hold duty bearers accountable for improved health sector performance. Tanya Accone and Sean Blaschke, Health Systems Strengthening Specialist, UNICEF, highlight the work of South Africa's MomConnect as a leading example of accountable healthcare: "They not only use mHealth to reach directly to the household, but they carry out routine client satisfaction surveys to obtain netter information on the demand side, and using this to hold health providers accountable for the quality of services they are providing. This model had already been in place in countries like Uganda, but is now being increasingly replicated elsewhere."

mHealth solutions contributing to positive MNCH outcomes have helped facilitate greater patient-doctor interaction crossing the rural-urban divide, which has subsequently enabled greater access to wider networks of services for women.

Adolescents and young adults: Supporting entrepreneurs of the future

Technology is an important medium to reach young people. Born into an increasingly digital world, more young people are utilising the benefits of mobile technologies to connect, communicate and share information. Exciting ways to engage young people will help ensure that mHealth solutions are receptive to their needs. The United Nations Population Fund (UNFPA) is one such organisation that runs design challenges and hackathons to bring together young innovative minds with leading health specialists and software engineers to develop new mobile app platforms that can be used to better reach young people with critical health information.

It is equally important to recognise that young people are often the innovators of tomorrow. In Uganda, for example, young people have developed mobile apps to monitor fetal distress, diagnose breast cancer, and disseminate information on HIV and AIDS. Two former students from Makerere University College of Computing and Information Technology in Kampala developed WinSenga, a mobile medical device linked to a mobile phone that can scan a pregnant woman's womb or detect fetal problems. Using technology based on the traditional Pinard horn that is used to listen to the heart rate of a fetus during pregnancy, the device allows

the examiner to determine the age, weight, position and breathing pattern of the fetus.

Through user-centered workshops, better focus can be given to designing mobile health solutions that resonate with the views, needs and experiences of young people. Putting more choices in the hands of children and young people will help improve and empower them to access vital health services.

By delving into the healthcare needs of at-risk groups, we can see how connecting to people who are commonly stationed at the periphery of services and visibility, mHealth can contribute to more equitable access to healthcare and brings more meaningful and inclusive progress towards long-term gains in sustainable development, specifically on Global Goal 3 and its individual targets: Good health and wellbeing –ensure healthy lives and promote well-being for all at ages by 2030.

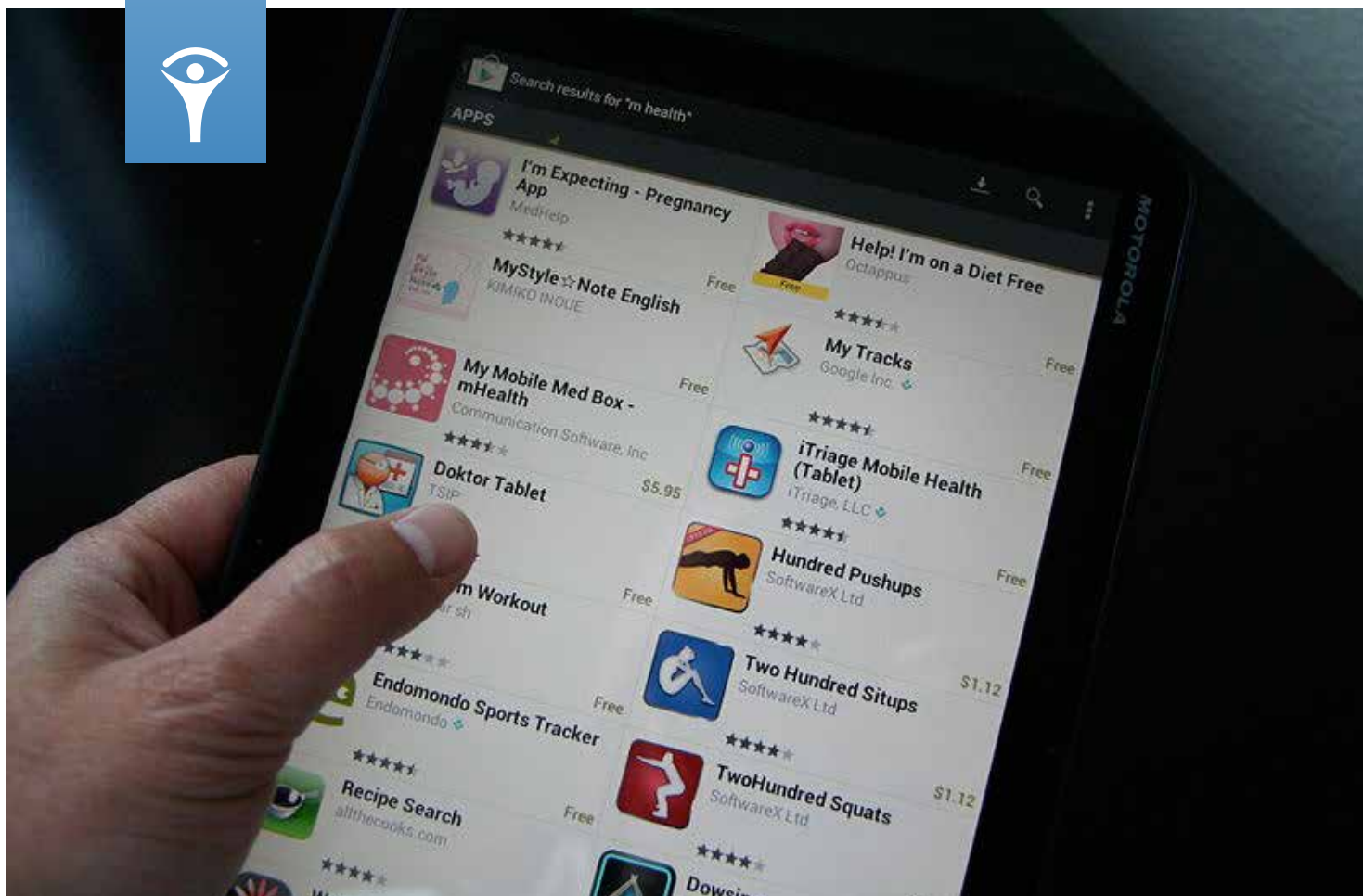
REMOTE DISEASE MONITORING

With over 7 billion mobile connections worldwide (GSMA Intelligence 2015), mobile health apps present the most desirable source of revenue in the mHealth sector. This is particularly the case when looking at its utilisation for the purpose of remote monitoring for patients. Valid concerns over the reliability and accuracy of diagnostic apps remain, which means patients should not completely depend on applications and certainly this area would benefit from more regulation on the use of such apps for health monitoring. As the mHealth field continues progress and new remote monitoring apps are released to the market, these technologies must ensure they are accurate and secure to protect the individual's health data. In spite of these concerns, remote monitoring has already shown its potential benefits and positioning in the market to meet the number of demands from patients and ordinary people looking to know more about their health and take ownership.

With more doctors and patients using mobile devices to manage chronic illnesses on a 24-hour basis, remote monitoring will comprise around two-thirds of the mHealth market. Remote monitoring involves doctors carrying out patient consultations on mobile devices, such as using Apple's FaceTime or Skype, where they still have access to medical records and can ensure the integrity of doctor-patient communication. The increasing adoption of remote monitoring tools is helping to free up non-emergency office visits while providing accurate data on patient conditions, which helps doctors focus their in-person patient care for those that require more detailed and complex medical assistance.

Wireless technology has helped streamline healthcare especially vastly improving the potential of clinical trials to progress more efficiently. For example, Apple's ResearchKit allows clinical trials to recruit, measure and analyse participants with faster and more frequent data to generate accurate results.

As these technologies advance and proliferate, clinicians, with support from wireless companies will look to mHealth to provide healthcare management for patients that reduces



complications and hospital admissions. This section provides an overview on the range of remote monitoring usages and where current investment and resources are being allocated.

Cardiovascular disease in China

Coaching apps are increasingly be used to assist chronic disease sufferers make patient care more convenient and manageable. Dr. Robert Schwarzberg of Sensei Corporation has developed a coaching app that provides advice on weight loss and virtual coaching on diabetes and blood pressure control. The app can track physical activity and body mass number as well as suggest food choices based on the patients dietary choices and lessons on healthy lifestyle.

Positive health outcomes have already been reported through the use of remote sensors and exercise reminders. For instance, a study in the United Kingdom found that the use of real-time mobile feedback combined with wrist accelerometers to monitor exercise showed an increase of 2 hours and 18 minutes per week in exercise. Exercise and a healthy diet are two of the major factors to reduce the risks associated with causing cardiovascular disease.

mHealth technology is also improving efficiency of medical response. For doctors, Apple's iPad has popular medical apps, including apps by Airstrip Cardiology that allows doctors to access electrocardiograms (ECG). In Brazil, Sistema Tele-Electrocardiogram Digital allows ambulances across the country to send cardiograms to the telemedicine unit of a specialist heart hospital in Sao Paulo. Within five minutes they receive a diagnosis to guide emergency treatment.

In China, remote monitoring for chronic cardiovascular diseases has been used with great effect. The ECG sensing handset, deployed by Qualcomm's Wireless Reach in

partnership with Life Care Networks and the Community Health Association of China, records 30 seconds of heart data and transmits data electronically to the 24-hour Life Care Networks Call Center in Beijing. Life Care Networks operates in cooperation with China Telecom, the third largest mobile operator in China. This telecom company runs the China remote ECG and blood pressure monitoring network system through the 3G mobile network, while Life Care Networks operates the remote cardiac monitoring center. This facility has over forty physicians that use wireless monitors to enable remote diagnosis to patients who are at the periphery of healthcare and provide real-time feedback to patients with cardiovascular diseases. Such devices are increasingly needed to tackle concerning national health demographics: over 3 million people die as a result of cardiovascular diseases each year in China, and those in rural areas have limited access to healthcare.

HIV/AIDS in Kenya

HIV/AIDS remains a major global health challenge. In Kenya, over 6 % of the adult population are diagnosed with HIV. 3G wireless technologies are being used to alleviate the administrative burden on healthcare workers and strengthen pharmaceutical management systems for ART. Since its implementation in Kenya, there has been a 70% increase in the number of facilities completing reports at the time of dispensing and the delivery of these records to the Kenya Medical Supplies Agency fell dramatically from 7 hours to 5 minutes. Effective records management is critical for the delivery of Antiretroviral Treatment (ART) as a part of the Kenyan Government's plan to reduce HIV/AIDS-related morbidity and mortality.



Tuberculosis in South Africa

Tuberculosis (TB) continues to be the leading cause of death in South Africa, with the World Health Organization (WHO) statistics giving an estimated incidence of 450,000 cases of active TB in 2013. This means 1% of the population of about 50 million develop active TB disease each year. Globally, this is the third highest incidence of any country after India and China, and the incidence has increased by 400% over the past 15 years.

To help tackle the disease, the SIM-pill system attempts to reduce the incidence of TB by encouraging a greater rate of medication adherence. SIM-pill system works by monitoring the patient's pill schedule, intake of medication and sends SMS reminders to the patient as well as caregiver. In the pilot stage in South Africa, 90% of patients complied with Tuberculosis (TB) medication compared to 20-66% without the use of the mHealth tool.

Dengue fever in India and Sri Lanka

In South Asian countries, particularly in India and Sri Lanka, where Dengue Fever has a high occurrence rate, it is not uncommon in some provinces for central authorities to be informed of disease outbreaks after substantial time has passed, at least 15 to 30 days. This leads to slower treatment response and impairs the containment of the disease. The delivery of mobile technology has ensured these delays have dropped considerably. The Real-Time Bio-surveillance Programme enables public authorities to use mobile devices for data mining to survey for "anomaly detection" in disease patterns. Those that report significant outbreaks receive additional resources for diagnosis and treatment to limit the spread of the disease.

Recommendations for remote monitoring of diseases

PwC Health Research Institute (2014) has put forward several recommendations focused on improving mHealth usage and interventions:

1. Expand the use of self-monitoring tools to promote patient health ownership: mHealth tools that advance treatment and provide quantifiable data that can be easily analysed are most likely to lead to positive health outcomes and engage informed patients.
2. Health ICT systems must have secure and open platforms for multiple data streaming platforms.
3. Collaboration between new and traditional healthcare providers will help develop and commercialise mHealth devices.
4. mHealth drives effectiveness and efficiency: Remote monitoring can help care providers better understand high-risk populations and move them into low-cost care settings. Those previously inaccessible can be reached through mHealth solutions.

MOBILE BASED DISEASE SURVEILLANCE AND HEALTH PROMOTION

Mobile phone-based surveillance has the potential to provide real-time validated data for disease clustering and prompt response and investigation. This section highlights how technology is being used to monitor and contain diseases as part of understanding and solving global and national health concerns in an ever borderless and connected world.

Controlling Ebola through mHealth strategies

The Ebola epidemic, until the beginning of this year, had threatened to turn into one of the most devastating public health crisis in recent times and has rapidly become one of the deadliest occurrences of the disease since its discovery in 1976. The Ebola outbreak in West Africa was first reported in March 2014 and more than a year on, at least 11178 people have reportedly died from the disease, primarily in six countries: Liberia, Guinea, Sierra Leone, Nigeria, Mali and the United States. At the peak of the outbreak, the total number of reported cases was more than 27,000 infected people.

In many of these Ebola-hit countries they feature high mobile phone subscriptions, unsurprisingly mHealth strategies have emerged as a low-cost, high-impact solution to mapping outbreaks and providing education to contain the disease. In Sierra Leone, IBM in partnership with Airtel launched a disease-mapping system in October 2014. The strategy is aimed at allowing local people to send free text messages about Ebola to the Government from which heat-maps can then be generated linking emerging issues to location information. Tracking population movements using mobile devices also has an important role to play in ensuring proper relief assistance, needs assessment, and optimal infectious disease surveillance.



mHealth strategies have also been utilised as an educational tool for behavioural change. The Red Cross also collaborated with Airtel to launch a platform that sends informative text messages to people in the most affected areas. So far, 2 million people have been reached through this platform, with messages about Ebola screening, diagnosis and treatment as well as promoting simple hygiene measures, including regular hand washing and wearing correct personal



protective equipment when caring for ill patients at home. mHealth strategies such as these help to contain the disease in the short-term, but also help mitigate against future disease outbreaks.

mHealth strategies have also extended to health care professionals treating Ebola patients. UNICEF and IntraHealth International have partnered with Liberia's Ministry of Health and Social Welfare to provide healthcare workers with reference and training materials on protective gear, safe injection and burial injections that can be downloaded from their phones. This ensures that those at the forefront of disease prevention and control have reduced risk of infection.

The Ebola outbreak also demonstrated how technology has motivated one of the biggest paradigm shifts by turning commonly passive beneficiaries to active, educated health consumers. The Ureport is a social monitoring tool designed for youth and other community members to strengthen community-

led development and citizen engagement. It uses community communication to identify health needs, raise awareness, identify health sector gaps, and establish a strong long-term system post-emergency. Since the app aggregates voices with hundreds of thousands with the same concerns, it is an important app to improve information communication flows between relevant government ministries and the affected communities.

During the course of the Ebola efforts to date, over 320,000 SMS messages have been sent aimed at understanding the needs of people and providing them with information. UNICEF received over 86,000 messages about Ebola, each contributing to a community-based effort to stop the disease (USAID, 2015).

Dana Zucker of UNICEF Innovation Unit states the critical effectiveness of mHealth strategies in fighting outbreaks relies on *"simple technology like a basic SMS phone that can support and strengthen the additional communication efforts that are already happening by connecting people to better, more accurate information faster than before."*

Recommendations

1. Continued Ebola monitoring is needed to fully analyse the effectiveness of these mHealth strategies.
2. These strategies are only as useful as the scope of mobile phone penetration. Compared to Guinea (63/100 people) and Liberia (60/100 people), Sierra Leone has a rate of 44/100 people mobile subscription adoption. Scaling up mobile phone subscription will enhance the impact and reach of mHealth strategies fighting Ebola.

MERS surveillance in South Korea

Middle East Respiratory Syndrome (MERS) has infected at least 25 people in South Korea and killed two since it arrived in the country (as of August 2015.) WHO reports the MERS outbreak in South Korea — the largest outside Saudi

Arabia where the disease first emerged in 2012, is likely to grow (WHO, 2015). South Korean officials have isolated 680 people to limit the spread of the disease. Since 2012, there have been at least 1,154 lab-confirmed cases of MERS worldwide along with 431 deaths, with a mortality rate of 37%.

South Korea is in a good position to contain the MERS outbreak because of its advanced medical system and one of the world's fastest broadband connections.

South Korean authorities have been tracking the disease through the mobile phones of hundreds of people under quarantine to prevent the spread of the deadly MERS virus.

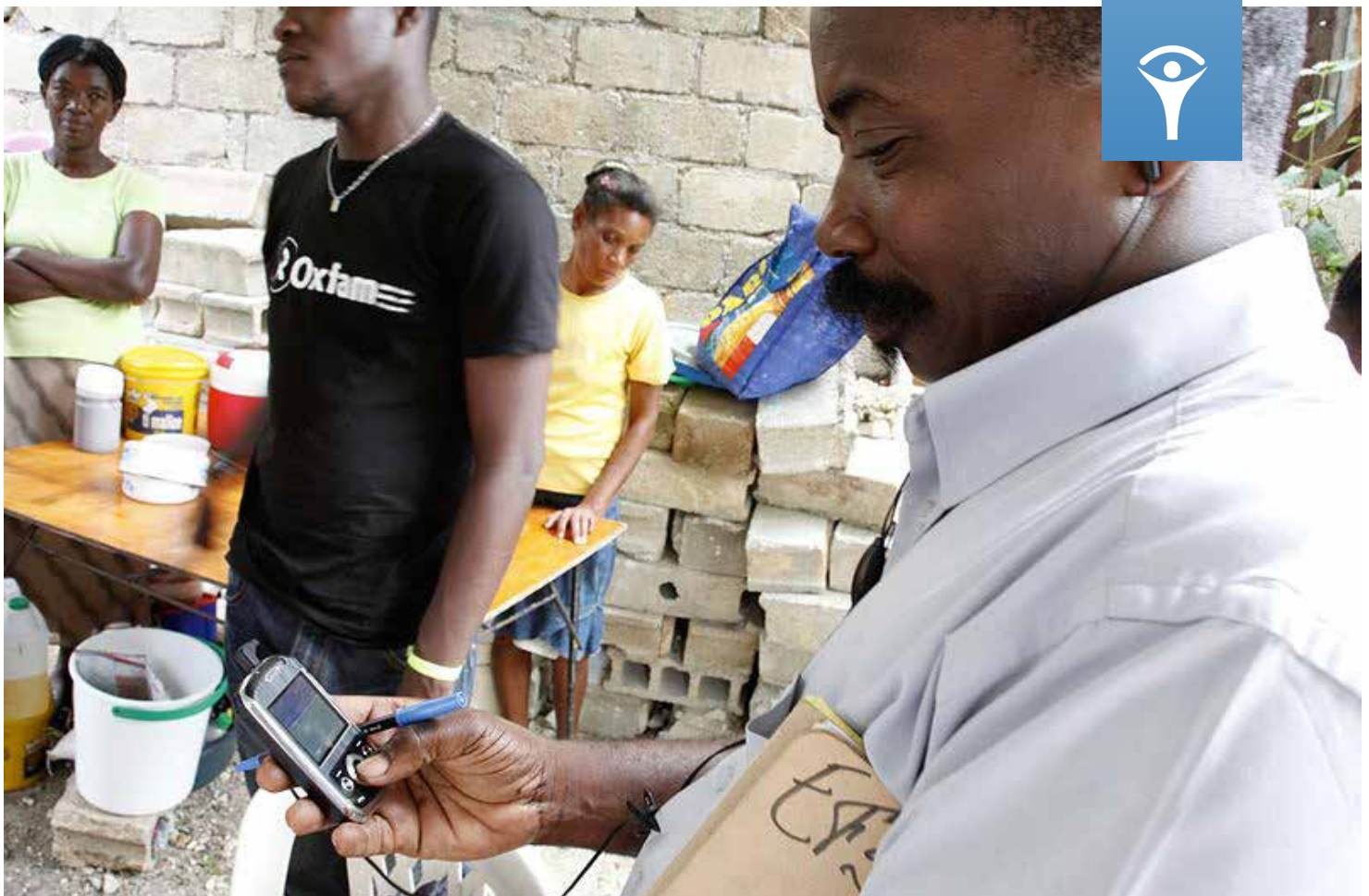
Monitoring population movement after major disasters

The private sector is key to ensuring comprehensive mobile coverage in disaster areas, minimising overlap or duplication. The use of mobile devices can generate collective intelligence that influences response efforts.

In Haiti, mobile operator Digicel made its communication data available as part of a non-profit initiative to track populations displaced by the earthquake in 2010 and steer aid to worst affected areas. Mobile phones were also used to access needs in Haiti and report those requiring urgent medical assistance. Following the earthquake, outbreaks of cholera were reported. During disasters, cholera is particularly deadly, with mortality estimated to increase more than 50-fold compared to baseline rates during stable conditions. The platform provided by Digicel helped track cholera by locating active mobile phones. Further, the information transmission system, SEAMUS, was designed in response to the challenge of accessing and collecting scattered information in remote areas in Haiti. Traditionally, health workers document the information manually. With SEAMUS, health workers in the field use their cell phones to send a text message with specific data, such as the cholera cases or quality of water, to a designated number. SEAMUS also produces a database of all received messages and enables experts to do trend analysis, historical reports, statistics, and mapping. This system meets the Strategy and Plan of Action eHealth for the Americas, which seeks to "promote the use of epidemiological surveillance services, including the human-animal interface, through the use of information and communication technologies."

In the Philippines, Surveillance in Post Extreme Emergencies and Disaster (SPEED), a project supported by the WHO, uses SMS or the internet to alert emergency health officials to dangerous situations and send them health information, as well as allowing them to receive data on health conditions in communities and reports of disaster damage. The system also sends immediate "notification alerts" to the mobile phones of designated recipients when the number and distribution of specified health conditions go over a specified threshold, signifying the potential development of a possible outbreak or epidemic, thereby allowing officials to respond quickly.

After Nepal's devastating earthquake earlier this year, survivors and medical personnel started using mHealth to deliver critical medical information in places where smartphones were the only available resource.



AskTheDoctor.com opened its website for two months to enable those in the country to use the service free of charge. This allowed both patients and doctors to connect virtually, and in real time, with a platform of 10,000 physicians around the world. The most commonly asked questions were for information on fractures and dislocations; wounds and infections; amputations; and head and facial injuries. Approximately 85% of the questions coming into the site from Nepal were via smartphone, pointing to the value of mobile tools for delivering healthcare immediately after a disaster. With hospitals and physicians struggling to recover, disaster relief teams equipped with laptops, tablets and smartphones can coordinate care with healthcare providers outside the disaster area.

Jonathan Brass, from the International Federation of the Red Cross (IFRC), highlights the importance of functional and innovative technology in humanitarian settings. IFRC use Trilog Emergency Response Application (TERA), which is a two way messaging system that updates people in a certain geographical location on health risks/preventative measures and/or surveying. TERA was operating in Haiti after the earthquake and recently in West Africa during the Ebola crisis. Brass notes that the great benefit of the TERA system is its ability to be flexible, targets and works on non-smartphones.

Brass also highlighted the crucial importance in crisis settings of making sure emergency information can be isolated when need. IFRC's global reference centres have developed first aid apps in partnership with local Red Cross national societies, available in local language they provide information on the risks in the host country, on treatments, health centres and other useful information. The blood bank/donor apps can be used to identify locations with blood supplies and provide information on providing and access blood.

Increasingly victims of natural disasters and beneficiaries of emergency aid will turn to technology to inform relief agencies what they need and track the progress of aid heading to them. As such, aid agencies will need to keep abreast of changes in technology and ensure they are being used effectively.

Recommendations

1. Identify and promote incentives for joint approaches to humanitarian crises, resilience and sustainability with private sector and development agencies
2. Establish innovation hubs that can assist with key problems facing humanitarian action. Humanitarian innovation can be strengthened by connecting private sector research and development with aid agencies' innovation hubs, including the UN Innovation Network established in 2013.
3. Humanitarian- private sector engagement should be broadened to create multi-stakeholder collaboration

Health surveillance among displaced populations

The United Nations predicts there will be 4,270,000 Syrian refugees by the end of 2015. The majority of these displaced people will be hosted in Turkey, Lebanon, Jordan, Iraq and Egypt – with 88% living outside the region's vast refugee camps. In any country hosting significant numbers



of displaced persons, either from conflict, climate or natural disasters, states struggle to monitor public health concerns over the spread of diseases.

Jordan hosts one of the highest refugee populations in the world. There are currently 650,000 Syrian refugees comprising approximately 10% of the entire Jordanian population. As a result of inadequate information on disease prevalence in the refugee camps, very little is known about communicable, non-communicable and mental health issues among displaced populations. Therefore, given the current crisis across in the Middle East and the continuing flow of refugees into Jordan, there is a need to strengthen public health surveillance to monitor priority health diseases, conditions and events. While health services within refugee camps are primarily provided by international organisations, 80% of refugees live in non-camp settings and away from medical assistance available to them.

To this end, the Ministry of Health of Jordan in partnership with the World Health Organisation implemented two phases of a pilot public health surveillance project between May and December 2014. This project was the first time mobile tools were applied to deliver national health surveillance. In cases where notifiable diseases were reported, alerts were sent via SMA and email to appropriate levels of Ministry of Health (MOH), managed by Nexmo and Postmark respectfully. At the end of the pilot, 4,373 cases of mental health, non-communicable and communicable disease were reported from 87 mobile devices across 54 sites, which included new cases of diabetes, hypertension, Hepatitis A, Meningitis and Measles. The results of the pilot study clearly indicate how mobile information technology enables standardised, coded data to be collected, analysed and reported in real-time.

Recommendations

1. All alerts must be responded to within 48-72 hours and an investigation form completed on a mobile device and uploaded in real-time that will be needed to access the status of referral, case management, laboratory diagnosis and contact tracing
2. Formal outbreak investigations must be initiated by a country's Ministry of Health
3. The future scaling-up and implementation of national integrated public health surveillance must be feasible and cost-effective
4. Analysis of disease burden among refugee populations can inform decision making and resource allocation: More data collection and analysis is needed that will help facilitate detailed knowledge of disease among host communities and displaced populations for public health and clinical decision-making
5. An online interactive framework should be developed for data visualisation and reporting: a password-protected, online framework updated every hour can inform decision-making and planning

John Haskew, Technical Officer, WHO Jordan, explained: "During the consultation health workers use mobile tablets to provide case-based reporting of disease and to introduce electronic modules for prescribing, using the WHO 'model list of essential medicines', and clinical diagnostic algorithms, including the integrated management of childhood illness and WHO Mental Health Gap Action Programme."

Health surveillance efforts in Jordan provide a snapshot into the ways technology is being used to deliver innovative needs-based solutions to at-risk groups affected by crises, be that war, natural disasters or climate change. In war-torn countries, the digital space for promoting health is being more widely utilised. To tackle the massive shortage of medical staff in ICUs, the US-based organisation Syrian American Medical Society (Sams) offers a e-learning, telemedicine and tele-surgery to train and aid medical staff. Sams offers medical courses through e-learning to supplement the training of physicians, medical staff and nurses. Sams has also recruited a global network of specialist physicians who are on call, so Syrian physicians can consultations through teleconference when cases are complicated. Sams is now developing the capability to allow overseas specialists to supervise complex operations via web video links in the surgery.

Patrick Gordon, chair of the WGET Forum at the United Nations Office for the Co-ordination of Humanitarian Affairs (UNOCHA), emphasises the critical importance of communications in the humanitarian setting: "*All these digital forms of aid have one underlying dependency – and that is robust networks. None of this will actually work unless people – both the aid workers and the beneficiaries – have access to communications. Where communications was a 'nice to have' at one point, now it is a 'need to have.'*"

The Humanitarian Mobile Connectivity Charter (HMCC), launched in 2015, aims to coordinate operators so that they work together to provide or re-establish connectivity in emergencies. Axiata, Etisalat, Ooredoo and Smart Communications have already signed the Charter.

Mobile based notifiable disease surveillance

Each country has its own infrastructure for developing surveillance data tailored to population needs and national resources. Identifying infectious diseases in its early stage is essential for ensuring optimal management and control of diseases and reducing impact. All health workers require accurate and real-time data so they can decide on the effectiveness of implemented policies on dealing with diseases and new policies on disease emergencies.

The reality in a majority of cases is that epidemics are already in society before authorities are notified and can then initiate effectiveness mitigation efforts. There is ever-greater need for enhanced surveillance capacity and efficient ways to analyse notifiable disease surveillance data, propelled by internet and mobile communications systems.

The World Health Organization Regional Office for Africa has proposed an Integrated Disease Surveillance and Response approach for public health surveillance and response in the African Region to improve health facilities at district and national level. For instance, the National Notifiable



Disease Surveillance System (NNDSS) is a multifaceted public health disease surveillance that provides public health officials information to monitor the occurrence and spread of disease. The GSMA Pan-African mHealth Programme engages mobile and health industries in order to reduce the fragmentation of mHealth services by creating a collaborative integrated business framework to launch sustainable and scalable services.

Recommendations

1. Since many medical staff at district level own mobile phones and demonstrate high efficiency in its use, the introduction of mHealth innovation can improve disease reporting and should be more widely encouraged.
2. The district level will need to be empowered with resources that can facilitate mHealth initiatives since response efforts in verification and intervention are quickest from the district level.
3. Emphasising the appropriate adoption of mHealth tools, training and strategies is essential for ensuring the most useful information is generated from the flow of data.

In Kenya, mSOS platform was developed in a collaborative research project between Ministry of Health, Kenya Medical Research Institute (KEMRI), JICA, Japan Science and Technology Agency (JST) and Nagasaki University Institute of Tropical Medicine. With mSOS, health workers send real-time information on suspected cases of immediately notifiable diseases to the MOH using ordinary mobile phone handsets and a toll-free number.

mSOS is also equipped with a password-protected web portal where maps, epidemic graphs and tables of suspected incidences and response actions are displayed on the web portal in real-time. All information is displayed and reviewed in real-time, and all data is stored at a server owned by the MOH. MOH officials use these tools to map incidences and plan outbreak containment measures

Recommendations

1. mSOS sustainability is enhanced by promoting the use of local technology. Disease surveillance apps can use mSOS as a best practice model, which will enable modification and system integration to suit various platforms and local needs.
2. Stakeholder participation, particularly at the local level, is essential for system development and programming.
3. mSOS can be used for capacity enhancement, supportive supervision and sensitisation of health workers on surveillance activities.

mWASH solutions: Sanitation-related disease surveillance

Water and sanitation practitioners have begun to tap into mHealth as tools to improve water, sanitation, and hygiene (WASH) services.

The Lancet child survival series (2003) argued oral rehydration therapy (ORT) as the single intervention available with the greatest potential to save lives. In Guatemala, 20 % of deaths that occur in children under 5 years old are a result of diarrhoeal disease.



However, through proper sanitation education the risk drivers behind these deaths can be reduced. A system combining SMS messaging with web-based platform can help provide continual education of trainer health promoters for real-time consultations, and monitor community health worker activity. Such a system was introduced in Guatemala in 2013 in coordination with a validated framework for (ORT) and zinc supplementation (ZS). However, despite the introduction ORT intervention in Guatemala, only 11-12 % of children under five years old are treated for diarrhoea. This is a serious concern given the strong connection between malnutrition and dehydration, which increases the burden of disease in impoverished countries. Therefore, with greater efforts on outreach and access, ORT and ZS combined with mobile education will help the efficacy and sustainability of these education campaigns through encouraging local collaboration and ownership.

Recommendations

1. There is a continued need to optimise the decision-making, treatment delivery, and educational processes used in managing childhood diarrhoeal diseases.
2. Promoting improved health outcomes can be achieved through SMS messaging.
3. End-to-end data transmission between healthcare workers and remote experts can be supported through open-source, cost-free mHealth infrastructure. This will provide automated analyses to provide crucial diagnostic advice and patient treatment options.



CONNECTED HEALTH: REALISING THE RIGHT TO HEALTH FOR ALL

The range of mobile technology application and adoption demonstrated in this report provide only a brief snapshot of the scale and scope of mHealth technology today. What is clear is that communication and health are being connected on multiple platforms to provide innovative, efficient, cost-effective means of healthcare and wellbeing services catering to all age groups and genders cutting across geographical spaces that make traditional healthcare provision acutely difficult and in some cases impossible. If the Human Rights Convention (Article 19) indicates that communication is a human right, then there needs to be recognition that it

is given the same priority as education, food, health and shelter in terms of service provision. This means that the communications industry must connect with communities and leading organisations in the sector to ensure patients, doctors and families can communicate their needs.

One of the major difficulties with new mHealth solutions are that they are often not supported by the necessary flow of resources and finances to make these emerging solutions sustainable. Thus, developing sound, reliable mHealth business models that can be adapted, modified and sustained in the long-run will ensure that the mHealth sector remains relevant, recognised and influential so that the health industry can streamline communication channels alongside traditional communications and feedback mechanisms.



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