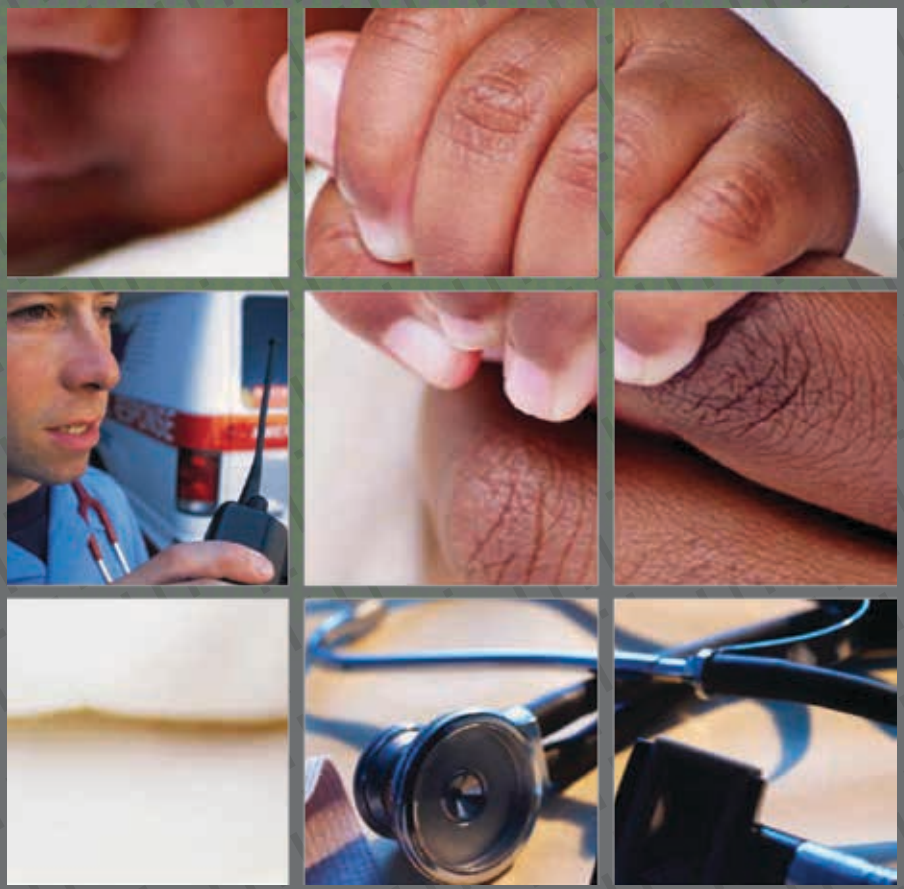
ICT APPLICATIONS

# ICT for Improving INFORMATION AND ACCOUNTABILITY FOR WOMEN'S AND CHILDREN'S HEALTH

Report



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Telecommunication Development Sector

# ICT for improving information and accountability for women's and children's health

***July 2013***

This publication is produced within the framework of the work related to the Commission on Information and Accountability for Women's and Children's Health (CoIA). It captures the contributions that ICT and eHealth innovations are providing to CoIA countries to face the challenges of meeting the Millennium Development Goals 4 and 5.

The ICT Applications and Cybersecurity Division of the ITU Telecommunication Development Bureau (BDT) led the preparation, co-ordination and writing of this report in collaboration with Véronique Inès Thouvenot, Stephen Settimi, Lilia Pérez-Chavolla, Accenture Development Partnerships (Lionel Bodin, Jennifer Neely and Charles Dennis), and ITU interns: Sophie Adama, Mehdi Amri, and Judit Hernandez.

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## Foreword

The fast approaching 2015 deadline, set by the UN for meeting the Millennium Development Goals, marks the urgency of ensuring that all the resources available to those countries still lagging behind in reaching them are being allocated and used as fully and efficiently as possible. This publication concentrates on the recommendations provided by the Commission on Information and Accountability for Women's and Children's Health (CoIA) to aid 75 priority countries meet the MDGs 4 and 5—aimed at reducing child mortality and improving maternal health worldwide—, examining in particular the role that information and communication technologies (ICTs) can play in improving information and accountability.

Access to computers, mobile-cellular technologies, fixed and mobile broadband, and Internet services is crucial to expand the reach of healthcare services and health information to remote and rural areas. When implemented in the framework of a well-coordinated national health strategy, health information technologies can become valuable tools for the healthcare system, empowering policymakers, health frontline workers and patients to increase the quality of maternal and child healthcare provided in all countries.

No woman should pass away when giving birth because the right information did not get to her on time, when we have the information and communication technology available. No epidemiologic situation should get out of control because the information was not received early enough, when we have more than 90 per cent global mobile coverage. All children, regardless of their place of birth and the socio-economic situation of their parents, should have access to proper healthcare and education because information technology is at our fingertips.

With this report, ITU seeks to provide practical information on the diverse ICT solutions that can move countries forward in their goal of achieving the MDGs 4 and 5 by 2015.

Brahima Sanou
Director
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## Executive summary

Given the critical importance of the Millennium Development Goals to reduce child mortality and improve maternal health (MDGs 4 and 5), the United Nations established in January 2011 a high-level commission to improve global reporting, oversight and accountability for women's and children's health—the Commission on Information and Accountability for Women's and Children's Health (CoIA). CoIA seeks to increase the likelihood that pledges for women's and children's health are honoured and that resources are spent in the most effective way to save lives.

Information and communication technology (ICT) and eHealth applications play an essential role in meeting the ten recommendations set by the CoIA. Together, they aim at creating a system to track whether donations for women's and children's health are made on time, if resources are spent wisely and transparently, and whether the desired results are achieved. This report reviews each of the ten CoIA recommendations, highlighting the contributions ICT applications can provide in their implementation and in fast tracking the fulfilment of the MDGs 4 and 5. This publication focuses on the 75 developing and least developed countries of interest to CoIA (hereafter referred to as CoIA countries), which account for 98 per cent of all maternal and child deaths worldwide.

In the near term, the CoIA recommendations seek to promote the use of ICT in the implementation of a range of projects to support women's and children's health in several key areas. These projects should address CoIA targets and leverage the funds and expertise available. It should be recognized, however, that without a national strategy and plan fully in place, projects implemented to achieve quick progress might need to be revisited after several years' time. It is therefore recommendable to develop, in parallel, a national eHealth strategy that includes reproductive, maternal, neonatal, and child health (RMNCH) as a priority and aims to ensure the best use of funds. Such strategy should also take account of the potential short-term nature of any projects and include a transition plan in the planning process.

To the extent possible, adoption of ICT in RMNCH efforts should include eHealth initiatives with proven effectiveness. In particular, they should capitalize on the rapid expansion of mobile-cellular networks and encourage the harmonization of eHealth standards, given the specific context of CoIA countries. Measurement of results should be integrated into the planning phase of all projects. Stronger evidence is needed of the impact of ICT on RMNCH, whether in health outcomes, efficiency, effectiveness of care, and so forth. Experiences and results should be shared for the benefit of all countries.

Innovation in eHealth and mHealth applications is gaining momentum. Consequently, the examples highlighted in this report are only a few of the many solutions that are already improving the health of women and children globally, and which could be replicated in other CoIA and developing countries to save lives.

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# I Introduction

The deployment of information and communication technologies (ICTs) and the development of electronic health (eHealth)[1] applications for reproductive, maternal, neonatal, and child health (RMNCH) have gained momentum and interest over the past several years among the healthcare workers community, hospitals, clinics, and patients. Today, doctors exchange medical images, diagnostics, and second expert advices without borders, while eminent specialists offer consultations and training online to hundreds of colleagues all over the world.

In least developed and developing countries, improved access to mobile-cellular technology, Internet services, and fixed and mobile broadband[2], has facilitated the implementation of an increased number of eHealth and mHealth pilot projects. These technologies and projects are already providing immense hope to isolated communities and low-income populations in the 75 countries where the Commission on Information and Accountability for Women's and Children's Health[3] (CoIA) is focusing its work on, by bringing the benefit of in-time care to the areas where 98 per cent of the maternal, newborn, and child deaths take place worldwide (see Figure 1).

Despite the impressive progress CoIA countries have made in reducing maternal and child mortality since the 1990s, RMNCH programmes confront formidable challenges in helping these countries reach the objectives set in the Millennium Development Goals (MDGs) 4 and 5 to reduce child mortality and improve maternal health, respectively, by 2015. Among CoIA countries, there are still an estimated 360 000 deaths of pregnant mothers per year, most of them being preventable and occurring during or immediately after birth, and 40 per cent of children under five die within the first 28 days of life, translating to around three million deaths per year[4].

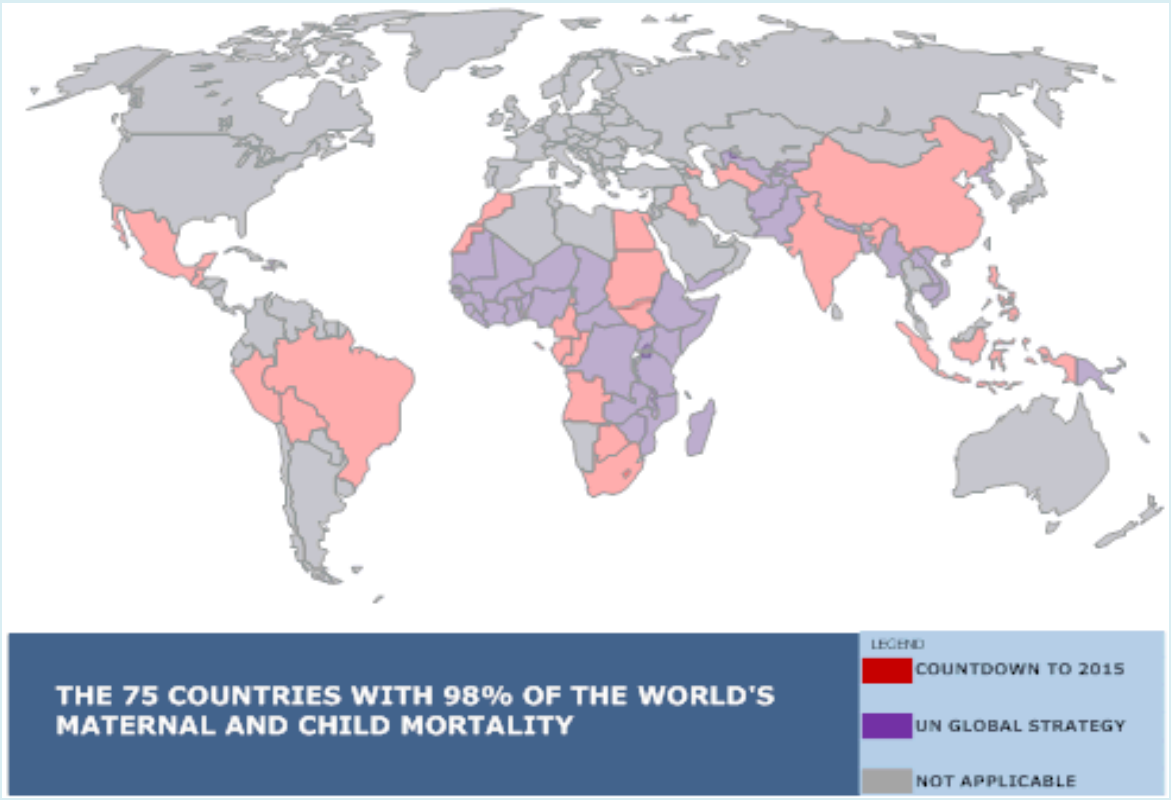
1 eHealth is the effective use of information and communication technology (ICT) for health.

2 For detailed country data, see Annexes 2 to 5 in this report.

3 Given the critical importance of the Millennium Development Goals to reduce child mortality and improve maternal health (MDGs 4 and 5), a high-level commission to improve global reporting, oversight and accountability for women's and children's health – the Commission on Information and Accountability for Women's and Children's Health – was established in January 2011 to increase the likelihood that pledges for women's and children's health are honoured and that resources are spent in the most effective way to save lives. See: www.who.int/pmnch/media/membernews/2011/20110620_commission_on_accountability/en/

4 WHO/iERG (2012). *Every Woman, Every Child: From commitments to action.* The First Report of the independent Expert Review Group (iERG) on Information and Accountability for Women's and Children's Health, p. 2. See: www.who.int/woman_child_accountability/ierg/reports/2012/IERG_report_low_resolution.pdf.

**Figure 1: Countries where CoIA recommendations are being implemented**[5]




*Source: WHO/iERG (2012). Every Woman, Every Child: From Commitments to Action – The First Report of the independent Expert Review Group (iERG) on Information and Accountability for Women's and Children's Health.*

To support these and other countries in improving information and accountability for maternal and child health, this report gives an overview of the status of telecommunication services available in CoIA countries, providing concrete examples on the role eHealth and ICTs can play in implementing the recommendations proposed by CoIA in September 2011 in its framework for global reporting, oversight and accountability on women's and children's health. The report examines also key technical, policy, governance and human resources considerations that need to be taken into account for the successful implementation of ICT and eHealth projects at a national scale to accelerate the reduction of maternal and child mortality in CoIA countries and advance the delivery of healthcare services to these populations.

[5] Of the 75 CoIA countries, 43 are classified by the United Nations as least developed countries (LDCs) with the lowest-income level worldwide, while the remaining 32 are developing countries. Of the 43 LDCs under CoIA, 37 are included in the UN Global Strategy for Women's and Children's Health, and six additional countries are in the Countdown to 2015. See Annex 1 for a complete list of CoIA countries by region.

# II Status of telecommunications in CoIA countries

The level of access to and usage of ICT in CoIA and other developing countries have improved in the last years due to the convergence of several factors, including:

- increased competition that fostered the rapid deployment of mobile-cellular technology;
- the launch of high-speed mobile networks and services (3G and EDGE) in several countries;
- the roll out of fixed and mobile broadband services;
- significant decreases in the prices for mobile-cellular services and handsets, particularly of 2G mobile phones;
- increased access to Internet services through telecentres and low-cost personal computers; and
- the introduction of the modality of prepaid service for mobile-cellular, and, in some CoIA countries like Bangladesh, India and China, for mobile broadband services also, that have made both services more affordable to low-income sectors of the population.

### Fixed-telephony and mobile-cellular services

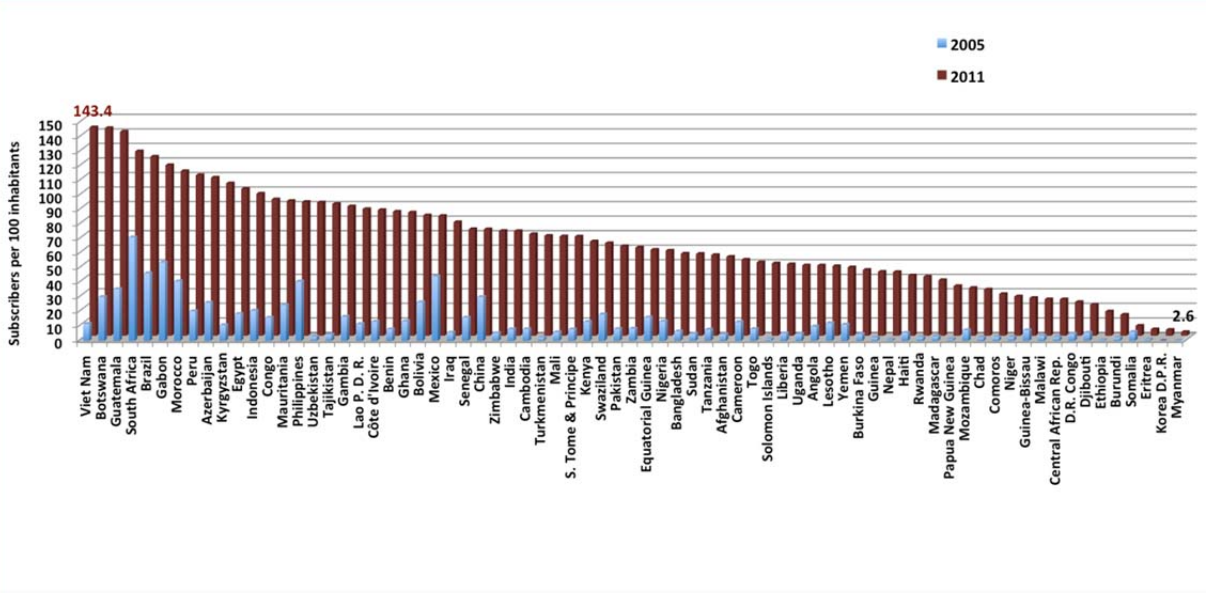
While growth in fixed-telephone subscriptions has remained stagnant[6] or followed negative trends in most developing countries (Africa, for example had a teledensity of 1.4 fixed-telephone subscriptions per 100 inhabitants in 2011), the penetration of mobile-cellular subscriptions in developing countries has grown significantly, reaching 79 per cent by 2011[7]. According to ITU estimates, by the end of 2011, 90 per cent of the world population had access to 2G networks. Meanwhile, the world population coverage of 3G services reached 45 per cent, with more than 160 countries providing 3G services to the public in 2011.

In 2011, China and India—two CoIA countries—ranked first and second worldwide in total number of mobile-cellular subscriptions, reaching more than and near to one billion subscriptions respectively. From 2005 to 2011, CoIA countries made significant inroads in increasing the number of mobile-cellular subscriptions among their population (see Figure 2 and Annex 3). In 49 CoIA countries (65%), the penetration of mobile-cellular subscriptions grew at annual rates of at least 30 per cent during the last six years. Moreover, of the 75 CoIA countries, 45 (60%) were serving at least 50 per cent of their population by 2011, and Viet Nam was leading this group of countries with a penetration of 143.4 mobile-cellular subscriptions per 100 inhabitants.

6 For detail on current penetration rates of fixed-telephone subscriptions in CoIA countries, see Annex 2.

7 ITU (2012). *ICT Facts and Figures 2011*, p. 2. See: www.itu.int/ITU-D/ict/facts/2011/material/ICTFactsFigures2011.pdf

**Figure 2: Mobile-cellular subscriptions per 100 inhabitants, CoIA countries, 2005 and 2011**




*Source: ITU World Telecommunication/ICT Indicators Database 2012.*

This rapid growth is explained by reductions in the price of service, access to more affordable handsets, the availability of prepaid services and the introduction of competition in the mobile-cellular market. ITU estimates, for instance, that between 2008 and 2010, the rates for a sub-basket of mobile-cellular services fell by 22 per cent in developing countries, compared to a reduction of 6.7 per cent in the fixed-telephone sub-basket for the same period[8].

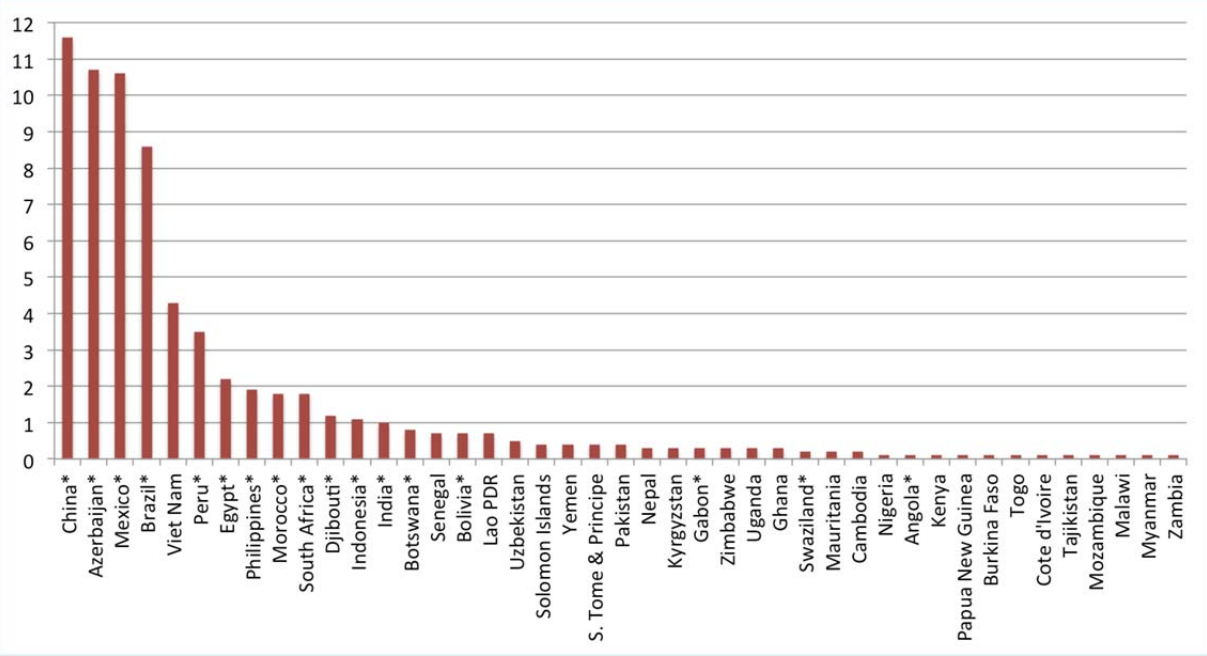
### Fixed (wired) and mobile-broadband services

Since fixed-broadband networks require larger investments, their roll out in developing countries has followed a slower pace than mobile-broadband technologies (see Figures 2 and 3, and Annexes 4 and 5). Of the 75 CoIA countries, only 13 had penetration levels of fixed-broadband subscriptions above one per cent, as illustrated in Figure 3; nevertheless, the number of fixed-broadband subscriptions is growing at a much faster pace among developing countries (18% over 2011) than in developed ones (5% CAGR)[9].

[8] Idem, p. 7.

[9] ITU (2012). *Measuring the Information Society 2012 Report: Main Findings*, p. 5. See: www.itu.int/ITU-D/ict/publications/idi/material/2012/MIS2012_highlights_short.pdf

**Figure 3: Fixed (wired) broadband subscriptions per 100 inhabitants in CoIA countries, 2011**




*Source: Broadband Commission (2012). The State of Broadband 2012: Achieving Digital Inclusion for All. See: www.broadbandcommission.org/Documents/bb-annualreport2012.pdf, pp. 82-83.*

It should be noted, however, that many developing countries are just installing basic fixed-broadband networks, so their subscriptions tend to be limited to speeds below 2 Mbit/s, which restricts the type and quality of applications and services that users can get access to, including data- and video-intensive services crucial for several eHealth and telemedicine uses. Nevertheless, next generation networks (NGNs) will be capable of much higher data transmission speeds and capacities, enabling the use of advanced data services by large users, such as hospitals and businesses in urban areas[10].

### Reaching rural and remote communities

For rural and remote communities, wireless technologies still represent the best and most affordable option for broadband services, despite their lower bandwidth capacity compared to fixed-broadband. In developing countries, mobile-broadband subscriptions have grown 45 per cent annually over the last four years, representing about twice the number of fixed-broadband subscriptions in these countries[11]. In Africa, the region to which most CoIA countries belong, mobile-broadband penetration has reached 4 per cent, compared to less than one per cent for fixed-broadband penetration[12]. Moreover, increased roll out of WiMAX technology in some developing countries offers an option for access to high-speed mobile services and health-related applications[13].

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10 ITU (2012). *Measuring the Information Society 2012 Report: Main Findings*, p. 1.

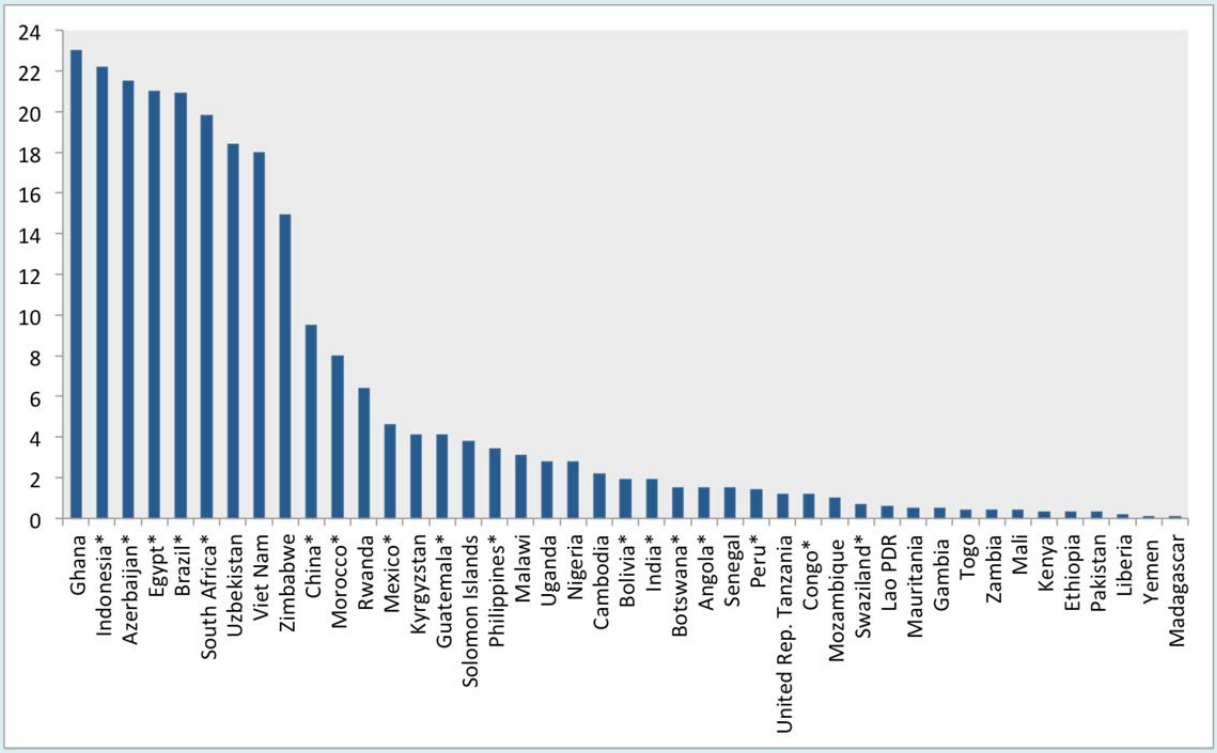
11 ITU (2012). *ICT Facts and Figures 2011*, p. 2.

12 Idem, p. 4.

13 ITU (2012). *Measuring the Information Society 2012*, p. 5.

Compared to fixed-broadband service, more than twice the number of CoIA countries (30) have reached penetration rates for active mobile-broadband subscriptions above one per cent, with Ghana reaching almost 25 per cent of its population by 2011, according to the Broadband Commission (Figure 4 and Annex 5).

**Figure 4: Active mobile-broadband subscriptions per 100 inhabitants in CoIA countries, 2011**




*Source: Broadband Commission (2012). The State of Broadband 2012, pp. 84-85.*

It should be noted that, along with the development of these telecommunication technologies, in CoIA countries, more traditional media, such as radio and television, continue to provide efficient means for disseminating information to rural and remote communities, as well as for reaching those who live in poor urban areas. Radio and television are affordable technologies, accessible to families, and capable of conveying information in local languages.

The following chapter provides concrete examples of the use of ICTs and traditional media for RMNCH programmes in CoIA countries.

# III ICT intersect: The ten CoIA recommendations in the context of eHealth and innovative ICT solutions

The expansion of information and communication technologies and particularly, the fast deployment of mobile-cellular telephony have supported the development of eHealth tools and services worldwide. Together, improved access to and usage of ICTs and eHealth applications provide the 75 priority countries under CoIA an unprecedented opportunity to meet the goals set in ten recommendations and, consequently, to make progress towards meeting MDGs 4 and 5.

To measure the advancement made by these countries in strengthening accountability for health along the MDGs 4 and 5, each recommendation provides a set of indicators to be met by 2015 or earlier. These indicators are designed to increase the reliability and accessibility of women's and children's health information and data, strengthen the mechanisms to track resources, and enhance the oversight of resources and results obtained, both nationally and globally, in each of the ten areas of the recommendations[14]. This chapter describes each of the ten CoIA recommendations, highlighting the ways in which the use of innovative ICT solutions and the development of national eHealth strategies can and, in some cases, has already contributed to improvements in information and accountability for women's and children's health in CoIA countries.

## Recommendation 1: Vital events: Civil registration and vital statistics (CRVS) and maternal death surveillance and response (MDSR)

With this first recommendation, the CoIA focuses on a concrete and major concern for CoIA countries: The need to improve the system for registration of births and infant and maternal deaths, the notification and review of maternal deaths, as well as promoting the approval of improvement plans for civil registration and vital statistics (CRVS) (Table 1).

**Table 1: Proposed indicators for Recommendation 1**

*By 2015, all countries have taken significant steps to establish a system for registration of births, deaths and causes of death, and have well-functioning health information systems that combine data from facilities, administrative sources and surveys.*

| Proposed indicators |
|---|
| Birth registration |
| Death registration |
| Maternal death reviews |
| Civil registration and vital statistics (CRVS) improvement |

[14] WHO/iERG (2012). *Every Woman, Every Child: From commitments to action*, p. 3.

### Background and current status

Birth and death registration, maternal mortality measurement, including number of deaths, their causes and circumstances, are critical factors for accountability. Functional Civil Registration and Vital Statistics systems (CRVS) are the preferred source of data for death count and causes of death (COD). Unfortunately, only two of the 49 lowest-income countries have functional CRVS[15]. The implementation of Maternal Death Surveillance and Response Systems (MDSR) within the health sector that include maternal death identification, reporting, review and response at facilities and community levels, are also critical to understand determinants of maternal death, to improve the quality of obstetric care, and to take corrective action in service provision.

### The role of ICTs

Documenting these vital events on a regular and systematic basis requires the implementation of reliable mechanisms for data collection, storage, and dissemination. ICTs have already proved their utility in other sectors, such as banking, insurance and commercial activities, improving the accuracy of transaction records and increasing the accessibility and diversity of services provided to the public[16]. In the health sector, registration of vital events, such as deaths and births, are still mostly paper-based systems and the reporting of these records is often delayed. The use of electronic systems can contribute to drastically reduce such delays, providing near real-time reporting, in addition to significantly improving data quality.

### Birth and death registration

Some countries have started to realize the potential of leveraging the power of ICT for registering, reporting, and reviewing vital events both at the facility level, using in many cases web-based systems, and at the community level, using mobile-based data collection solutions.

The e-District Project for births and deaths registration in India provides a good example of the use of such systems at the District level (see Box 1).

**Box 1: The *e-District Project* for birth and death registration services in the districts of Kapurthala and SBSN, India**

The *e-District Project* in India seeks to provide its citizens with a seamless system of electronic service delivery at the district administration level through automation workflow, back-end computerization, and data digitalisation. In the area of health and family welfare, since May 2012, the project is helping local government implement an electronic birth and death registration system, available to all citizens and healthcare workers, for issuing birth and death certificates. In rural areas, government officers will collect birth/death data from health workers, village caretakers or head of families and enter the information electronically, using the e-District system for issuing the certificates. The objective is to ensure that the defined process of service delivery of birth/death certificates is adequately and timely followed.

*Source: Government of India. See: http://pbhealth.gov.in/e-district.crs.pdf; http://deity.gov.in/sites/upload_files/dit/files/E-district040511.pdf*

[15] See: www.who.int/bulletin/volumes/89/11/11-097220/en/index.html.

[16] An example of the impact of ICT use in the banking sector of Nigeria, one of the CoIA countries, is provided in Akinlolu Agboola (2005). *Information and Communication Technology (ICT) in Banking Operations in Nigeria – An Evaluation of Recent Experiences*. See: http://unpan1.un.org/intradoc/groups/public/documents/aapam/unpan026533.pdf

Where fixed telecommunication infrastructure are unavailable, mobile-cellular phones can also facilitate the registration of vital events, such as births and deaths, particularly in remote and isolated areas, as illustrated in the case of Liberia (see Box 2).

**Box 2: Mobile birth registration in Liberia**

With only 4 per cent of births registered annually, Liberia ranks second highest globally in unregistered births. Although the registration of births and small children was impede for several years due to civil war, the post-conflict government is aiming at addressing this gap. The Liberia Poverty Reduction Strategy identifies as one of its priorities the development of a population information system, and particularly, the improvement of birth registration.

To this end, the Liberia Ministry of Health and Social Welfare, in collaboration with UNICEF, the United Nations High Commissioner for Refugees, Plan Liberia, and Crisis Management Initiative, launched the Universal Birth Registration (UBR) system, the country's first decentralized electronic birth registration and certification system. UBR aims to increase birth registration and certification for children under-six to 90 per cent in two years, which represents an important step towards achieving the fundamental right of every child to a name and nationality at birth. An initiative under UBR promotes the use of mobile-cellular technology to collect birth registration information in rural areas, which is then transmitted via global positioning response signal (GPRS) to the main registration service. This Mobile Birth Registration (MBR) project has been implemented successfully in one county in Liberia and will be scaled up to other counties, allowing the printing of birth certificates in rural counties across the nation.

*Source: H. Toivanen, J. Hyvönen, M. Wevelsiep & M. Metsäiemi (2011). Mobile birth registration in Liberia. VTT Working Papers 159. See: www.vtt.fi/inf/pdf/workingpapers/2011/W159.pdf*

### Civil registration and vital statistics (CRVS)

The electronic birth and death registration services mentioned above should be integrated within broader national CRVS systems and linked to national databases of vital events records, if they are in place. The CRVS system tends to fall under the mandates of different ministries that are in charge of the registration of different population; birth and death registration might be under the Ministry of Health, whereas other ministries oversee other civil registrations. As a result, bringing together relevant government actors to agree on a broad civil registry and vital statistics system is one of the key challenges CoIA countries face.

ICT can play a critical role in strengthening CRVS by facilitating the registration of vital events, both at the facility and community levels. The careful integration of medically certified deaths occurring in health facilities into those occurring and being registered within communities provides the best means to fully understand what people are dying from. To facilitate such integration, however, it is essential to take into consideration also diverse aspects of data consistency, standardized vocabularies, and interoperability. This comprehensive approach has already been adopted in some CoIA countries, as exemplified in Box 3, which discusses the approach taken by the Cambodia Government in implementing its CRVS system.

**Box 3: Civil registration and vital statistics: The case of Cambodia**

In Cambodia, the Ministry of Interior, the National Statistics Office, and the Ministry of Health are steering actions in civil registration and cause of death (COD) certification by undergoing a comprehensive assessment and planning process for improving their civil registration and vital statistics (CRVS) system. Authorities in Kandal Province, Cambodia, for example, record births and deaths, produce certificates, and monitor and report vital events monthly. Improving the completeness, quality, and use of mortality data is a key next step. To standardize the way mortality statistics are derived from facility-based systems and communities, Cambodia is medically certifying and coding the underlying cause of death (COD) using the WHO-UQ tool ICD-10*, including the use of verbal autopsy (VA). This practice has increased coverage of medically certified deaths and CODs registered.

**Note: ICD-10, the International Classification of Diseases (ICD) is used to classify diseases and other health problems recorded on many types of health and vital records, including death certificates and health records. See: www.who.int/classifications/icd/en/*

*Source: WHO WPRO. See: www.wpro.who.int/health_information_evidence/Civil_registration/en/index.html*

Mobile devices can be used also to enhance the recording and reporting of vital events at the community level, to incorporate them into national CRVS systems, and to support the certification of vital events, like in the case of Ghana, presented in Box 4.

**Box 4: MOVE IT GHANA**

*Mobile platforms and information technology-enhanced data analysis and use for decision-making*

In Ghana, the Monitoring of Vital Events- through leveraging Innovations including Information Technology advances (MOVE-IT) project runs in three districts of the relatively deprived, northern region of the country. MOVE-IT employs community-based agents—known as surveillance and health cadres—to report the occurrence of vital events. Competent technical persons follow up these events, confirming their occurrence, and capturing the relevant details in records in community folders and through computers linked to the national system of vital events recording. This initiative aims at promoting the analysis of the data collected, as well as the use of the system at the local and national levels. Vital events records will be linked to the district health information system in the respective districts. In late 2011, the project started the implementation of the short message service (SMS) alert or notification system, the first of three phases of the IT component.

*Note: Information on the partners involved in this and other MOVE-IT country project is available at www.who.int/healthmetrics/move_it/move-it_projects_1582011_final.pdf.*

*Source: WHO. See: www.who.int/healthmetrics/news/MOVE_IT_Africa_Board_Paper_21.2.12.pdf*

### Maternal death surveillance and response (MDSR)

Maternal death reviews are the cornerstone of improvements in health systems and statistics. Better knowledge of the causes of death, of the local environment, and of the social status of the family will contribute to a more in depth understanding of the conditions that need to be addressed to improve the situation. In CoIA countries, such investigations remain an impressive challenge and are rarely in place. Paper-based systems exist in only a few countries, and only few of those use electronic formats.

Many new opportunities exist to leverage ICT to improve maternal death notification, review, surveillance and response. A national maternal death surveillance and response system should draw upon two main sources of information. Within the health system, facilities should be required to report all deaths of women during pregnancy, delivery and the postpartum period. Reporting systems, preferably Internet-based, should be used for review and action. At the community level, local networks of informants from the health, administrative or traditional authorities should report maternal deaths[17], taking advantage of mobile phones, where access is available. As mentioned above, integrating data from facilities and communities through the use, for example, of ICD-10 classification is critical to create useful data for surveillance.

Several eHealth projects have been launched recently to provide a package of community-based maternal and newborn child health services, including the registration of pregnant women and newborns, and reporting their health status through mobile phones—including death, when it occurs—to a central web server that provides a real-time view of the health of a community. See, for instance, the case of ChildCount+, explained in Box 5.

**Box 5: ChildCount+**

*A community health events reporting and alert system*

ChildCount+ is an mHealth platform developed by the Millennium Villages Project aimed at empowering communities to improve child survival and maternal health. The system develops and implements, among others, a two-way mobile phone-based community health events reporting, feedback, and illness alert system. This system monitors and manages follow-up on births and deaths, on pregnant women and newborn children, children under five years, and adult illnesses, such as tuberculosis (TB), malaria and non-communicable diseases.

*Source: ChildCount+. See: www.childcount.org/about/*

[17] See: www.who.int/bulletin/volumes/89/11/11-097220/en/index.html

At the facility level, where connectivity and electricity are available, online maternal death review systems can also be implemented, like in the case of Punjab, India, addressed in Box 6.

**Box 6: Online maternal death review system in Punjab, India**

With an estimated 67 000 maternal deaths and one million newborn deaths each year, India is seeking to accelerate the pace of decline of its Maternal Mortality Ratio (MMR) by giving impetus to the implementation of technical strategies and interventions for maternal health. The RCH–II National Programme Implementation Plan includes a Maternal Death Review (MDR) strategy to improve the quality of obstetric care and reduce maternal mortality and morbidity. The MDR provides detailed information on various factors at the facility, district, community, regional, and national levels that need to be addressed to reduce maternal deaths. Analysis of these deaths can identify the delays that contribute to maternal deaths at various levels and the information used to adopt measures to fill the gaps in service.

MDR has been implemented in some states for the last few years, while guidelines and tools were being framed for the states to use and implement easily. Following these guidelines, the Punjab National Rural Health Mission has established an online MDR monitoring system and seeks to strengthen capacities for data collection, assessment and review for evidence-based planning, monitoring and supervision. The system aims at ensuring that every death of mother and infant is recorded, so that the root cause and gaps in services are identified.

It has been observed that the majority of the maternal and child deaths and stillbirths remain unreported. When data is being collected, transferring documents from one official to another manually results in a time consuming process. This online project could ensure that reporting of mother and child deaths from all quarters is centralized through a single online software, available to all the departments, thus reducing systematic defects and gaps in reporting, and ensuring necessary administrative corrections and the formulation of strategies to reduce maternal and infant mortality rates (IMR).

*Source: Punjab National Rural Health Mission. See: http://pbhealth.gov.in/crs_main.htm. Image source: http://pbnrhm.org/login-mdr.aspx.*

## Recommendation 2: Health indicators

The CoIA has selected a set of eleven indicators on reproductive, maternal and child health for coverage and impact strategy, to assess the progress made towards the goals of the Global Strategy for Women's and Children's Health[18], as indicated in Table 2.

**Table 2: Proposed indicators for Recommendation 2**

*By 2012, 11 indicators on reproductive, maternal and child health, disaggregated for gender and other equity considerations, are being used for the purpose of monitoring progress towards the goals of the Global Strategy.*

| | Proposed indicators |
|---|---|
| Coverage:<br>Statistics for the eitght coverage indicators are available for at least one of the two preceding years, disaggregated by equity stratifiers | 1. Demand for family planning satisfied (met need for contraception)<br>2. Antenatal care visits (min. 4 visits)<br>3. Antiretroviral (ARV) prophylaxis among HIV positive pregnant women to prevent HIV transmission, and antiretroviral therapy for pregnant women who are treatment-eligible<br>4. Skilled attendance at birth<br>5. Postnatal care for mothers and babies within two days of birth<br>6. Exclusive breastfeeding for six months (0–5 months)<br>7. Three doses of combined diphtheria-tetanus-pertussis (DTP3) immunization coverage (12–23 months)<br>8. Antibiotic treatment for suspected childhood pneumonia |
| Impact:<br>Data for the three impact indicators are available based on data collected in the preceding three years, disaggregated by equity stratifiers | 9. Maternal mortality ratio<br>10. <5 child mortality, with the proportion of newborn deaths<br>11. Stunting prevalence among children under five |

### Background and current status

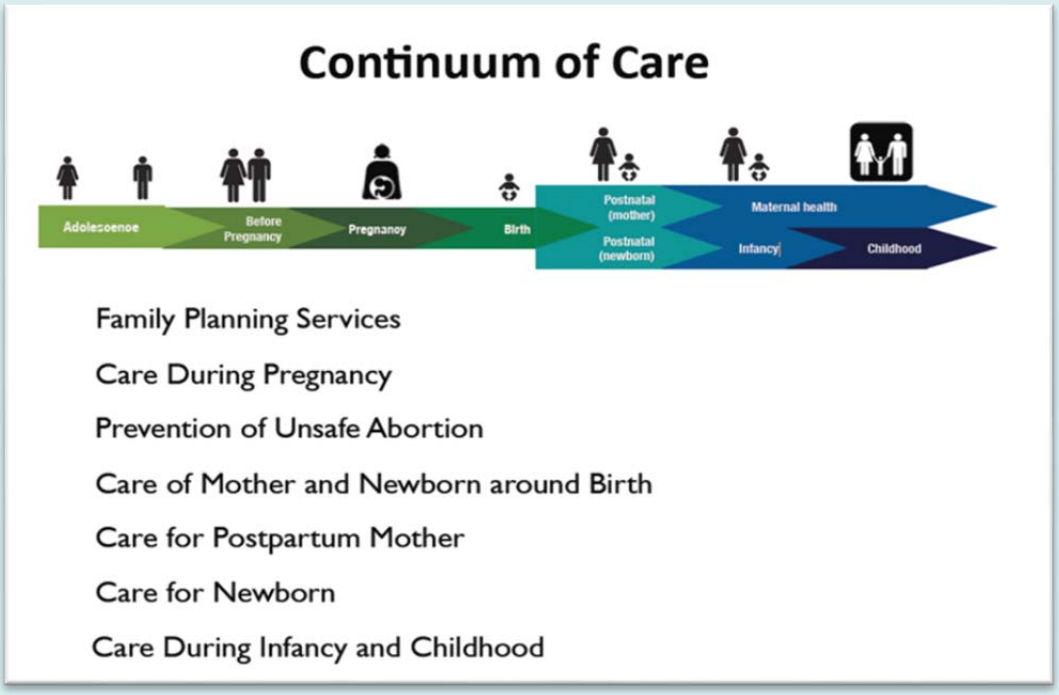
In terms of CoIA, *coverage* and *impact* refer to the various activities undertaken along the WHO Continuum of Care (Figure 5), including the demand for family planning, antenatal care visits, skilled birth attendance and post natal care, among other health events covering the period from pre-pregnancy, pregnancy, post-pregnancy and early childhood. The eleven indicators set by CoIA are largely derived from the Multiple Indicator Cluster Survey (MICS[19]) developed by the UNICEF, and the Demographic and Health Surveys (DHS[20]) developed by the USAID household surveys, which provide large amounts of data on developing countries. Their estimates are used in MDGs reports to the UN Secretary General and in the Countdown to 2015 reports.

[18] See: www.everywomaneverychild.org/images/content/files/global_strategy/full/20100914_gswch_en.pdf

[19] See: www.unicef.org/statistics/index_24302.html

[20] See: www.who.int/healthmetrics/partners/USAID/en/index.html

**Figure 5: WHO Continuum of Care**




*Source: WHO Department of Making Pregnancy Safer*[21].

The indicators included in Recommendation 2 are significantly varied and involve health professionals at all levels of healthcare facilities, from communities to major hospitals. They also include logistics systems ranging from cold chains to deliver vaccination and immunization to young children, to nutrition to fight stunting prevalence. To enable the identification of equity or gender gaps, the data collected should be disaggregated using gender and equity stratifiers concerning age, urban/rural residence, geographic location, ethnicity, and when possible, HIV status, education and marital status.

The 2015 targets set out by the CoIA for this recommendation represent millions of data to be collected by multiple agents (health facilities, household surveys, and administrations, among others), aggregation mechanisms, and decision support systems to adequately inform policy makers and deciders in the public health arena. This has to be considered as an integrated Health Information System (HIS), supported by an industrial data production that responds to criteria of quality, ethics, security and protection. Transforming paper-based systems to electronic systems is not a simple exercise. In consequence, CoIA countries need to consider this question carefully and examine the foundational work required to support the establishment of such systems. The policy, governance, human resources and technical factors that need to be taken into consideration are discussed in greater detail in Chapters IV and V of this report.

[21] See: www.who.int/pmnch/about/continuum_of_care/en/index.html

### The role of ICTs

The flourishing of information technologies and, in particular, the rapid expansion of communication networks over the last decade, have enabled dramatic changes in the collection and analysis of health care data, both at the operational level of each healthcare institution and at the level of national health systems. Individual doctors, clinics and many hospital wards have long sought to digitize their patient registries and medical histories for easier retrieval and analysis. Many have also computerized particular functions such as billing, laboratories and medical imaging. Initially, these were commonly isolated initiatives, which in larger institutions easily led to a proliferation of custom-made, standalone systems. Later, local area networking and an increased focus on standards enabled increased connections between formerly disparate systems within hospitals. Such post-hoc efforts at integration within an overall enterprise architecture framework often prove complex and costly. Yet, they also tend to highlight redundancies and overlaps, enhancing data quality as a result, by collating the information about a particular patient in a coherent fashion. In addition, these integrative efforts have helped ensure access to centralized services throughout a hospital, or even between geographically dispersed institutions. Nevertheless, the electronic exchange of patient data between institutions with varying technical and organizational setups adds another order of complexity.

Similarly, in the field of public health and national health systems management, public health specialists have commonly used specialized software, including general statistics packages and tools, such as the United States Centers for Disease Control and Prevention (CDC) Epi Info, the WHO Health Mapper, and the ubiquitous Microsoft Excel. Another extremely widespread tool is MS Access, which has often been used as a platform for local system development. However, most of these tools are standalone applications, conceived before the expansion of the Internet to rural areas, a development that has accelerated tremendously through the dissemination of third generation mobile technologies, which enhances data transfer capacity. This rapid expansion of data networks has extended the range of ICTs capable of enhancing multiple aspects of data handling, ranging from data collection and data quality to data analysis and dissemination. Furthermore, the transition to networked systems has facilitated the development of functionalities beyond the current paradigm of expert reviews, allowing interaction at a much larger scale.

The use of web and mobile technologies present new opportunities both quantitatively and qualitatively. When it comes to data collection, expanded connectivity enables the deployment of web applications that let health facilities enter data directly into central servers, without the need for any software installation or database management at the local level. Furthermore, facilities that have already computerized their internal operations—through an electronic Medical Record System, for instance—can construct gateways to enable direct reporting from their system, thus obviating the need to re-enter data. Electronic reporting can thus replace slow and error-prone paper reporting, and completely eliminate copying and calculation errors. Nevertheless, such automated reporting may require considerable programming in the local system, if a standard reporting mechanism is not already developed.

Moreover, an electronic system allows for the introduction of a range of data quality measures, including sending alerts when values deviate substantially from an established trend, and comparing related values, such as the total number of births to the number of live births. Likewise, data become immediately available at the district, provincial and national levels, facilitating timely decision-making and the provision of rapid feedback to local users, through comments on the raw data reported, more sophisticated analyses, and by allowing comparisons between similar facilities or districts.

The nearly ubiquitous access to mobile telephony enables direct interaction with Community Health Workers (CHWs) in the field and the use of SMS technology for data collection and alerts, as exemplified in the case of mTRAC in Uganda (Box 7).

**Box 7: mTRAC**

*Using SMS for disease surveillance and for monitoring essential medicine supply in Uganda*

**mTRAC** is an SMS-based reporting platform that enables health care workers (HCW) to send weekly government reports on disease surveillance, malaria case management, and stock quantities of antimalarial drugs, using mobile phones and computers. Launched by the Ministry of Health of Uganda as a pilot project in 2011, the platform is now operated by the MoH and fully integrated into its Health Information Management System. mTRAC has been rolled out to every District, currently reaching all health facilities in the country.

mTRAC still requires HCWs to fill out a paper-based form, as reference, to help them report the weekly number of identified cases and deaths caused by monitored diseases—such as neonatal tetanus and malaria—, the number of maternal and perinatal deaths, and information on malaria drug-stock and testing. Once weekly data has been collected, HCWs send the reports, at no cost, via an SMS template, an unstructured supplementary service delivery (USSD) interface, or an online, computer-based Dashboard. For instance, should a HCW need to report one weekly death due to malaria (MA) and one due to cholera (CH), she would send an SMS to the District health team stating: *DEATH. MA.1 CH.1*.

The adoption of mTRAC has sped up the transfer, analysis and dissemination of health information from lower health facilities to the District and Ministerial levels in Uganda. According to UNICEF, mTRAC has sustained a 90 per cent response rate for weekly reports via SMS. Data generated from these reports inform decision making in real time, letting District health teams and health centres respond immediately to SMS alerts on notifiable diseases, sudden increases in malaria cases and drug stock-outs.

To ensure sustainability and scalability, the mTRAC system works on any mobile phone and on all major telecom networks in the country. Accountability and transparency are improved also through the implementation of a toll-free health service complaint hotline that lets community members report stock-outs or closed clinics, via SMS, using any of the most common Ugandan languages.

*Sources: UNICEF, WHO, UKaid (n.d.) mTrac, Health Center Manual SMS. See: https://smsinaction.crowdmap.com/reports/view/213; UNICEF (Aug. 15, 2012). Uganda – mTrac Monitors Medicine Supplies Using SMS, SMS in Action. See: www.unicef.org/uganda/9903.html*

As wireless broadband, smartphones and tablet computers become increasingly affordable, the reach and scope of these mobile eHealth applications can be expected to expand also, benefitting local health staff in their daily operations and improving their direct interaction with beneficiaries in their communities. Yet, for such mHealth initiatives to substantially strengthen the whole health system, it is indispensable to integrate them into common, back-end services, which combined, would become the core of an overarching information architecture.

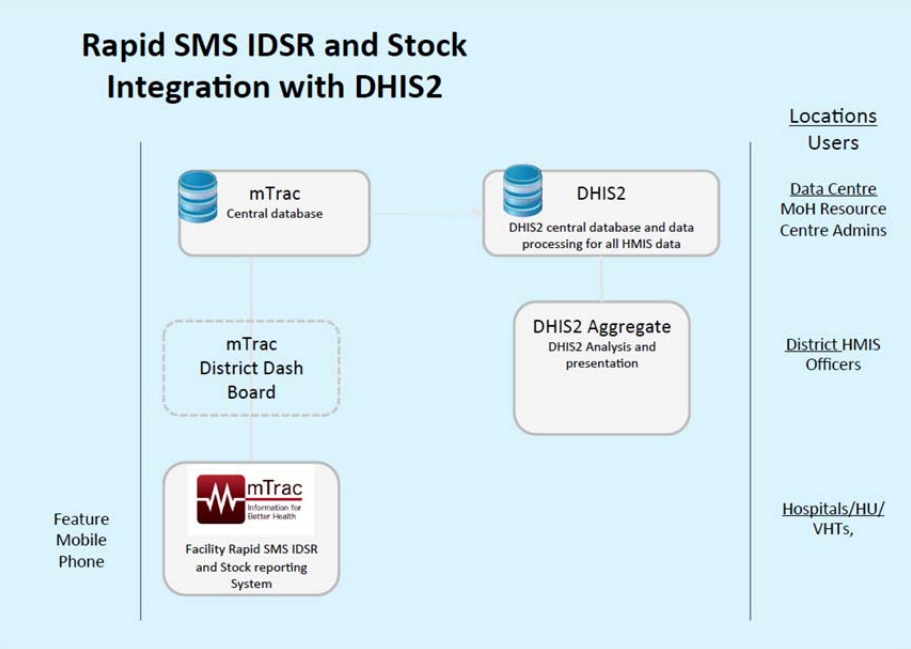
Embedding analytical functionalities into web applications would "democratize" these tools, making them accessible not only to a few experts, but also throughout the health system, at the provincial, district and facility levels. Expanded access would shorten feedback loops and promote the involvement of an increased number of health staff. It would also ease communication across strict hierarchical reporting lines, and increase the establishment of social networks with peers who may be geographically distant. In sum, a well-planned web-based system provides the infrastructure for community building, both with local colleagues and with peers elsewhere.

In addition, a web-based setup considerably facilitates the appropriate sharing and dissemination of analyses, reports, and even of the underlying data with relevant stakeholders, such as donors, international organizations, and the public at large, as exemplified in the case of Uganda (Box 8).

**Box 8: District Health Information Software in Uganda**

The District Health Information Software (DHIS2) is a modular, web-based, open source Java application used for the collection, validation, analysis, and presentation of aggregate and transactional data, tailored (but not limited) to integrated health information management activities. Rather than a pre-configured database application, DHIS2 is a generic tool with an open meta-data model and a flexible user interface that allow the user to design the contents of a specific information system, without the need for programming.

Taking advantage of the existence of adequate ICT infrastructure in most of its districts, Uganda adopted this web-based Health Information System (HIS) in 2011, becoming the second country in Africa to implement it countrywide. Through this implementation, Uganda aims at facilitating the management of HIS data, improving the reporting of individual facility aggregate information, and facilitating planning and delivery of quality health care nationwide. DHIS2 uses mobile applications for reporting and viewing reports online, as illustrated below. Launched in 2012 by the Director General of Health Science, the DHIS2 Uganda Instance has been installed on a central server at the Ministry of Health (MoH) and rolled-out to all 112 Ugandan districts, which have also received training on the system.




As part of the National System for HMIS, all districts are currently reporting facility aggregate data online, reaching reporting rates of about 85 per cent. This rate includes MCH indicators from the four districts (Kabarole, Kamwenge, Kiibale, Kyenjojo) where the "Saving Mothers and Giving Life" (SMGL) programme is being implemented. In these SMGL districts, DHIS2 has been implemented at the sub-district and facility levels, allowing data analysis and use at the lower levels. The SMGL districts are also implementing mobile data collection from the community. Implementing partners also have access and interact with the districts on data use. On a weekly basis, Village Health teams submit reports on the death rates of infants and women in reproductive age, allowing the teams to follow up and audit this information. The DHIS2 mobile is also used a means of communication to the village health team on any maternal and child health campaigns.

DHIS2—which replaced the Epi Info and other legacy databases used in Uganda—is expected to change the culture of information use by stakeholders at all levels of health systems management. It will also enable tracking and distribution of health commodities through the web-pharmaceutical order and reporting. The system, which provides weekly, monthly, quarterly and annual reports, will track prevalence of diseases and monitor the distribution of drugs and other supplies. DHIS2 also aims at

improving quality and efficiency of disease surveillance, enhancing protection and prevention by making processes, such as HIV testing, fast and easy.

**"The DHIS is clearly taking root. There is something about the software that people find satisfying and useful. So I am optimistic that it is here to stay. Well done."**

Biostatistician of Kibaale District, one of the SMGL districts where the pilot is being implemented.

**Image source:** Magnus Korvald

Currently, Uganda is using the DHIS2 system for data entry, data validation, data set aggregation, generation of reporting summaries, as well as for charting and mapping, using the ibuilt data visualizer and GIS, respectively. For instance, the MoH is using the DHIS2 Tracker to conduct maternal and neonatal death audits, registering detailed data about each death, and capturing data reported on paper.

*Source: WHO Innovation Working Group and the United States Centers for Disease Control and Prevention.*

The capacity to bring together data from a number of sources for monitoring and evaluation (M&E) activities, planning, and overall health systems reviews highlights the importance of developing data and indicator definitions, and thereby the need for data harmonization. In addition to various routine reporting systems, core services, such as facility registry and a harmonized registry of indicators, provide a tremendous infrastructure for other key data sources, in particular household surveys such as USAID Demographic and Health Surveys (DHS) and the UNICEF Multiple Indicator Cluster Survey (MICS). Finally, a web-enabled, integrated health information infrastructure allows reporting information for its inclusion in national or regional observatories for health data, such as the WHO Global Health Observatory.

## Recommendation 3: eHealth and innovation

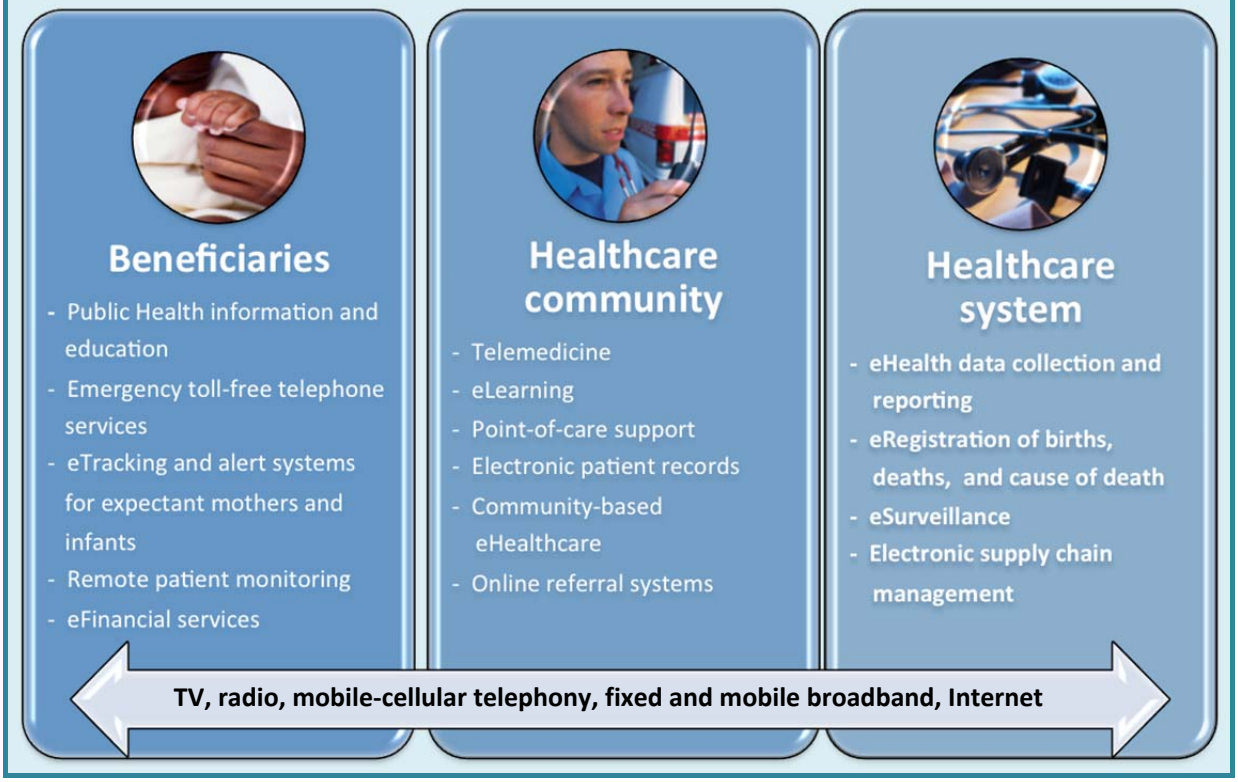
**Table 3: Proposed indicator for Recommendation 3**

| *By 2015, all countries have integrated the use of Information and Communication Technologies in their national health information systems and health infrastructure.* | |
|---|---|
| Proposed indicator | *National eHealth strategies* |

The CoIA has stressed the importance of using eHealth and innovative tools to help improve the provision of maternal and child healthcare. The adoption of ICTs by the healthcare sector has exploded in recent years, stimulated in part by the essential role such technologies play in facilitating the access to effective family planning and improving data collection processes for enhanced accountability along the CoIA indicators.

The adoption of eHealth and ICT innovations benefits stakeholders not only across the Continuum of Care, but also throughout the healthcare sector, as illustrated in Figure 6 and explained in Table 4 below.

**Figure 6: eHealth applications and ICTs benefit diverse stakeholders in the health sector**



## Table 4: eHealth and ICT innovations for RMNCH along the Continuum of Care

### A. eHealth services provided to individuals, new and expectant mothers, infants, their families and communities

| ICT innovations and services | Examples of what ICT services can offer along the Continuum of Care | | | | Examples of eHealth projects in CoIA countries[22] |
|---|---|---|---|---|---|
| | Pre-pregnancy | Pregnancy | Birth | Post-natal | |
| **Public Health Information and Education**<br>• Call centres and helplines<br>• Local radio<br>• SMS/IVR-based health • education and promotion<br>• SMS and social networks for behaviour change and communication | • Access to reproductive health information<br>• Reinforce positive health behaviour change, such as child spacing<br>• Stimulate demand on reproductive healthcare | • Providing tips on appropriate care and general information on pregnancy<br>• Support the prevention and treatment of mother-to-child transmission of HIV/AIDS and other communicable diseases<br>• Peer support networks of pregnant women<br>• Improving access and utilization of maternal health services by pregnant women | • Incentivizing women to attend facilities, providing skilled care during and after birth | • Access to information about infant and child nutrition, safe drinking water, hygiene promotion, etc. | • MAMA [2]<br>• Medic Mobile [39] |
| **Emergency toll-free telephone services** | | | • Improve transportation of pregnant and newborn with complications<br>• Access to skilled care at the time of birth in case of obstetric emergency care | | • HealthLine [31] |
| **e-Tracking and alerts systems for expectant mothers and infants**<br>• Patient registration<br>• Treatment compliance<br>• Appointment reminders | | • Providing prenatal advice at every stage of gestation<br>• Reminding pregnant women of pre-natal visits, informing nurses to follow-up | | • Infant registry for immunization<br>• Reminders for mothers requiring post-natal care for themselves and for their infants<br>• Alerts for infant vaccinations | • M-CHANJO [11]<br>• MoTech [42]<br>• UNICEF Reminder Mother System [53] |
| **Electronic directories for health care providers**<br>• Hospitals and clinics database<br>• Health professionals database | • Improve quick access to health services across the Continuum of Care | | | | • Hospitalsworldwide. com [33]<br>• M4RH [37] |
| **Remote patient monitoring** | | • Detecting and monitoring warning signals and typical symptoms of high-risk pregnancies | | • Home care and treatment of newborn with complications | • Amanece [16]<br>• Pesinet [44] |

[22] The eHealth projects listed in this table are further described in Annex 9 below. The number in brackets corresponds to the project number in Annex 9.

| | | | | | |
|---|---|---|---|---|---|
| **eFinancial services** | • Allowing women to save toward delivery and postnatal care | • Payments for healthcare related to antenatal care, e.g. consultation, diagnosis, lab tests, etc. | • Payments for healthcare related to birth, e.g. transportation and hospital care | • Payments related to post-natal care, e.g. child immunizations | • Health Systems 20/20 [32]<br>• Changamka Medical Smart Card [21] |

## B. eHealth services provided to healthcare providers, health centres, health professionals, doctors, nurses and midwives, and Community Health Workers (CHW)

| ICT innovations and services | Examples of what ICT services can offer along the Continuum of Care | | | | Examples of eHealth projects in CoIA countries |
|---|---|---|---|---|---|
| | Pre-pregnancy | Pregnancy | Birth | Post-natal | |
| **Telemedicine**<br>• Audio-Video-conferencing<br>• Tele-ultrasonography, Tele-cardiology solutions, etc.<br>• Remote diagnostics | | • Detecting and monitoring warning signals and typical symptoms of high-risk pregnancies<br>• Remote obstetrical ultrasound examination | • Access to trained medical professionals in case of emergency | • Screening/tests related to HIV, syphilis and other diseases<br>• Speeding up sending test results for early infant diagnosis | • TulaSalud [52]<br>• RAFT [45]<br>• SMART [49] |
| **eLearning**<br>• Online training materials<br>• SMS quizzes<br>• SMS/MMS/IVR-based training | • CHW training on reproductive health | • CHW training on healthy pregnancy and delivery | • Delivering education to traditional birth attendants | • CHW training on newborn and early childhood care | • AMREF [17] |
| **Point-of-care support**<br>• Decision support systems (e.g. checklists and algorithms) | | • Screening for pregnancy risk factors<br>• Improve efficiency in diagnosis and treatment across the continuum of care through protocol-driven care | | • Integrated management of childhood illness for children under 5 years old | • e-IMCI using D-Tree [27] |
| **Electronic patient records**<br>• EHR, EMR, PHR | • Allowing seamless integration of patient history data across the Continuum of Care | | | | • RPMS Electronic Health Record [47] |
| **Community-based eHealthcare** | • Collection of routine patient data during home and clinic visits to track health indicators at community level<br>• Case management<br>• Report and track expectant mothers and newborn health status and send alerts in case of abnormalities<br>• Management of workforce and performance monitoring and incentives<br>• Improve information flow back to the community level<br>• Improve the communication between and medical skills of health care institutions and birth attendants | | | | • Childcount+ [9]<br>• CommCare [23]<br>• Medic Mobile [39] |
| **Referral systems**<br>• Closed calling network<br>• Online or SMS-based | | | • Referrals and transportation of pregnant and newborn with complications to facilities with adequate resources<br>• Access to skilled care at the time of birth | | • SHINE [48]<br>• EhealthPoint [26] |

## C. eHealth services provided to healthcare managers and administrators to strengthen health systems

| ICT innovations and services | Examples of what ICT services can offer along the Continuum of Care | | | | Examples of eHealth projects in CoIA countries* |
|---|---|---|---|---|---|
| | Pre-pregnancy | Pregnancy | Birth | Post-natal | |
| **Electronic health data collection and reporting**<br>• Online Health Information System<br>• Structured SMS or mobile data collection forms | • Collect, aggregate, and analyse health data related to demand for family planning | • Collect, aggregate, and analyse health data related to HIV-ARV distribution to pregnant women, and antenatal care visits | • Collect, aggregate, and analyse health data related to skilled attendance at birth, as well as to post natal care for mothers and babies 2 days after birth | • Collect, aggregate, and analyse health data related to exclusive breast feeding, immunization, antibiotic treatment for childhood pneumonia, and stunting prevalence | • Online Reporting of National Rural Health Mission, Punjab, India [13] |
| **Electronic birth, death and cause of death registration** | | | • Birth, death and cause of death registration | | • e-District Kapurthala, India [1] |
| **e-Surveillance** | | | • Maternal and Infant death notification, review and surveillance | • Maternal and child health surveillance related to meningitis, malaria, diarrhoea or nutrition | • Online maternal death review system in Punjab, India http://pbnrhm.org/login-mdr.aspx |
| **Electronic Supply Chain Management** | • Stock management for reproductive health products | • Stock management for life saving commodities[23] | • Stock management for life saving commodities | • Stock management for vaccines, pneumonia, diarrheal drugs, etc. | • SMS for Life [50] |

[23] See: www.everywomaneverychild.org/resources/un-commission-on-life-saving-commodities/life-saving-commodities

To promote the scaling up of innovative mobile health programmes for RMNCH and in support of the UN Secretary General's *Every Woman Every Child* global strategy, the Innovation Working Group—managed by the mHealth Alliance—initiated a catalytic funding mechanism, with funds from the Norwegian Agency for Development Cooperation (Norad) and technical support from the WHO. Annex 6 profiles 16 projects or grantees that have been provided catalytic mHealth grants and which are active in 12 countries throughout Africa and Asia. Collectively, these projects aim to reach 1.5 million mothers and children, 6 500 health facilities, and 100 000 health workers.

### Some existing ICT tools and platforms that can accelerate innovation

Some ICT tools and open source platforms exist already that can accelerate the deployment of innovative ICT solutions for RMNCH. Mobile data gathering services, for instance, had proven their efficiency and cost effectiveness in many settings, especially in remote locations. Several Open Source tools exist to facilitate the creation and deployment of data gathering services, whether using SMS or tailored data entry forms that are downloaded on mobile devices to facilitate data collection in the field. Collected data are then sent back to a central server that provides data analytics tools, mapping and data export services, among other services. These solutions are considered as low cost, flexible and adapted to countries with limited resources and can be deployed relatively quickly.

Examples of such platforms and tools include, but are not limited to CommCare[24], Medic Mobile[25], RapidSMS[26], NOKIA Data Gathering tool[27], Magpi[28] (formerly EpiSurveyor), eMOCA[29], and the MoTech suite[30]. Those platforms and tools have already shown promising results in gathering, collecting, and exchanging health information, as well as in delivering many community-based healthcare services (see Boxes 9 and 10 for examples of such tools). Special attention should be paid, however, to protecting the security of the data collected, as well as to developing policies that regulate who has ownership over the data, who is allowed to have access to the information collected, and how these data will be used. Building capacity and educating skilled staff are also critical success factors for this kind of services. Those considerations are examined in greater depth in Chapter IV of this report.

[24] See: www.commcarehq.org/home/

[25] See: http://medicmobile.org/

[26] See: www.rapidsms.org/

[27] See: https://projects.developer.nokia.com/ndg

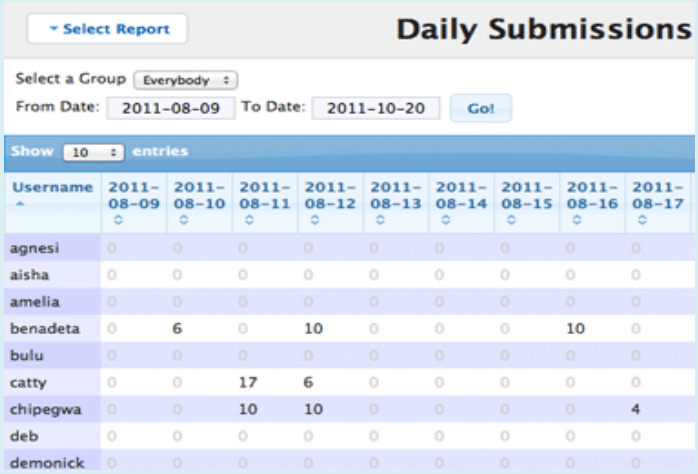
[28] See: www.datadyne.org/magpi-mobile/

[29] See: http://main.ccghe.net/content/emocha

[30] See: http://motechsuite.org/

**Box 9: CommCare**

CommCare is an easily customizable mobile health (mHealth) platform that allows community health workers (CHW) track and support their interactions with patients. The platform provides an alternative to the traditional practice of CHWs of using paper to manually track their work and carrying large patient education flipcharts. Instead, each CHW is equipped with an inexpensive mobile-cellular phone that runs an open-source and easy-to-navigate software.




| Username | 2011-08-09 | 2011-08-10 | 2011-08-11 | 2011-08-12 | 2011-08-13 | 2011-08-14 | 2011-08-15 | 2011-08-16 | 2011-08-17 |
|---|---|---|---|---|---|---|---|---|---|
| agnesi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| aisha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| amelia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| benadeta | 0 | 6 | 0 | 10 | 0 | 0 | 0 | 10 | 0 |
| bulu | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| catty | 0 | 0 | 17 | 6 | 0 | 0 | 0 | 0 | 0 |
| chipegwa | 0 | 0 | 10 | 10 | 0 | 0 | 0 | 0 | 4 |
| deb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| demonick | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

The CHW registers patients using customized electronic forms that were developed with the help of low-literate CHWs in several countries and across multiple languages. CommCare automatically submits visit data in 'real-time' to a central cloud server, CommCareHQ. Data on this server is privacy-protected, backed up, and accessible to supervisors and programme managers around the world.

CommCare improves the quality of and access to care through client lists on the CHWs' phones, checklists for CHWs, and SMS reminders when visits are due. It also boosts the accountability of care by facilitating real-time monitoring of CHW activities.

*Source: CommCare. See: [www.commcarehq.org/home/](www.commcarehq.org/home/)*

**Box 10: Medic Mobile—Kujua web application**

Medic Mobile has developed diverse low-cost tools that take advantage of SMS, email, SIM, J2ME or Android applications, as well as hosted and distributed web applications to coordinate community health workers and facility providers in remote villages. The goal is boosting the quality of maternal and neonatal health care by increasing referrals for skilled birth attendance and/or facility delivery, improving danger sign monitoring, and increasing coverage of complete antenatal and postnatal visits. Medic Mobile considers SIM applications to be ideal for health workers at low-level facilities because they function on any mobile handset available in developing countries. This feature makes this type of projects low-cost and scalable.

Kujua, one of Medic Mobile applications is a distributed, online/offline web application developed for the organization of health services. Its scalability and flexibility stem from being built on Apache's CouchDB software, and from its ability to be used in local clinics over diverse operating systems, be it Windows, Mac OS, or Linux. Through its SMS gateway, this web application receives and parses structured SMS messages, and stores them in a local database. While Kujua serves as a mobile health information hub for each clinic, it also harnesses cloud and ground computing, depending on the infrastructure.

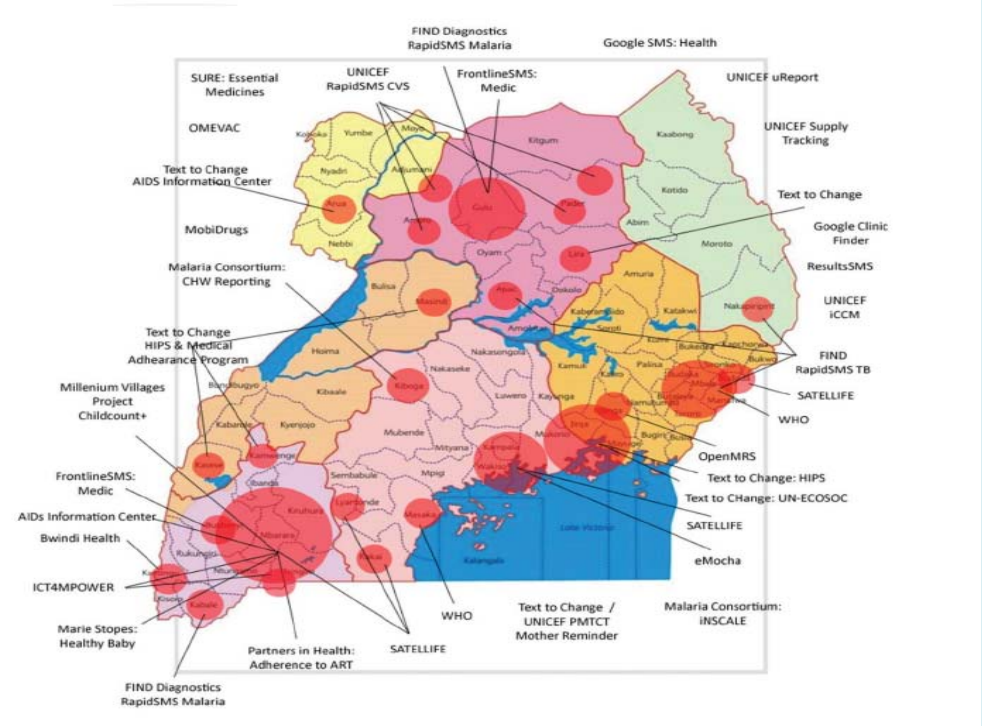
The platform, implemented in Benin, Cameroon, and Nepal, can use its replication feature to periodically synchronize a clinic's records with other clinics, hospitals, district management sites, or national offices running Kujua. Clinicians and managers at any tier of the health system can view dashboards, drill down through data, looking across clinics, districts, or even countries.

*Source: Medic Mobile. See: http://medicmobile.org/tools/; http://southasiainstitute.harvard.edu/site/health_southasia/Submission_abstracts/Mobile%20Network%20of%20Safety.pdf*

### The need for a national eHealth strategy

While ICTs are fast expanding in CoIA countries, most eHealth projects and innovative interventions are still limited in terms of scope and expansion. One of the hurdles CoIA countries and other developing nations face is the proliferation of fragmented eHealth pilot projects within their territories. Although some of these projects have been institutionalized, most tend to operate outside an effective eHealth framework or strategy, thus lacking the benefit of a central directive that links them to national priorities, and limiting their potential for interconnectivity and interoperability to scale up. The case of Uganda's mHealth projects, illustrated in Figure 7, provides an example of this challenging typical scenario.

**Figure 7: Uganda mHealth distribution map**




*Source: Pilotitis in Uganda: mHealth mapping. See: www.flickr.com/photos/texttochange/5178727492/*

The CoIA has defined the implementation of national eHealth strategies as the key indicator for Recommendation 3, eHealth and innovation, as shown in Table 3 above. CoIA countries are working on developing national eHealth strategies that bring together stakeholders and international partners to promote collaboration and avoid duplication of efforts. Although several countries have made remarkable progress, it is evident that more work still needs to be done in order to promote the adoption of national eHealth strategies. Detailed information on the adoption of eHealth national strategies is available at the WHO's Global Observatory for eHealth site[31].

To support governments in their ongoing efforts to develop national eHealth strategies, ITU and WHO recently published the National eHealth Strategy Toolkit[32] (Box 11). The experience of the Philippines, one of the CoIA countries that have adopted an eHealth strategy, is described in Box 12.

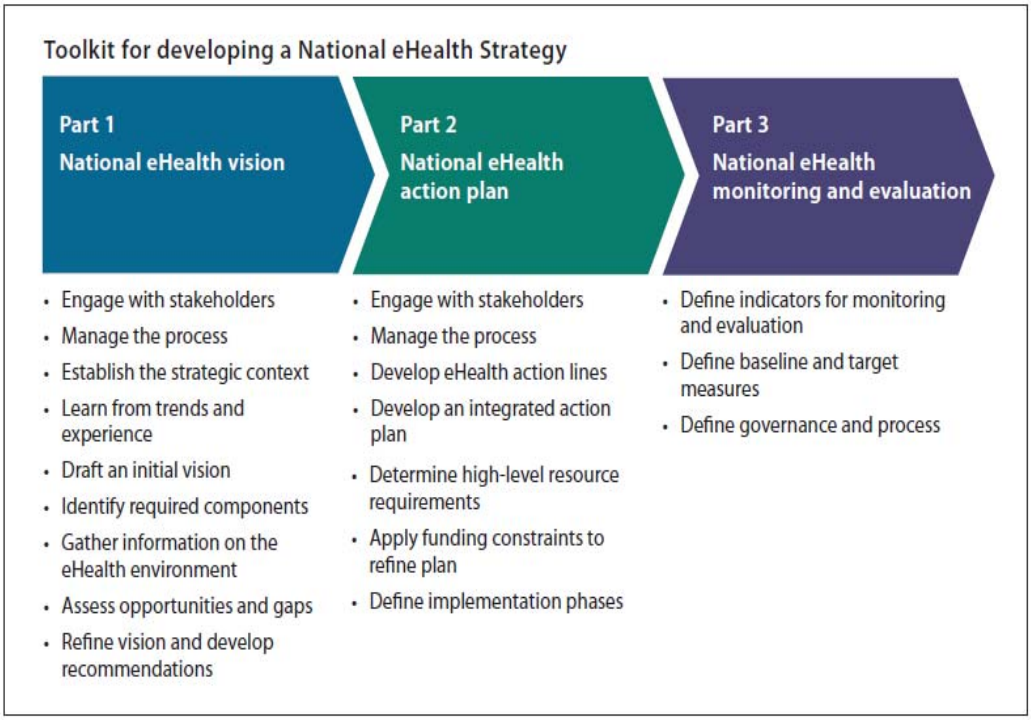
[31] See: http://www.who.int/goe/policies/countries/en/index.html

[32] See: http://www.who.int/ehealth/publications/en/index.html

**Box 11: National eHealth Strategy Toolkit**

Experience has shown that harnessing ICT for health requires strategic and integrated action at the national level to make the best use of existing capacity, while providing a solid foundation for investment and innovation. Establishing the main directions and detailed planning of the steps needed are key factors for achieving longer-term goals, such as health sector efficiency, reform or more fundamental transformation.

Developing a national eHealth programme is a goal of many countries. A national eHealth programme can contribute to reaching health and development goals and, for some countries, will constitute a major step towards implementing recommendations, such as those of the Commission on Information and Accountability for Women's and Children's Health.




The *National eHealth Strategy Toolkit* provides a framework and method for the development of a national eHealth vision, an action plan, and a monitoring framework. The Toolkit is a resource for developing or revitalizing a country's eHealth strategy, and as such, it is equally useful to countries that are just setting their strategies out, as well as to those that have already invested significantly in eHealth. This includes countries that are seeking to build on promising results from pilot initiatives, establish foundations for scaling up eHealth projects, or update strategies to reflect changing circumstances. Moreover, the Toolkit can be used by government leaders in the health sector, in the ministries, departments, and agencies that will manage the development of an eHealth strategy.

*Source: ITU. See: www.itu.int/ITU-D/cyb/app/e-health/NeHSToolkit/intro.phtml; www.who.int/ehealth/en/*

**Box 12: The Philippines' eHealth Strategic Framework and Plan**

The Philippines is one of the CoIA countries that have already embarked in developing a national eHealth Strategy or telemedicine plan. Taking advantage of diverse inputs, including the recommendations of the ITU/WHO *National eHealth Strategy Toolkit*, the Philippines is developing an *eHealth Strategic Framework and Plan.* This Framework proposes a national eHealth vision, action lines, an eHealth plan, and a monitoring framework that respond to the economic, technological, and administrative challenges and opportunities of the country, so as to achieve a more efficient and equitable health care system.

Since the 1980s, the Philippine government has prioritized the role of ICTs in achieving health programmes. This includes the implementation of telemedicine projects targeted to remote and underserved communities and vulnerable populations; the use of ICT to support health emergency and disaster surveillance activities, and the use of information systems as cornerstones for a more efficient administration and delivery of healthcare, services and outcomes.

The new eHealth Strategic Framework defines as its mission "to effectively use Information and Communication Technology to improve healthcare delivery, administration and management, and communicating health". To this end, the Framework sets strategic goals that aim at helping the country achieve its vision of Universal Health Care, while also fulfilling several of the proposed CoIA recommendations: (1) developing enabling structures and resources, including legal, technical and financial frameworks to better implement eHealth; (2) increase the efficiency of mission-critical health application systems; (3) establish a coherent health information system; (4) institutionalize knowledge management systems at the subnational level; and (5) implement telemedicine and mHealth services to reach geographically isolated and disadvantaged areas and support the attainment of the MDGs.

The latter goal includes among its strategic targets the implementation of RMNCH initiatives, in particular, the "Watching Over Mothers and Babies" (WOMB) system, a maternal and neonatal health tracking database system aimed at scheduling and recording the provision of maternal and child care services, and monitoring their progress, using a combination of mobile applications (such as SMS reminders), teleconsultation, the Internet, and central database technologies.

*Source: Philippines' Department of Health (2013). Philippine eHealth Strategic Framework and Plan 2013-2017. Draft document.*

## Recommendation 4: Resource tracking

As tracking down expenditures for RMNCH remains an important challenge in CoIA countries, IT innovative systems are essential tools for the long-term support and sustainability of national health accounts.

**Table 5: Proposed indicators for Recommendation 4**

| *By 2015, all 75 countries where 98 per cent of maternal and child deaths take place are tracking and reporting, at a minimum, two aggregate resource indicators: (i) total health expenditure by financing source, per capita; and (ii) total reproductive, maternal, newborn and child health expenditure by financing source, per capita.* | |
|---|---|
| Proposed indicators | *Total health expenditure*<br>*RMNCH expenditure (Government and external sources)* |

### Background and current status

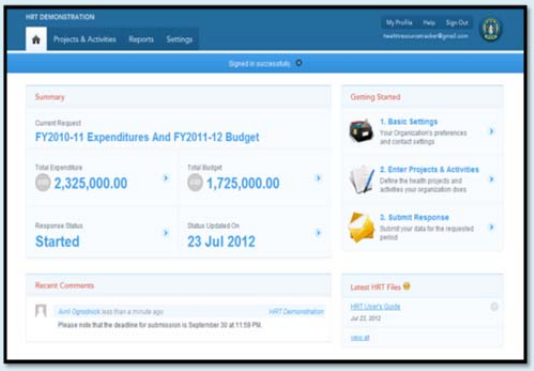
The adequate distribution of financial flows along the Continuum of Care depends largely on the CoIA countries' ability to link health expenditures per capita, and, more specifically, expenditures on RMNCH to their financing sources. Improved tracking and reporting of inflows and outflows directed to health and RMNCH activities would result in greater accountability, helping donors and beneficiaries better assess the impact of development aid in CoIA countries, in terms of increased social welfare and return on investment. Most CoIA governments, receiving support for RMNCH programmes, face the challenge of keeping track of the great variety of funding cycles and financing sources present in their territories. Calculating per capita health care expenditures requires national governments to manage and regulate health care expenditures across the sector. Moreover, disaggregating those expenditures to report total spending on reproductive, maternal, newborn and child health care by financial source, per capita, as proposed in Recommendation 4, represents a challenging task. Evidently, meeting these challenges will require the rapid adoption of IT systems to make the collection and analysis of financial resources and health expenditures more reliable and efficient.

### The role of ICTs

Ongoing improvement of health outcomes in CoIA countries calls for governments and policy-makers to ensure that health resources are efficiently allocated. Online tracking systems, for example, can enable decision-makers to gain a clear picture of financing flows in the health sector. Having access to accurate information would empower governments to better identify successful investments, evaluate the factors that contributed to their success, and support long-term decision-making and planning for the sector. Specific online tools have been developed to better track aid funding in countries, thus avoiding duplication, and ensuring local sustainability and mutual accountability. Rwanda, for example, has adopted a Health Resource Tracker system that provides decision-makers access to the health expenditure information critically needed for budgeting, planning and policy-making (see Box 13).

**Box 13: Rwanda Health Resource Tracker**

Rwanda Health Resource Tracker (HRT) supports policy-making and planning for improving health outcomes by providing decision-makers useful national health data on budgets and expenditures. The HRT tool has three components: (1) A central database that compiles data on the flow of financial resources in the health sector; (2) an easy-to-use online interface to collect information from all institutions active in the sector; and (3) a variety of output features to extract summary information and work plans that can guide health sector planning and performance management.




Compared to previously used processes, the HRT facilitates the harmonization of budget and expenditure data. It also reduces the overall effort needed for producing and analysing this information, thus improving quality, and making financial information more accessible, easier to collect, and more likely to be used.

*Source: Health Resource Tracker. See: www.hrtapp.com/*

Another useful tool available to CoIA countries is the WHO National Health Accounts (NHA) Production Tool (NHAPT)[33]. This tool guides health accountant teams through the entire process of producing a NHA, thereby reducing their need for technical assistance and increasing local capacity. This approach, which most of the COIA countries will follow in coming years, has been recommended for its ability to make health expenditure data more robust and timely, at a lower cost. Resource tracking initiatives are slowly expanding to other CoIA countries, thanks to their governments' participation in capacity building efforts. The CoIA independent Expert Review Group (iERG) reported that, in 2012, 30 of these countries (40%) had participated in training sessions and 18 of them had reported RMNCH expenditure at least once[34]. Furthering these efforts will require addressing factors that currently limit the long-term implementation of sustainable national health accounts, such as the high turnover of administrative staff, limited IT training and education, as well as weak institutional and IT systems.

## Recommendation 5: Country "compacts"

**Table 6: Proposed indicator for Recommendation 5**

| | |
|---|---|
| *By 2015, in order to facilitate resource tracking, "compacts" between country governments and all major development partners are in place that require reporting, based on a format to be agreed in each country, on externally funded expenditures and predictable commitments.* | |
| Proposed indicator | *Financial reporting system* |

### Background and current status

A country "compact" is a written commitment made between a government and its development partners on externally funded expenditures and predictable commitments. Country compacts have evolved over the past two decades with the advent of structure adjustment programmes (SAP[35]) in the 1980s and poverty reduction strategies (PRS[36]) through sector-wide approaches (SWAp[37]). The Global Fund and Millennium Challenge Account formalized these partnership approaches with coordinated country mechanisms (CCM[38]). According to the independent Expert Review Group, as of 2012, 35 of the 75 priority countries (47%) had a country-led reporting system in place for externally funded expenditure and predictable commitments, as proposed in Recommendation 5 (see Figure 9 below)[39]. In May 2012, for instance, the Ministry of Health of Mauritania signed a national compact with 16 partners, including the Ministry of Economic Affairs and Development, technical cooperation partners, donors, and civil society organizations. This compact provides a framework that facilitates greater coordination between donors and the government, increases accountability and transparency in national planning, improves the

33 The NHA Production Tool – version 2 will be accessible online from the WHO web site.

34 WHO/iERG (2012). *Every Woman, Every Child: From commitments to action*, p. 28.

35 See: www.who.int/trade/glossary/story084/en/index.html

36 See: www.worldbank.org/en/topic/poverty

37 See: www.who.int/trade/glossary/story081/en/

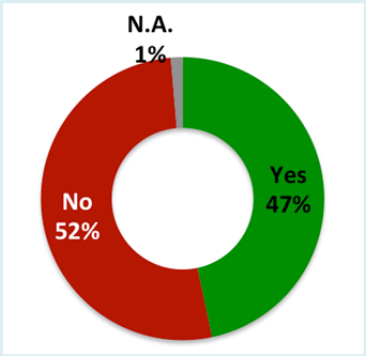
38 See: www.theglobalfund.org/en/ccm/

39 WHO/iERG (2012). *Every Woman, Every Child: From commitment to action*, pp. 67, 69.

predictability of long-term financing for the health system, and facilitates the harmonization of aid and the use of existing funds[40].

Varied portfolios and different funding and budget cycles among partners impact the functionality of RMNCH programmes and complicate reporting. Additional complexity is brought about by the integration of RMNCH with programmes focusing on non-communicable and infectious diseases, as well as social safety-net initiatives. Tracing specific programme outputs and outcomes to the financial aid granted by each member of the compact is challenging, in particular, at the sub-national level, where multiple partner programmes are implemented.

**Figure 8: CoIA countries with established country compacts, as of 2012**




| | | |
|---|---|---|
| YES | 35 | Angola, Bangladesh, Benin, Burkina Faso, Burundi, Chad, China, Comoros, D.R. Congo, Ethiopia, Ghana, Guinea Bissau, Kenya, Kyrgyzstan, Lao P.D.R., Lesotho, Madagascar, Malawi, Mali, Mauritania, Mozambique, Nepal, Niger, Papua New Guinea, Rwanda, Senegal, Sierra Leone, Sudan, Tajikistan, Togo, Uganda, U. R. Tanzania, Uzbekistan, Vietnam, Zambia. |
| NO | 39 | Afghanistan, Azerbaijan, Bolivia, Botswana, Brazil, Cambodia, Cameroon, Central African Republic, Congo, Côte d'Ivoire, D.P.R. Korea, Djibouti, Egypt, Equatorial Guinea, Eritrea, Gabon, Gambia, Guatemala, Guinea, Haiti, India, Indonesia, Iraq, Liberia, Mexico, Morocco, Myanmar, Nigeria, Pakistan, Peru, Philippines, Sao Tome & Principe, Solomon Islands, Somalia, South Africa, Swaziland, Turkmenistan, Yemen, Zimbabwe. |
| Not available | 1 | South Sudan |

*Source: WHO/iERG (2012). Every Woman, Every Child: From commitment to action, pp. 67, 69. Note: Data for countries listed in the "yes" category reflect the most recent data/survey from the preceding three years (2011, 2010, 2009); data for countries listed in the "no" category reflect the most recent data/survey dating from six to 12 years (2000-2006); no recent data was available for South Sudan at the time of the 2012 iERG review.*

[40] The World Bank Group (2012). Mauritania signs a National Compact: Ownership, Alignment, Harmonization, Managing for Results and Mutual Accountability for Impact. *HHA – Harmonization for Health in Africa.* See: www.hha-online.org/hso/hha/news/3780/mauritania-signs-national-compact-ownership-alignment-harmonization-managing-results-a

### The role of ICTs

Development partners often have competing programmes within the same country, and it is difficult for them to coordinate and harmonize their initiatives. ICTs enable open and transparent communication through electronic mail, web publishing, social media and other applications. An Online Compact Portal, for instance, can bring together information about development partners' projects, which would help reduce redundancy, increase transparency, facilitate coordination and improve information sharing and quality.

## Recommendation 6: Reaching women and children

**Table 7: Proposed indicator for Recommendation 6**

| *By 2015, all governments have the capacity to regularly review health spending (including spending on reproductive, maternal, newborn and child health) and to relate spending to commitments, human rights, gender and other equity goals and results.* | |
|---|---|
| Proposed indicator | *Reviews on health spending* |

### Background and current status

Connecting RMNCH-related expenditures to the commitments and benefits women and children living in CoIA countries are receiving will require countries to create interoperable data sets that give governments the capacity to regularly review spending on specific RMNCH activities and link it to development goals set out by governments and development partners, such as those relating to human rights, gender and other equity goals.

A more complete picture on how health expenditures relate to commitments, human rights, gender and other equity goals would imply performing cross-databases analyses, in which spending data of the health sector are correlated to and analysed with data coming from other systems within or from outside the health sector. This type of analysis is a valuable tool that should be considered and planned for, as information about health spending, both planned and realized, is essential for evidence-based budgeting, planning and policy-making.

### The role of ICTs

The use of ICTs is critical in performing accurate reviews and statistical analyses on health spending. Tools, such as the "Health Resource Tracker" described in Box 13, can not only track resource flows in the health sector from their many sources, but also relate them to the ultimate health function and the end beneficiaries they serve. Other statistical tools, such as the Statistical Package for the Social Sciences (SPSS[41]) and SAS[42], can also enhance local capacity to perform health-spending analyses and to relate spending to specific RMNCH and development outcomes within a local context, which can greatly improve RMNCH programme planning. Box 14 illustrates an example of how statistical software like SPSS can support the analysis of health expenditure data, helping policymakers and donors evaluate the development impact of resource inflows. However, more advocacy and communication on these ICT solutions need to take place at a larger scale to ensure their utilization on a regular basis.

[41] See: www.ats.ucla.edu/stat/spss/

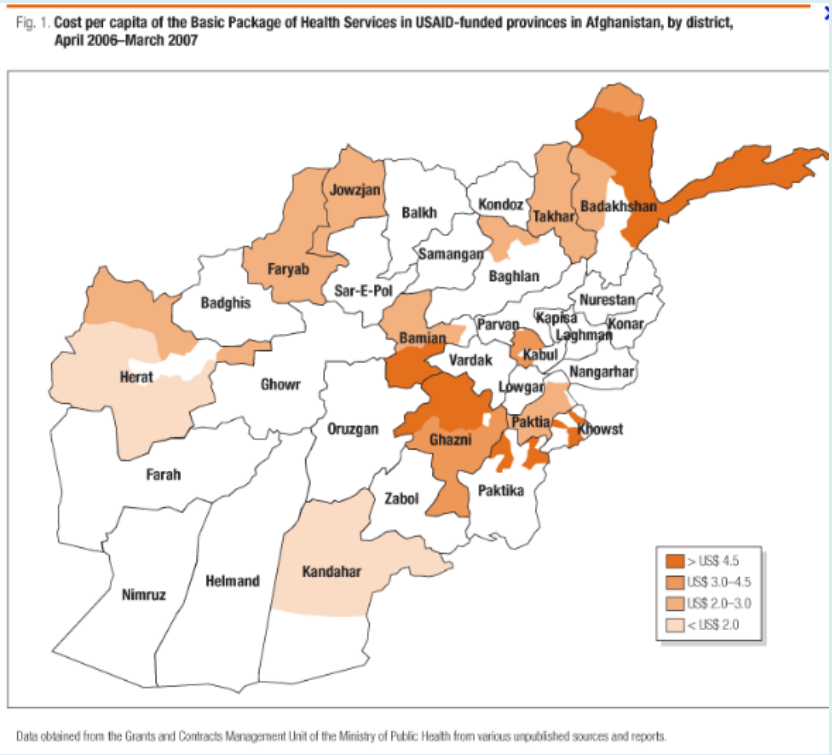
[42] See: www.sas.com/

**Box 14: Using the Statistical Package for the Social Sciences (SPSS) for health**

*Analysis of the cost of a basic package of health services in Afghanistan*

In 2008, representatives of the organizations Management Sciences for Health (Afghanistan) and of the Basic Support for Institutionalizing Child Survival Project (BASICS)—an initiative implemented in Afghanistan by Management Sciences for Health (United States)—researched the impact that the use of contractual services has on the cost of a basic package of health services in Afghanistan.

Using SPPS, the researchers analysed data from 21 different nongovernmental organization contracts for service delivery over a one year period, grouping data from 355 health facilities and more than 4 000 health posts. Data were pooled from five data sets on expenditure, service utilization, quality (i.e. client satisfaction and the availability of essential medicines and female health-care providers), pharmaceuticals, and security and remoteness scores. Pearson's partial correlation and multiple linear regression models were used to examine correlations between expenditure and other study variables.




The study found that planning the allocation of resources based on information on service characteristics, geographical distance, and the security situation does not necessarily improve the results, since those parameters do not consistently explain observed variations in per capita costs or visits.

*Source: O. Ameli & W. Newbrander (2008). Contracting for health services: effects of utilization and quality on the costs of the Basic Package of Health Services in Afghanistan. Bulletin of the World Health Organization, 86(12), pp. 920-928. See: www.scielosp.org/scielo.php?pid=S0042-96862008001200009&script=sci_arttext*

## Recommendation 7: National oversight

**Table 8: Proposed indicator for Recommendation 7**

| *By 2015, all countries have established national accountability mechanisms that are transparent, that are inclusive of all stakeholders, and that recommend remedial action, as required.* | |
|---|---|
| Proposed indicator | *Performance reviews* |

### Background and current status

National oversight on accountability reflects the state of governance of health care provision where individual and collective responsibility is assignable to performance outcomes. Countries are asked to implement regular national health sector review processes that meet specific criteria, such as broad stakeholder participation. Such reviews involve numerous sources of information that should be accessible to all relevant stakeholders.

### The role of ICTs

ICT platforms provide a cost- and time-efficient infrastructure to facilitate the flow of data in real time from local healthcare and administrative facilities to the corresponding government offices at the regional and national levels, thus promoting increased transparency. With an adequate ICT infrastructure and resource capacity, national stakeholders—including government, NGOs and CSOs—can meet the reporting and accountability demands required of compacts and international conventions. Sound eHealth policies and ICT can improve transparency in these processes and open the door for improved quality control with broader stakeholder engagement.

"Open Government Data" is, for example, a new trend that can support health sector review processes. Many governments around the world are now releasing raw public data, opening and sharing their information with citizens, media and other stakeholders to help people understand how government works and how policies are made. Making these data easily available means it will be easier for people to review and make decisions and suggestions about government policies based on detailed information, as well as build useful applications that help society, or investigate how effective policy changes have been over time.

Datasets are made available on the web in a way it can be read by humans and processed by computers in open standard formats and under an open license, allowing for the data to be re-used by third parties. The public can review and download the data, and create new analyses and applications based on the data. This allows entirely new levels of civic engagement and government accountability and transparency, which, in turn, enhance public service delivery and the use of public resources[43]. A good example of an Open Government Data initiative is the BOOST initiative launched by the World Bank, which allows easy access to public expenditure data in Kenya, as explained in Box 15.

[43] See, as an example, the UK Open Government data website: http://data.gov.uk/ and the datasets published by the National Health Service: http://data.gov.uk/publisher/nhs-information-centre-for-health-and-social-care. See also www.data.gov/opendatasites for a list of countries, cities and organizations that have launched Open Data websites.

**Box 15: BOOST in Kenya**

In 2010, the World Bank started the BOOST initiative to help countries visualize public expenditure data through a user-friendly online interface. In the case of Kenya, the mapping interface combines central government datasets with information from local authorities and spending from the country's Constituencies Development Fund (CDF)—including CDF geo-coding projects.

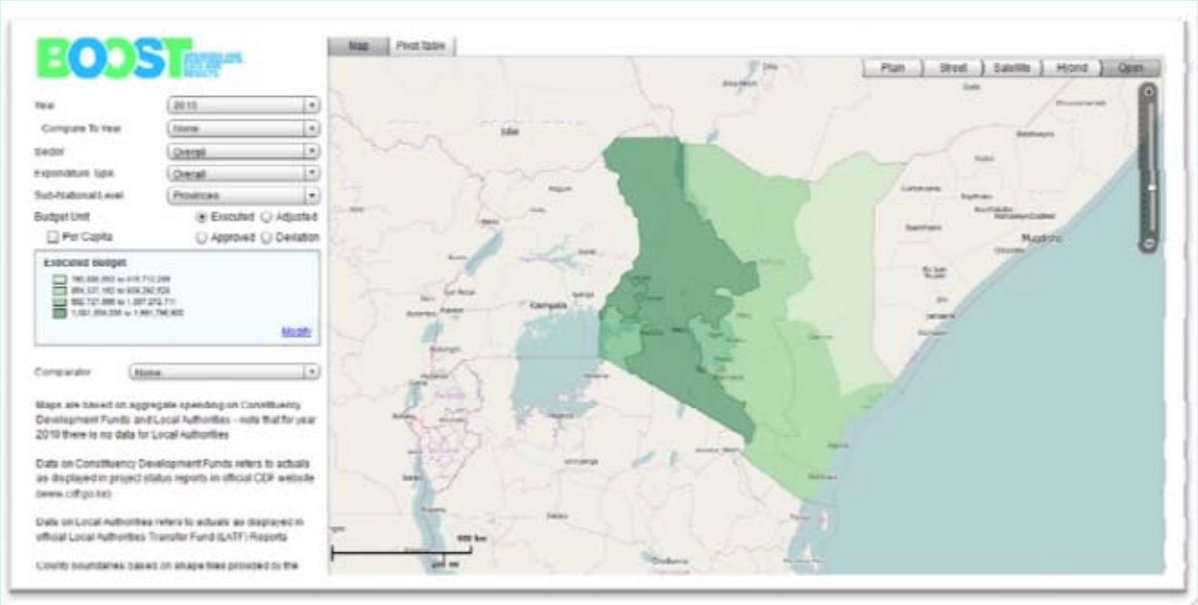



**Figure 2.4**. BOOST - Mapping Public Expenditure Data in Kenya

This effort is part of the Kenya Open Data initiative, which seeks to enhance government transparency and social accountability by facilitating public access to available datasets of interest to grassroots citizens, including pamphlets translated into Swahili for broader outreach.

*Source: H. Rahemtulla, J. Kaplan, B-S. Gigler, S. Cluster, J. Cless & C. Brigham. (2012). Open Data Kenya. World Bank Publications. See: www.scribd.com/doc/75642393/Open-Data-Kenya-Long-Version*

## Recommendation 8: Transparency

**Table 9: Proposed indicators for Recommendation 8**

| *By 2015, all stakeholders are publicly sharing information on commitments, resources provided and results achieved annually, at both national and international levels.* | |
|---|---|
| Proposed indicators | *Publicly available performance reports*<br>*Global partners transparency* |

### Background and current status

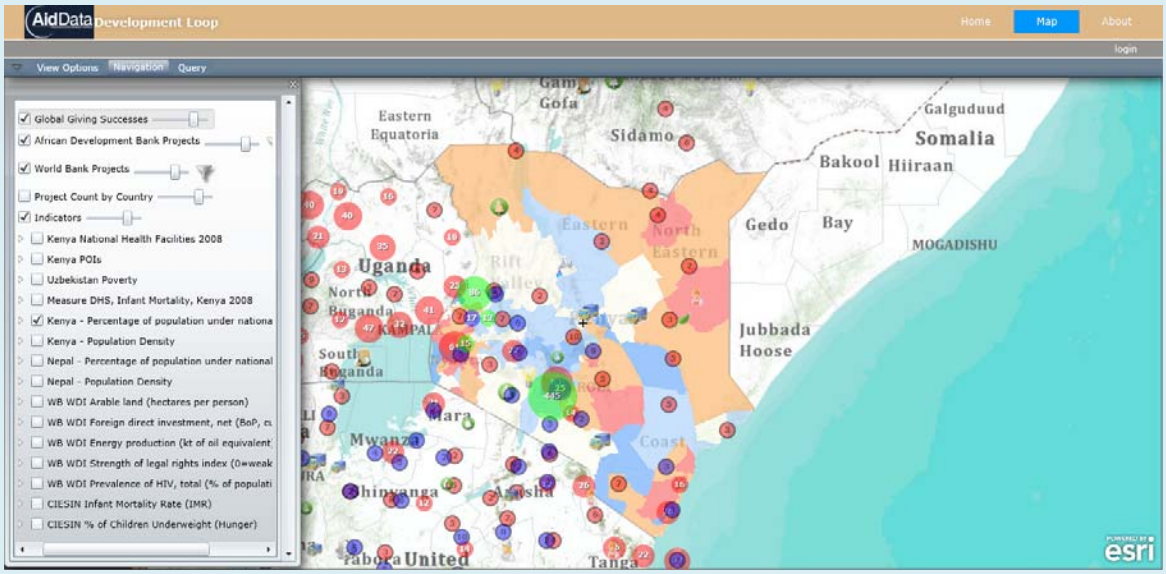
In the context of CoIA, transparency refers to public accessibility to information related to resources and achievements, and applies to all partners. Countries are asked to have effective data sharing and dissemination systems in place. The scope of the transparency requirement includes representatives of civil society, NGOs and national parliamentarians to ensure that citizens have access to essential information on commitments and resources.

### The role of ICTs

Several eHealth applications described so far and new trends such as "Open Government Data" can improve significantly government transparency in the health sector. The degree of transparency achieved by the different stakeholders can be measured by the extent to which information is made publicly available through a variety of media channels, including radio, television, websites, blogs and wikis, list servers, and even text and voice messaging. Social media in particular—information propagated mainly through peer-to-peer and social networks websites and blogs on the Internet—and SMS services can play a key role in increasing transparency and garnering public attention to health conditions and events, policy decisions, expenditures, and commitments as exemplified by the "Development Loop" application, described in Box 16.

**Box 16: Development LOOP**

Development Loop is a powerful, yet simple web and mobile application that allows users to visualize and compare ongoing aid projects being implemented by different financial donors in a particular area, country or region. The prototype currently includes development projects from the World Bank and the African Development Bank. The application enables donors to add, edit, and map their organization aid activities from anywhere in the world to make sure every dollar is being used effectively. The application creates dynamic, layered, and interactive maps that link project/financial aid information to development and health indicators, such as poverty rates and infant mortality. The layered maps can also be linked to beneficiary's feedback, giving donors and other users a useful tool for project management, decision making, and for evaluating the impact of funds allocated at the sub-national and local levels. This content can be accessed by and shared with others online through mobile and web technologies and can also be viewed offline.




Development LOOP also empowers foreign aid recipients by providing a tool for gathering their feedback at the ground level. The non-profit GlobalGiving collects comments, stories, and photos of local beneficiaries through SMS and a user-friendly interface. Development Loop uses the different visualization layers to create feedback loops between donors and beneficiaries, enabling the social monitoring of development projects and programmes, and facilitating mutual accountability.

*Source: AidData. See: www.aiddata.org/content/index/Maps/development-loop-app; http://appsfordevelopment.challengepost.com/submissions/1412-development-loop*

Used as a mechanism for public engagement, mobile applications, as well as access to the Internet and particularly to social networks, offer a democratic medium of exchange and can alter power relations among all the actors involved, shifting some of the power from the centre to the local level, providing such local actors have access to ICTs[44].

## Recommendation 9: Reporting aid

*By 2012, development partners request the OECD-DAC to agree on how to improve the Creditor Reporting System so that it can capture, in a timely manner, all reproductive, maternal, newborn and child health spending by development partners. In the interim, development partners and the OECD implement a simple method for reporting such expenditure.*

The OECD Development Assistance Committee (DAC) collects data on the volume, origin and types of aid and resource flows to over 150 developing countries and territories, including the CoIA countries. The Creditor Reporting System (CRS), in effect since 1967, provides disaggregated data on DAC donor aid activities, including official development assistance and flows from other official and private donors granted or loaned to a developing country for the promotion of economic development and social welfare[45]. In the area of health, the CRS collects data on aid flows directed to the health sector in general (e.g. infrastructure and medical services), as well as on aid used in the promotion of basic health (including basic nutrition, infectious disease control, malaria and tuberculosis control) and for reproductive health activities—such as reproductive healthcare and family planning standard control, including HIV/AIDS, among other indicators—, reporting channels of expenditure and what it is spent on. More recently, governments in several developing countries have implemented their own systems, known as aid information management systems (AIMS), for tracking domestic aid and improving its management. As of 2009, about 50 countries had implemented national AIMS platforms[46].

In 2009, an OECD analytical comparison of CRS and aid data captured at the country level found national aid reporting platforms to be more useful than CRS for internal development planning and aid expenditure tracking[47]. Consequently, as it relates to the implementation of the CoIA recommendations, CRS will need improvements to allow it to move from a general reporting of health sector data to the level of granularity needed for reporting on specific RMNCH spending on the ground.

In addition, the OECD CRS has the limitation of working with historical data aged upwards of 24 months; the use of these old data and out of date scenarios could have adverse effects in the planning, budgeting and investment decisions of CoIA countries. In contrast, data found in national aid management platforms (AMPs) are more current and accessible, facilitating planning and action in a timely manner. Nevertheless, OECD reported that wide variations in the structure of AIMS platforms and data among countries make it difficult to use their information for global comparisons[48].

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[44] P. Zimmermann & M. Finger (2005). *Information and Communication Technology (ICT) and Local Power Relationships: An Impact Assessment*. *Electronic Journal of e-Government*, 3(4), pp. 231-240.

[45] OECD DAC Global Humanitarian Assistance. See: www.globalhumanitarianassistance.org/data-guides/data-sources/oecd-dac

[46] R. Petras (October 2009). *Comparative Study of Data Reported to the OECD Creditor Reporting System (CRS) and to the Aid Management Platform (AMP).* See: www.oecd.org/investment/aidstatistics/43908328.pdf

[47] Idem.

[48] Ibid.

OECD stresses the need to untie aid dollars from externally imposed development activities. Significant cost-savings are expected from strengthening national ownership of the aid management process and from increasing the connection between national strategic objectives and aid flows. To that end, improvements to the CRS would be best accomplished by strengthening AMPs at the country level by leveraging ICT and many of the eHealth applications that have been described in this report, which facilitate data collection and reporting and improve information flow across the health sector to fulfil their accountability requirements.

## Recommendation 10: Global oversight

*Starting in 2012 and ending in 2015, an independent ''Expert Review Group'' is reporting regularly to the United Nations Secretary-General on the results and resources related to the Global Strategy and on progress in implementing the CoIA recommendations.*

The independent Expert Review Group (iERG) is actively involved in reporting results to the UN Secretary General on the yearly progress made throughout the 75 CoIA countries towards the multi-stakeholder programme of work on the ten recommendations. In that respect, ITU and WHO, in collaboration with partner organizations, continue to improve the tool sets and instruments that facilitate global oversight of progress in relation to the use of ICT to implement the CoIA recommendations. A baseline and progress report on how ICT has been used by the CoIA countries to improve information and accountability for women's and children's health will be prepared by ITU and WHO and presented to the iERG based on the data collected through the WHO Global eHealth Observatory Survey.

eHealth and ICT innovations will continue to constitute a powerful, ever-evolving opportunity to accelerate progress and contribute to reaching the goals of the CoIA recommendations. The following chapters examine some of the key governance, policy, human resources and technical factors that CoIA countries need to take into consideration when adopting eHealth and other ICT innovations for the improvement of maternal and child health.

# IV Governance, policy and human resources considerations

The uptake of eHealth and ICT tools and technologies requires fundamental understanding of the complex medical and technical environments in which they are implemented. Infrastructure and connectivity are still under-resourced in many CoIA countries, as are the human and institutional capacities necessary for sustainability. Other impediment to the integrated use of ICT in health systems is the lack of an appropriate policy and regulatory environment. This essential component is fuelled by the under-appreciation of data and information as tools for change.

A national eHealth strategy and framework is therefore critical to facilitate the establishment of an "enabling environment" for a wider uptake and use of innovative ICT for RMNCH. Some domain areas where strategies are essential to achieve the full implementation of ICTs at the national and sub-national levels are briefly described below[49]. These include:

1. ***Leadership and governance***: National eHealth governance mechanisms, along with short, mid, and long-term strategies for large-scale implementation, monitoring and evaluation of eHealth systems and services;
2. ***Policy and legal frameworks***: Policies and legislations that ensure the privacy, security, and confidentiality of data derived from eHealth systems and services, liability for eHealth services, and the compliance, conformance and accreditation of eHealth products and services; and
3. ***Human resources capacity building and incentives***: The promotion of educational programmes and training to increase the availability of a competent national IT health workforce that can implement and maintain eHealth systems and services for RMNCH.

### Leadership and governance

Governance considerations must be addressed from the very beginning, allowing the development of full national ownership, multisectoral engagement, and adequate human capacity at all levels.

It is of paramount importance to have a governance body, such as a national eHealth steering committee, that oversees the development and management of a national strategy on eHealth, identifying eHealth services relevant to RMNCH and coordinating multi-stakeholder efforts in the implementation of ICT-based solutions for RMNCH. This national governance body should develop and be guided by a national eHealth vision and plan that accounts for the full utilization of ICT for RMNCH.

Having a clear governance structure is crucial to carry out the full range of activities relevant to ICT use for RMNCH, such as programme management, task allocation, coordination and supervision, and full adherence to data management principles. Clear delineation of the lines of authority among all stakeholders is necessary also to facilitate the deployment and management of national eHealth systems and services.

### Policy and legal frameworks

Taking full advantage of ICTs' potential in the development and implementation of eHealth applications for RMNCH, as part of the health services, requires the adoption of distinct policies and legislations at the national and sub-national levels. This policy-enabled environment is key to the successful implementation, monitoring, and evaluation of eHealth systems and services.

[49] For a more detailed description of the components that make up a national enabling eHealth environment, please refer to the ITU-WHO *National eHealth Strategy Toolkit*, available at: www.itu.int/ITU-D/cyb/app/e-health/NeHSToolkit/intro.phtml; www.who.int/ehealth/en/

Table 10 illustrates key eHealth legislation, policy and compliance components that governments in CoIA countries need to address in a coordinated manner.

**Table 10: Examples of common eHealth legislation, policy and compliance components**

| Component | Description | Examples |
|---|---|---|
| Legislation | National legislation, policy and regulatory components that govern how health information is stored, accessed and shared across geographical and health sector boundaries | – Unique health identifier regimes<br>– Privacy, protection, storage and retention of personal health information<br>– Consumer protection, including in the online environment<br>– Access and consent to personal health information use and disclosure, including secondary use<br>– Audit and complaint procedures (e.g. such as those required for suspected breaches of privacy)<br>– Licensing regimes, which may be needed to ensure that private operators of components of a national eHealth environment meet required standards for privacy, integrity and security |
| Policy | Broader public policy required to support the development of a national eHealth environment | – Health sector policy (e.g. reform, improved access to and use of health information)<br>– Non-health sector policy (e.g. broader industry and economic development, utilization of existing eGovernment infrastructure)<br>– Policies to stimulate and manage innovation, risk, evaluation of feasibility and utility of services |
| eHealth-specific policy | Policies specifically governing eHealth services, including quality, safety and reimbursement of services provided. | – Policies on medical jurisdiction, liability for eHealth services (e.g. telemedicine), safety, data integrity and quality of care<br>– Reimbursement policies for eHealth services provided (e.g. telemedicine), both public and private<br>– Policies for managing Internet health information quality, sales of medicines and regulated health products<br>– Policies to demonstrate eHealth outcomes and clinical effectiveness |
| Compliance | Components required to support the development of eHealth products and which are compatible with the national eHealth environment | – Development of national eHealth standards and other interoperability requirements<br>– Compliance, conformance and accreditation of eHealth products and services |

*Source: WHO and ITU (2012). National eHealth Strategy Toolkit, p. 55.*

### Human resources capacity building and incentives

Continuous educational programmes and training are essential to increase the availability of a competent national IT health workforce who will design, develop, operate and support eHealth systems and services for RMNCH. This workforce includes health IT workers and health informaticians, as well as workers who will use eHealth as part of their jobs, such as healthcare providers and Community Health Workers.

At the community level, ongoing training and interaction through mobile technology have also been found to reduce attrition rates of Community Health Workers who live outside their own communities. The ability of CHWs to stay in contact with friends and family and have access to information otherwise only available in urban settings diminishes their sense of isolation and improves performance. For example, in Guatemala, the TulaSalud initiative has been able to retain 95 per cent of its 500 community health workers, partly due to ongoing training and interaction through mobile technology[50]. Great cost-benefits have been realized also through investments in ICT and in strategies that promote CHWs' ownership of technological innovations. Sierra Leone, for example, increased the quality of data entered by local Monitoring and Evaluation Officers into its national HIS through the provision of a financial incentive, equivalent to one third of an officer's monthly salary. Thanks to this incentive programme and to the CHWs' access to low-energy, solar-powered computers and Internet services, in less than two months, the number of districts submitting at least 50 per cent of complete facility data rose from 48 to 88 per cent, according to WHO[51].

[50] TulaSalud. See: http://www.mhealthed.org/iheed_report_updates.pdf

[51] WHO-PAHO (2010, March). Sierra Leone: Health data 'warehouse' now open for business. *Making Pregnancy Safer-Newsletter of Worldwide Activity*, Issue 8, p. 2. Search for CLAP1576.pdf or see: http://new.paho.org/clap/index.php?option=com_docman&task=doc_details&gid=85&Itemid=219

# V Technical considerations

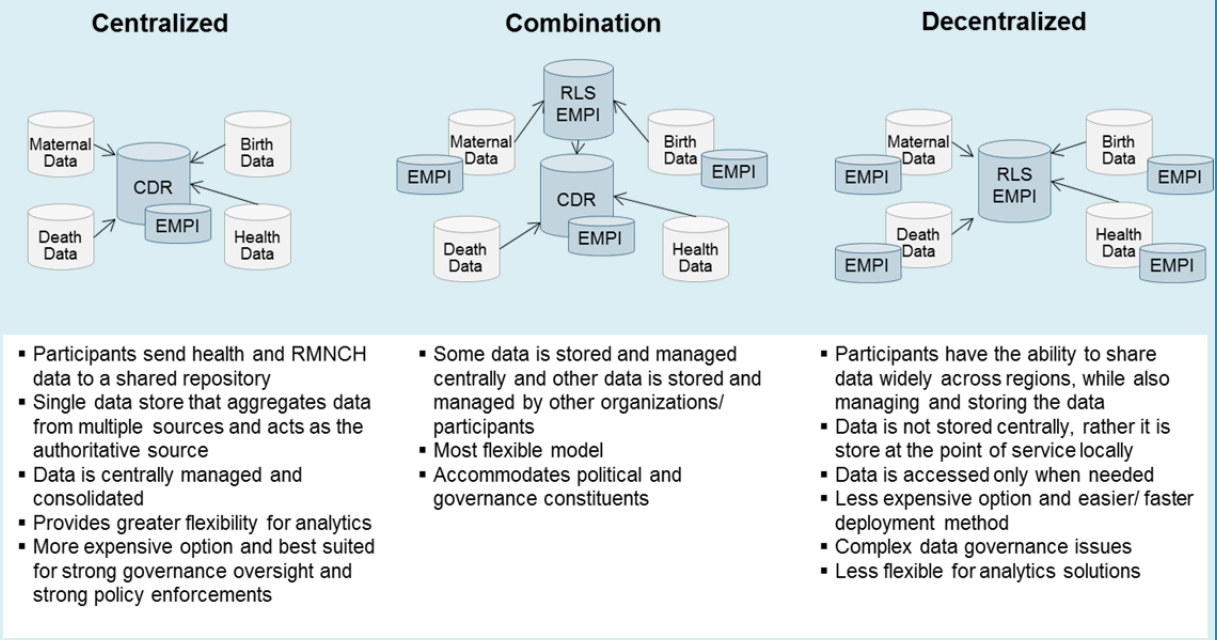
The implementation of successful Health Information Management Systems (HIMS) is driven by several technical considerations that need to be taken into account. This chapter discusses some of those considerations, which include deployment models, technical design and architecture, interoperability standards, and the actual implementation/rollout strategy.

### Health information management – Deployment models

There are various models for managing health information. Each model presents benefits and challenges of interoperability, development and sustainability, in addition to data governance issues around privacy and security for health professionals, health centres and individuals/patients.

In general, there are three models for health information management: Centralized, decentralized, and a combination of both. Figure 10 introduces these models and briefly describes the advantages and disadvantages to each one of them.

**Figure 9: Health information management deployment models**




- Participants send health and RMNCH data to a shared repository
- Single data store that aggregates data from multiple sources and acts as the authoritative source
- Data is centrally managed and consolidated
- Provides greater flexibility for analytics
- More expensive option and best suited for strong governance oversight and strong policy enforcements

- Some data is stored and managed centrally and other data is stored and managed by other organizations/ participants
- Most flexible model
- Accommodates political and governance constituents

- Participants have the ability to share data widely across regions, while also managing and storing the data
- Data is not stored centrally, rather it is store at the point of service locally
- Data is accessed only when needed
- Less expensive option and easier/ faster deployment method
- Complex data governance issues
- Less flexible for analytics solutions

*Note: EMPI: Enterprise Master Person Index;* ***RLS****: Record Locator Service;* ***CDR****: Central Domain Repository**
** Descriptions of above terms are provided in Annex 7.*

Several factors need to be taken into consideration when choosing a deployment model, including the services that will be deployed, data governance required supporting the needs of the stakeholders, as well as geographic and physical constraints, among others. Regardless of the chosen deployment model, a well thought out application architecture is extremely important to overcome some of the challenges faced by different models.

### Health information management – Application architecture

An application architecture provides guidance and structure to the design of IT applications and services. It is usually defined as the organizational design of the components and sub-components of an IT application, and it describes the integrated manner in which they interact to support the provision of required health information management. Application architecture is a key component of health information management, mainly due to the diversity of health data that need to be handled and to the potential integration requirements that may emerge in the short- and long-term periods. Careful consideration of an application architecture would bring the following benefits:

- **Scalability** – Anticipating growth and future capability needs is essential to aid in the longevity of any solution.
- **Reusability** – Leveraging shared services to promote consistent application of rules across the business, as well as promoting componentized software development, instead of large, all encompassing, monolithic applications that replicate common functionality (logging and auditing, for example).
- **Interoperability** – In a highly decentralized environment, developing or leveraging existing standards and protocols, message format, and coding standards are essential to allow various HIM systems to communicate and interoperate.
- **Flexibility** – Refers to the HIM ability to adapt, so as to include currently unknown or unforeseen requirements.
- **Manageability** – Describes the ability for the HIM to be monitored and maintained, to keep the encompassing systems secure, performing, and available.
- **Maintainability** – Defines the ease of which components of the HIM can be modified to correct defects, improve performance, and adapt to changing requirements.

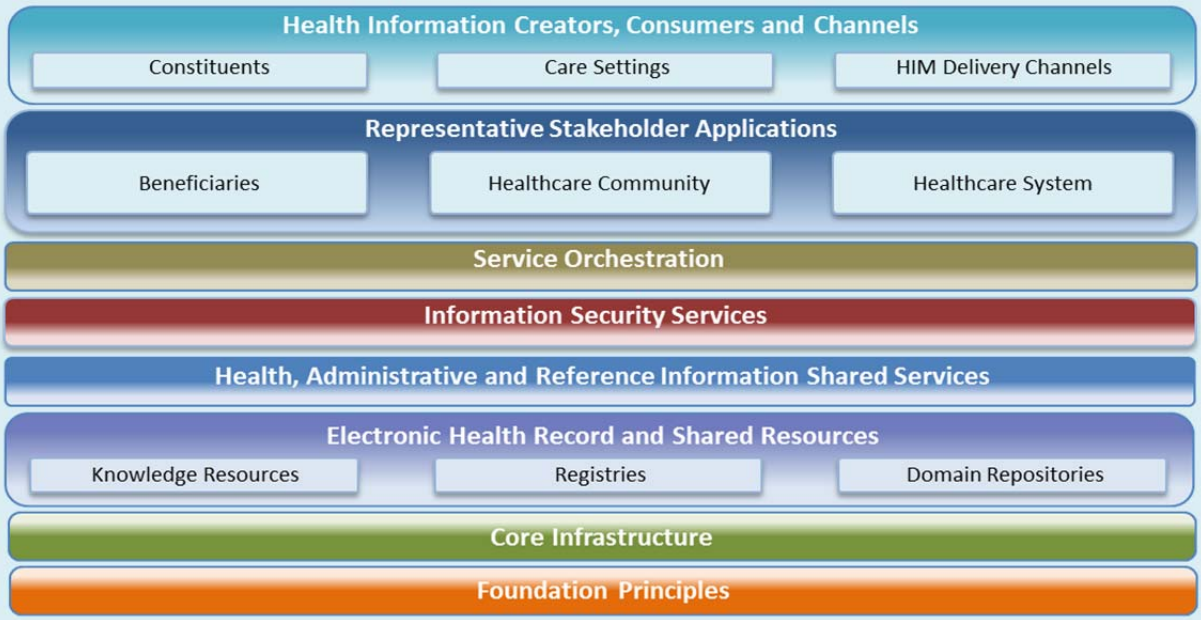
Defining an application architecture early on in the process helps ensure communication and consensus among stakeholders; it also assists in the initial design, integration, and/or purchase decisions for solutions that will compose the HIMS.

The following section introduces an example of an application architecture for health information management. This example could be used as a way to structure thoughts when designing an eHealth application, but should not be considered as a standard to be applied in every circumstance. Some components may become less relevant, depending on the nature of the application and the surrounding IT landscape.

### Example of health information management application architecture

There are various components of a health information management application architecture that need to work in harmony with each other to collect, aggregate, analyse and disseminate health information to appropriate users. The diagram in Figure 11 represents a high level depiction of an application architecture, outlining the multiple components required to manage health information and explained below. Annex 7 provides a detailed description of each of the components of the health information management application architecture described above.

**Figure 10: High level application architecture**




**Health information creators, consumers and channels:** Several groups of people make up the target producers and consumers of healthcare data and services. Data and available services can be provided to patients in a number of care settings and delivered via a number of channels.

**Representative stakeholder applications:** Refers to applications, services and data access tools developed for different stakeholder user groups, including beneficiaries, the healthcare community and the healthcare system.

**Service orchestration:** Utilizes state and workflow control to integrate applications and leverage shared services amongst applications and other services. This approach allows for the assembly of more granular, specialized capabilities that reduce point-to-point integrations between applications that are very hard to manage, monitor and maintain.

**Information security services:** A group of methods to intelligently control access to resources, enforce policies, secure information and log/audit who has accessed what resource and for what purpose. When dealing with information security, there are several key capabilities that need to be considered. These capabilities can be implemented and leveraged at a local solution level, scaled up to an enterprise wide solution, or any combination in between.

**Health, administrative and reference information shared services:** A category of shared services more specifically related to and supporting of the healthcare domain.

**Electronic health record and shared resources**: Contain the knowledge resources a health information management service needs for key references, registries and domain repositories.

**Core infrastructure:** Core infrastructure references those components on which every business transaction rides. It is the physical hardware used to interconnect computers, software and users.

**Foundation principles:** The execution and agreement of foundation principles around security, privacy, governance, interoperability and compliance, among others, are the corner stones to the success of almost any cross-organizational healthcare initiative. Focusing on these at the onset of the initiative is key, given the complexities surrounding these areas. Foundation principles assist with reaching an agreed upon approach, which will have a substantial impact on the solution design, delivery and use.

### Interoperability and standards

Data and systems interoperability[52] is considered essential to achieve the full potential of eHealth applications and for the seamless exchange of data using ICTs and medical devices. The appropriate use of ICTs is integral to the advancement of RMNCH care delivery, improving quality of service, reducing costs, and promoting the attainment of universal access. Transmitting personal or population data related to RMNCH in ICT-driven health information systems requires adherence to health data standards and related technology standards for the timely exchange of data for healthcare decisions. Interoperability of data within and between eHealth systems, based on a set of standards, is indispensable, whether for counting the number of newborns or maternal deaths, for managing midwives at facilities, for providing patient care through the review of digital images, for managing patient information through electronic medical records or for conducting public health surveys and surveillance. Lack of data interoperability not only hinders care and leads to fragmentation of health information systems, but at times can also cause fatalities.

Standards[53] are like the DNA of health information, providing the key to information systems interoperability. Standardization, as defined by the International Organization for Standardization (ISO[54]), is the process of agreeing on standards, which represent the common language that allows the exchange of data between disparate data systems. The goals of standardization are to achieve comparability, compatibility, and interoperability between independent systems; ensure compatibility of data for comparative statistical purposes; and reduce duplication of effort and redundancies.

eHealth and health information technology (HIT) standards are developed specifically to support interoperability of health information systems. With the growing demand for real-time information exchanges to support healthcare delivery, chronic disease management, healthcare planning and resources allocation, the public's protection from communicable diseases and other public health threats, and evidence-based research, the role of HIT standards and HIS interoperability is becoming more and more recognizable by the national health organizations and international community. Table 11 below shows some examples of Health Information Technology standards categories[55].

Implementing health data standards to achieve interoperability at all levels of healthcare delivery is not an easy task. The eHealth standardization process includes several phases. The first step in the process is the needs identification and priorities setting for Health Information Exchanges and HIT Standards. This phase is followed by the development and harmonization of standards; testing of standards-based specifications[56] (Trial Implementation); followed by the certification[57], deployment[58], and adoption[59] of standards-based ICT products.

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[52] Interoperability refers to the ability of two or more systems or components to exchange information and to use the information that has been exchanged. Adapted from Health Level Seven (HL7) EHR Interoperability Working Group, 2007. See: http://www.hl7.org

[53] A standard is a definition, set of rules or guidelines, format, or document that establishes uniform engineering or technical specifications, criteria, methods, processes, or practices that have been approved by a recognized standards development organization (SDO), or have been accepted by the industry as de facto standards, or de jure standards, i.e., formal legal requirements. De facto standards have become standards because a large number of companies have agreed to use them. They have not been formally approved as standards, but they are standards nonetheless.

[54] International Organization for Standardization (ISO). See: www.iso.org/iso/iso_technical_committee.html?commid=54960

[55] Public Health Data Standards Consortium (PHDSC). Health IT Standards. Web-Resource Center. See: www.phdsc.org/standards/health-information-tech-standards.asp

[56] See: www.phdsc.org/standards/health-information/ISB_Specifcions.asp

[57] See: www.phdsc.org/standards/health-information/CSBHIT_Products.asp

[58] See: www.phdsc.org/standards/health-information/ASBHIT_Products.asp

[59] See: www.phdsc.org/standards/health-information/adoption.asp

**Table 11: Categories of health information technology standards**

| Standards categories | Examples |
|---|---|
| Data standards | Vocabularies and terminologies |
| Information content standards | Reference information models (RIM) |
| Information exchange standards | Message-based and structured document-based |
| Identifier standards | National Provider Identifier (NPI)[60] |
| Privacy and security standards | Access control, audit, electronic consent |
| Functional and business standards | Work processes, workflow and dataflow models |
| Other standards | Internet standards, transport mechanisms |

*Source: WHO.*

Standards are developed and maintained by standards development organizations, data content committees (DCCs), standards setting organizations (SSOs), and designated standard maintenance organizations (DSMOs). Annex 8 provides examples of some of the standards applied to ICT-based interventions to measure CoIA-related RMNCH indicators at the community or facility levels.

### Roll out strategy

It should be stressed out that, when implementing an application architecture like the one described in this chapter, a phased roll out strategic approach should be considered. Two essential factors that require early definition are the architecture blueprint and the health information interoperability standards to be applied for all components. It is recommendable to progressively build applications that focus on a common target architecture, since this is the most appropriate way to optimize effort and time-to-market. Some implementation strategies could use interim architectures or interim standards. Before this direction is taken, however, it is appropriate to evaluate also the effort associated with migrating from an interim architecture to a target one.

As described in Chapter IV, a governance body responsible for defining and managing architectural matters, along with regulatory and standardization compliance, needs to be in place as early as possible. This step is essential to allow the governance body to oversee the definition of the overall architecture, while ensuring that the applications and services developed and deployed would fit and integrate adequately with new and already existing systems and solutions.

[60] United States Centers for Medicare and Medicaid Services, US Department of Health and Human Services; National Provider Identifier Standard. See: www.cms.hhs.gov/NationalProvIdentstand/

# VI Conclusion and recommendations

The description provided in this report of the use of ICTs along the diverse areas included in the ten CoIA recommendations gives a unique overview of the value of eHealth for RMNCH in CoIA countries. Several RMNCH indicators have benefited largely from the use of ICTs and innovative eHealth projects, including maternal surveillance and response, health indicators data collection, and the registration of vital events, births and deaths. Similarly, the adoption of ICTs for administrative and reporting activities across the healthcare system has empowered healthcare workers and the beneficiary population by providing them with the right information at the right time and place. To continue such developments, several CoIA countries have already embarked in the adoption and implementation of national eHealth and telemedicine strategies, thus creating the necessary environment for sustainable eHealth systems deployment.

Based on the information discussed in this report, and to aid CoIA countries exploit the capabilities that ICT and eHealth innovations offer to accelerate the achievement of the MDGs 4 and 5, while advancing also in fulfilling the recommendations proposed by CoIA, the following recommendations are proposed:

### Infrastructure

- **Accelerate the rate of mobile-cellular and broadband infrastructure deployment in CoIA countries**: A factor central to the rapid deployment of mobile-cellular and broadband technologies in developing countries is the creation of an enabling legal and regulatory framework. CoIA governments can stimulate investment and encourage the participation of the private sector in the deployment of telecommunication infrastructure through the adoption of policies that open those markets to competition, by lowering barriers to market entry, facilitating the establishment of public-private collaborations, and the use of universal service funds for extending those critical networks[61].
- **Facilitate access to mobile-cellular and broadband services among low-income and rural populations**: Providing affordable telecommunication services is essential for promoting access to and use of eHealth and mHealth applications in CoIA countries. The implementation of complementary strategies, such as the establishment of telecentres to increase Internet access and the provision of the modality of prepaid subscriptions for mobile-cellular and even mobile broadband services, where available, have been found to encourage adoption, as demonstrated by the examples of Bangladesh, China and India, where prepaid services are offered for both technologies. By the same token, strategies that promote the access of women to ICTs have been found to contribute to economic development, due to the crucial role women play in family life.

### Strategies

- **Develop and adopt national eHealth policies and strategies:** ITU and WHO are actively promoting the development of national eHealth strategies to guide multi-stakeholder efforts in the incorporation of ICTs into these countries' health information systems and health infrastructure, following a planned and needs-based approach. CoIA countries are encouraged to take advantage of available resources and tools—such as the *National eHealth Strategy Toolkit*[62]—to facilitate their country situation and needs assessment processes; they should

[61] For further information on global initiatives to promote the adoption of broadband networks see: Broadband Commission (2012). *The State of Broadband 2012: Achieving Digital Inclusion for All*. See: www.broadbandcommission.org/Documents/bb-annualreport2012.pdf

[62] See: ITU (2012), *National eHealth Strategy Toolkit*. See: www.itu.int/ITU-D/cyb/app/e-health/NeHSToolkit/intro.phtml

benefit also from sharing best practices, and learning from the experiences of other countries that have already engaged in this strategic process.

- **Ensure the inclusion of an mHealth component in eHealth policies and strategies:** The rapid expansion and upgrade of mobile-cellular telephone networks—and in some cases of mobile-broadband networks—in CoIA countries makes wireless technology the best platform currently available to support eHealth projects and the collection and reporting of health data in those countries. Consequently, it is essential for the eHealth strategies adopted in CoIA countries to include an mHealth component that takes advantage of the ubiquity and reach of wireless technology for healthcare delivery, particularly among low-income and rural populations, whose access to health services tend to be more limited.
- **Encourage the harmonization of eHealth standards:** Interoperability is essential to support the scale up of promising eHealth applications from local to regional and national levels. Governments in CoIA countries are encouraged to promote the harmonization of eHealth standards at the national level to facilitate the flow and exchange of health information across the health sector. In view of the limited financial resources available for the implementation of eHealth initiatives, ensuring the harmonization of standards increases efficiencies and raises the probability of long-term sustainability of those initiatives for the benefit of the population[63].
- **Take security concerns into consideration**: Electronic health records and health information systems are repositories of health data and personal information that can easily be misused and abused where ICT use is not appropriately protected against cyber-threats. It is therefore essential for CoIA governments to support the adoption of legislation and standards that ensure the confidentiality and security of electronic health information throughout its collection, processing and safekeeping, as well as the integrity of the networks through which such information is transmitted[64]. Taking preventive steps to enhance the security of both data and their supporting networks would improve public confidence in health information systems and work as a potential disincentive for cybercrime.
- **Improve measurement of the impact of eHealth applications and services, particularly at the community level**: This report has highlighted the need for stronger evidence of the quantitative and qualitative effects that the implementation of ICT and health information technologies (eHealth, mHealth, telemedicine, etc.) has had on the healthcare sector, and in particular, on enhancing RMNCH. The efficiency of these innovative technologies and models of care delivery should be measured also in terms of the reduction in costs and waste they achieve, when compared to alternative models of care delivery. Collecting disaggregated data on the costs and benefits of implemented projects would provide more comprehensive information on their actual impact on the delivery of RMNCH services at the community level and assist in filling identified evidence gaps[65].

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63 For further information see: Jonathan Payne – mHealth Alliance (2013). *The State of Standards and Interoperability for mHealth among low- and middle-income Countries*. See: www.mhealthalliance.org/images/content/state_of_standards_report_2013.pdf

64 Further detail on cybersecurity is available in ITU (2012). *Understanding Cybercrime: Phenomena, Challenges and Legal Response.* See: www.itu.int/ITU-D/cyb/cybersecurity/projects/crimeguide.html

65 For further information on the current state of mHealth evidence, see: W. C. Philbrick – mHealth Alliance (2013). *mHealth and MNCH: State of the Evidence.* See: www.mhealthworkinggroup.org/sites/mhealthwg.org/files/philbrick_mnch_final.pdf

- **Target financial resources specifically for eHealth services:** National health financial plans should include budget for the development and implementation of eHealth applications, including mHealth, based on the national eHealth strategy. Further efforts are to be pursued in CoIA countries to increase coordination mechanisms between donors, innovators, development partners, and recipients to enhance accountability and move forward in achieving MDGs 4 and 5.
- **Develop human capacity in eHealth:** The success of eHealth projects depends greatly on the willingness of local health workers and beneficiaries to adopt new technologies and adapt them to satisfy local needs. As a result, development of ICT skills among these stakeholders would increase acceptance and demand for ICT and their health applications. Enhancing human capacity in eHealth requires the development of curricula in medicine and health programmes that focus on the use of ICTs for health. Similarly, engineering and IT programmes imparted in CoIA countries could be expanded to include courses on health applications.

## Annex 1: List of the 75 CoIA countries

The CoIA has defined 75 countries forming part of the Strategic Work plan. It includes 49 countries in the UN Global Strategy and 26 additional countries in the countdown to 2015 (marked with*).

| African Region | | | | | |
|---|---|---|---|---|---|
| Angola* | Chad | Ethiopia | Lesotho* | Niger | South Africa* |
| Benin | Comoros | Gabon* | Liberia | Nigeria | Swaziland* |
| Botswana* | Congo* | The Gambia | Madagascar | Rwanda | Togo |
| Burkina Faso | Côte d'Ivoire | Ghana | Malawi | Sao Tome and Principe | Uganda |
| Burundi | Dem. Rep. of the Congo | Guinea | Mali | Senegal | United Rep. of Tanzania |
| Cameroon* | Equatorial Guinea* | Guinea-Bissau | Mauritania | Sierra Leone | Zambia |
| Central African Republic | Eritrea | Kenya | Mozambique | | Zimbabwe |
| **Region of the Americas** | | | | | |
| Bolivia* | Brazil* | Guatemala* | Haiti | Mexico* | Peru* |
| **Eastern Mediterranean Region** | | | | | |
| Afghanistan | Egypt* | Morocco* | Somalia | Sudan* | |
| Djibouti* | Iraq* | Pakistan | South Sudan* | Yemen | |
| **European Region** | | | | | |
| Azerbaijan* | Kyrgyzstan | Tajikistan | Turkmenistan* | Uzbekistan | |
| **South-East Asia Region** | | | | | |
| Bangladesh | India* | Myanmar | | | |
| D.P.R. Korea | Indonesia* | Nepal | | | |
| **Western Pacific Region** | | | | | |
| Cambodia | Lao P.D.R. | Philippines* | Viet Nam | | |
| China* | Papua New Guinea | Solomon Islands | | | |

*Source: WHO/iERG (2012). Every Woman, Every Child: From commitments to action, p. 60.*

*Note: The distribution of countries by regions follows that used by the World Health Organization.*

## Annex 2: Fixed-telephone subscriptions per 100 inhabitants, CoIA countries, 2011

| Economy | Fixed-telephone subscriptions per 100 inhabitants | Economy | Fixed-telephone subscriptions per 100 inhabitants |
|---|---|---|---|
| Brazil* | 21.9 | Papua New Guinea | 1.9 |
| China* | 21.2 | Lesotho* | 1.8 |
| Azerbaijan* | 18.1 | Lao P.D.R. | 1.7 |
| Mexico* | 17.2 | Benin | 1.7 |
| Indonesia* | 15.9 | Angola* | 1.6 |
| Peru* | 12.6 | Solomon Islands | 1.5 |
| Viet Nam | 11.5 | Gabon* | 1.5 |
| Morocco* | 11.1 | Uganda | 1.4 |
| Guatemala* | 11.0 | Côte d'Ivoire | 1.3 |
| Turkmenistan* | 10.7 | Ghana | 1.1 |
| Egypt* | 10.6 | Malawi | 1.1 |
| Kyrgyzstan | 9.3 | Eritrea | 1.1 |
| Bolivia* | 8.7 | Myanmar | 1.1 |
| South Africa* | 8.2 | Sudan* | 1.1 |
| Botswana* | 7.4 | Ethiopia | 1.0 |
| Uzbekistan | 6.9 | Burkina Faso | 0.8 |
| Swaziland* | 6.3 | Kenya | 0.7 |
| Iraq* | 5.5 | Mali | 0.7 |
| Tajikistan | 5.5 | Bangladesh | 0.7 |
| D.P.R. Korea | 4.8 | Madagascar | 0.7 |
| S. Tome & Principe | 4.7 | Zambia | 0.6 |
| Yemen | 4.3 | Niger | 0.5 |
| Togo | 3.9 | Nigeria | 0.4 |
| Philippines* | 3.8 | Mozambique | 0.4 |
| Cambodia | 3.7 | Rwanda | 0.4 |
| Cameroon* | 3.3 | Burundi | 0.4 |
| Pakistan | 3.2 | United Rep. Tanzania | 0.4 |
| Comoros | 3.1 | Congo* | 0.3 |
| Gambia | 2.8 | Chad | 0.3 |
| Zimbabwe | 2.8 | Guinea | 0.2 |
| Nepal | 2.8 | Central African Rep. | 0.1 |
| Senegal | 2.7 | D.R. Congo | 0.1 |
| India* | 2.6 | Liberia | 0.1 |
| Djibouti* | 2.0 | Afghanistan | 0.0 |
| Mauritania | 2.0 | **World average** | **17.3** |

*Source: ITU World Telecommunication/ICT Indicators database, 2012.*

*Note: There is no information available on Equatorial Guinea, Guinea-Bissau, Haiti, Sierra Leone, Somalia, and South Sudan. Countries in the Countdown to 2015 subgroup are marked with an asterisk (*). Data in italics refer to ITU estimates.*

## Annex 3: Mobile-cellular subscriptions per 100 inhabitants, CoIA countries, 2011

| Economy | Mobile-cellular subscriptions per 100 inhabitants | Economy | Mobile-cellular subscriptions per 100 inhabitants |
|---|---|---|---|
| Viet Nam | 143.4 | Nigeria | 58.6 |
| Botswana* | 142.8 | Bangladesh | *56.5* |
| Guatemala* | 140.4 | Sudan* | 56.3 |
| South Africa* | *126.8* | United Rep. Tanzania | 55.5 |
| Brazil* | 123.2 | Afghanistan | 54.3 |
| Gabon* | *117.3* | Cameroon* | 52.4 |
| Morocco* | 113.3 | Togo | 50.4 |
| Peru* | 110.4 | Solomon Islands | 49.8 |
| Azerbaijan* | 108.7 | Liberia | 49.2 |
| Kyrgyzstan | *104.8* | Uganda | 48.4 |
| Egypt* | 101.1 | Angola* | 48.4 |
| Indonesia* | 97.7 | Lesotho* | *47.9* |
| Congo* | 93.8 | Yemen | 47.0 |
| Mauritania | 92.7 | Burkina Faso | 45.3 |
| Philippines* | 92.0 | Guinea | *44.0* |
| Uzbekistan | 91.6 | Nepal | 43.8 |
| Tajikistan | *90.6* | Haiti | *41.5* |
| Gambia | *89.0* | Rwanda | 40.6 |
| Lao P.D.R. | 87.2 | Madagascar | 38.3 |
| Côte d'Ivoire | 86.4 | Sierra Leone | *35.6* |
| Benin | 85.3 | Papua New Guinea | *34.2* |
| Ghana | 84.8 | Mozambique | 32.8 |
| Bolivia* | 82.8 | Chad | 31.8 |
| Mexico* | 82.4 | Comoros | 28.7 |
| Iraq* | *78.1* | Niger | 27.0 |
| Senegal | 73.3 | Guinea-Bissau | *26.0* |
| China* | 73.2 | Malawi | 25.1 |
| Zimbabwe | 72.1 | Central African Rep. | 25.0 |
| India* | 72.0 | D.R. Congo | 23.1 |
| Cambodia | 69.9 | Djibouti* | 21.3 |
| Turkmenistan* | 68.8 | Ethiopia | 16.7 |
| Mali | 68.3 | Burundi | *14.5* |
| S. Tome & Principe | 68.3 | Somalia | *6.9* |
| Kenya | 64.8 | Eritrea | 4.5 |
| Swaziland* | 63.7 | D.P.R. Korea | *4.1* |
| Pakistan | 61.6 | Myanmar | 2.6 |
| Zambia | 60.6 | | |
| Equatorial Guinea | *59.1* | | |

*Source: ITU World Telecommunication/ICT Indicators database, 2012.*

*Note: There is no information available on South Sudan. Countries in the Countdown to 2015 subgroup are marked with an asterisk (*). Data in italics refer to ITU estimates.*

## Annex 4: Active fixed (wired) broadband subscriptions per 100 inhabitants, CoIA countries, 2011

| World Rank | Economy | Fixed (wired)-broadband subscriptions per 100 inhabitants | World Rank | Economy | Fixed (wired)-broadband subscriptions per 100 inhabitants |
|---|---|---|---|---|---|
| 53 | China* | 11.6 | 137 | Angola* | 0.1 |
| 58 | Azerbaijan* | 10.7 | 138 | Kenya | 0.1 |
| 59 | Mexico* | 10.6 | 139 | Papua New Guinea | 0.1 |
| 67 | Brazil* | 8.6 | 140 | Burkina Faso | 0.1 |
| 87 | Viet Nam | 4.3 | 141 | Togo | 0.1 |
| 91 | Peru* | 3.5 | 142 | Cote d'Ivoire | 0.1 |
| 100 | Egypt* | 2.2 | 143 | Tajikistan | 0.1 |
| 101 | Philippines* | 1.9 | 144 | Mozambique | 0.1 |
| 103 | Morocco* | 1.8 | 145 | Malawi | 0.1 |
| 104 | South Africa* | 1.8 | 146 | Myanmar | 0.1 |
| 108 | Djibouti* | 1.2 | 147 | Zambia | 0.1 |
| 110 | Indonesia* | 1.1 | 149 | Bangladesh | 0.0 |
| 112 | India* | 1.0 | 150 | Benin | 0.0 |
| 117 | Botswana* | 0.8 | 152 | Sudan* | 0.0 |
| 118 | Senegal | 0.7 | 153 | Rwanda | 0.0 |
| 119 | Bolivia* | 0.7 | 154 | Ethiopia | 0.0 |
| 120 | Lao P.D.R. | 0.7 | 155 | Madagascar | 0.0 |
| 122 | Uzbekistan | 0.5 | 157 | D.R. Congo | 0.0 |
| 123 | Solomon Islands | 0.4 | 158 | Turkmenistan* | 0.0 |
| 124 | Yemen | 0.4 | 159 | Comoros | 0.0 |
| 125 | S. Tome & Principe | 0.4 | 160 | Gambia | 0.0 |
| 126 | Pakistan | 0.4 | 161 | Mali | 0.0 |
| 127 | Nepal | 0.3 | 162 | Niger | 0.0 |
| 128 | Kyrgyzstan | 0.3 | 163 | United Rep. Tanzania | 0.0 |
| 129 | Gabon* | 0.3 | 164 | Guinea | 0.0 |
| 130 | Zimbabwe | 0.3 | 165 | Cameroon* | 0.0 |
| 131 | Uganda | 0.3 | 166 | Congo* | 0.0 |
| 132 | Ghana | 0.3 | 167 | Eritrea | 0.0 |
| 133 | Swaziland* | 0.2 | 168 | Liberia | 0.0 |
| 134 | Mauritania | 0.2 | 169 | Chad | 0.0 |
| 135 | Cambodia | 0.2 | 170 | Central African Rep. | 0.0 |
| 136 | Nigeria | 0.1 | 172 | Haiti | 0.0 |

*Source: Broadband Commission (2012). The State of Broadband 2012, pp. 82-83.*
*Note: There is no information available on the following CoIA countries: Afghanistan, Burundi, D.P.R. Korea, Equatorial Guinea, Guatemala, Guinea-Bissau, Iraq, Lesotho, Sierra Leone, Somalia, and South Sudan. Countries in the Countdown to 2015 subgroup are marked with an asterisk (*).*

## Annex 5: Active mobile-broadband subscriptions per 100 inhabitants, CoIA countries, 2011

| World Rank | Economy | Active mobile-broadband subscriptions per 100 inhabitants | World Rank | Economy | Active mobile broadband subscriptions per 100 inhabitants |
|---|---|---|---|---|---|
| 40 | Ghana | 23.0 | 123 | Togo | 0.4 |
| 41 | Indonesia* | 22.2 | 124 | Zambia | 0.4 |
| 43 | Azerbaijan* | 21.5 | 125 | Mali | 0.4 |
| 44 | Egypt* | 21.0 | 126 | Kenya | 0.3 |
| 45 | Brazil* | 20.9 | 127 | Ethiopia | 0.3 |
| 47 | South Africa* | 19.8 | 128 | Pakistan | 0.3 |
| 52 | Uzbekistan | 18.4 | 129 | Liberia | 0.2 |
| 53 | Viet Nam | 18.0 | 131 | Yemen | 0.1 |
| 59 | Zimbabwe | 14.9 | 132 | Madagascar | 0.1 |
| 71 | China* | 9.5 | 134 | Myanmar | 0.0 |
| 76 | Morocco* | 8.0 | 135 | Nepal | 0.0 |
| 80 | Rwanda | 6.4 | 136 | Benin | 0.0 |
| 84 | Mexico* | 4.6 | 137 | Burkina Faso | 0.0 |
| 88 | Kyrgyzstan | 4.1 | 138 | Burundi | 0.0 |
| 89 | Guatemala* | 4.1 | 139 | Cameroon* | 0.0 |
| 90 | Solomon Islands | 3.8 | 140 | Central African Rep. | 0.0 |
| 96 | Philippines* | 3.4 | 141 | Chad | 0.0 |
| 97 | Malawi | 3.1 | 142 | D.R. Congo | 0.0 |
| 99 | Uganda | 2.8 | 143 | Cote d'Ivoire | 0.0 |
| 100 | Nigeria | 2.8 | 144 | Equatorial Guinea | 0.0 |
| 103 | Cambodia | 2.2 | 145 | Eritrea | 0.0 |
| 105 | Bolivia* | 1.9 | 146 | Gabon* | 0.0 |
| 106 | India* | 1.9 | 147 | Guinea | 0.0 |
| 108 | Botswana* | 1.5 | 148 | Guinea-Bissau | 0.0 |
| 109 | Angola* | 1.5 | 149 | Niger | 0.0 |
| 110 | Senegal | 1.5 | 150 | S. Tome & Principe | 0.0 |
| 111 | Peru* | 1.4 | 152 | Comoros | 0.0 |
| 112 | United Rep. Tanzania | 1.2 | 153 | Djibouti* | 0.0 |
| 113 | Congo* | 1.2 | 154 | Somalia | 0.0 |
| 115 | Mozambique | 1.0 | 155 | Bangladesh | 0.0 |
| 119 | Swaziland* | 0.7 | 160 | Papua New Guinea | 0.0 |
| 120 | Lao P.D.R. | 0.6 | 166 | Turkmenistan* | 0.0 |
| 121 | Mauritania | 0.5 | 173 | Haiti | 0.0 |
| 122 | Gambia | 0.5 | | | |

*Source: Broadband Commission (2012). The State of Broadband 2012, pp. 84-85.*
*Note: There is no information available on the following CoIA countries: Afghanistan, D.P.R. Korea, Iraq, Lesotho, Sierra Leone, Sudan, South Sudan, and Tajikistan. Countries in the Countdown to 2015 subgroup are marked with an asterisk (*).*

## Annex 6: mHealth Alliance Active Grantee Projects (2012 – 2014)

| Round 1 (Jan 2012-Dec 2013) grantees | |
|---|---|
| Cell-Life – MAMA, South Africa | Cell-Life uses the MAMA SMS service to reach mothers with information on HIV testing, healthy pregnancy and infant care, and provides mothers with access to the National AIDS Helpline. Cell-Life is partnering with local health departments and NGOs to *reach 38,000 mothers by 2014*. |
| Clinton Health Access Initiative (CHAI) – SMART, Nigeria | CHAI, the Federal Ministry of Health (FMOH) of Nigeria and Hewlett Packard have partnered on the SMS Printers to Accelerate Return of Test Results for Early Infant Diagnosis of HIV/AIDS programme (SMART), which reduces turnaround time of test results by approximately 15 days. By 2014, CHAI plans to *have deployed 600 printers in all 6 geopolitical zones.* |
| Dimagi – CommCare, India | In partnership with Catholic Relief Services, World Vision and Real Medicine Foundation, Dimagi's open source mobile maternal and child health case management tool is being deployed by Accredited Social Health Activists to deliver health information and services across *five provinces in India*. To support scale up, Dimagi is launching the Active Data Management tool to strategically use the data collected for decision-making. |
| D-Tree International – mNUT, Zanzibar | Alongside UNICEF and the Government of Zanzibar, D-Tree International provides rural health workers with a mobile phone-based decision support application, which gives them tools to identify, treat and care for children with severe acute malnutrition. By 2014, D-Tree aims to *roll out the system in all 10 districts in Zanzibar.* |
| Grameen Foundation – MOTECH, Ghana | The Grameen Foundation, in partnership with the Ghana Health Service, supports poor, rural women and Community Health Nurses by delivering time-specific information to women about pregnancy, childcare practices and appointments, while supporting electronic records systems for nurses. Grameen has formed a public-private partnership with MTN Ghana to sustainably expand access to these services. |
| IRD – Interactive Alerts for Vaccine Coverage, Pakistan | Interactive Research and Development (IRD) is using Interactive Alerts, an electronic vaccine registry, to increase coverage of vaccines in support of the Pakistan Expanded Program on Immunization. Interactive Alerts provides SMS reminders to patients and caregivers, radio-frequency identification tag stickers for immunization cards, and an innovative lottery system of conditional cash transfers to reach over *15,000 infants in Sindh Province*. |
| MoH Rwanda RapidSMS and mUbuzima, Rwanda | The Ministry of Health of Rwanda is training community health workers to use mHealth applications to monitor and promote maternal and neonatal health, identify potential risks, and promote antenatal care at health facilities. The mHealth applications in use are "RapidSMS," which helps track pregnant women, and mUbuzima, which is used to collect and report MDG indicators at the community level. |
| Novartis – SMS for Life, Cameroon, Tanzania, Ghana | Novartis has developed the SMS for Life initiative, which tracks weekly stock levels to reduce stock-outs of key anti-malarial medicines and is being scaled to reach all health facilities in Cameroon and Tanzania. In Ghana, SMS for Life is used to reduce mortality in childbirth by bringing real-time visibility to blood supplies in all hospitals in Ghana. |
| **Round 2 (Jan 2013-Dec 2014) grantees** | |
| Changamka Microhealth – mPowerment, Kenya | Changamka Microhealth works to reduce the financial, transportation and knowledge barriers to maternal and child health care by providing women with mobile access to their savings and health insurance, informational messages and appointment reminders. Currently serving the rural population of Vihiga District, Changamka aims to operate in *three additional districts in western Kenya by 2015*. |
| CHAI – Supporting Mother-Infant Pairs using SMS Mobile Technology, Malawi | CHAI is using Frontline SMS to improve the capacity for patient follow-up in its patient care model, the Mother-Infant Pair (MIP) clinic, for prevention of mother to child transmission of HIV. By 2015, Frontline SMS will be supporting health workers in MIP clinics in *six districts in the southern region of Malawi*. |

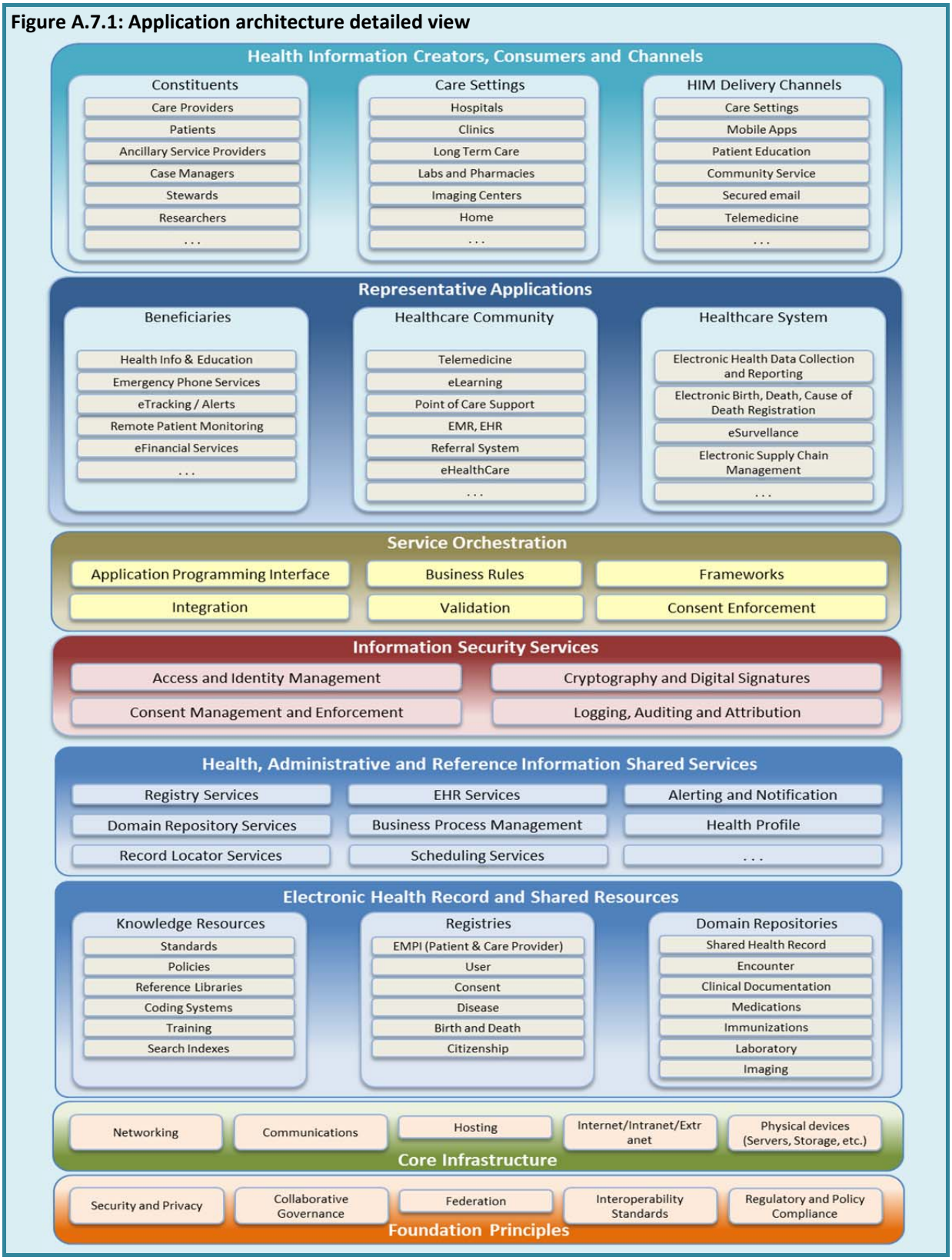
| Round 2 (Jan 2013-Dec 2014) grantees | |
|---|---|
| International Institute for Communication and Development (IICD) – MAMMA, Mali & Senegal | To improve monitoring of malaria, IICD and its partners train community health workers to use mobile applications to improve the collection of localized data, logistical coordination and clinical communication. The applications also enable health clinics and community organizations to more rapidly respond to malaria outbreaks. By 2015, IICD aims to be monitoring *a population of 200,000 in Bamako, Mali, and 100,000 in the Fatick region of Senegal.* |
| Malaria No More – NightWatch, Tanzania | Malaria No More will work with the Tanzania House of Talent to develop NightWatch: Mobile. This programme will add an interactive mobile component to the NightWatch malaria communications platform to improve knowledge and motivation for the use of bed nets to prevent malaria in Tanzania. |
| Praekelt Foundation – MAMA South Africa, South Africa | Praekelt Foundation uses the MAMA SMS service in South Africa to provide mothers with high quality and locally relevant weekly information on pregnancy and infant care. The service will expand to include a community portal with social networking features, a live chat feature permitting real-time engagement with experts and counsellors, and additional SMS messaging and interactive quizzes. MAMA *plans to reach one million mothers and household decision-makers over three years with these services.* |
| Medic Mobile – Kujua ("To Know"), India | Medic Mobile has partnered with Developmental Medical Foundation Centers in India to improve the scalability and reach of its novel software platform, PatientView, which provides vaccination and SMS reminders to patients to further improve vaccination rates among underserved populations. Medic Mobile *plans to reach 50,000 patients by 2015 throughout Delhi, Warangal, Mumbai and Hyderabad.* |
| Society for the Elimination of Rural Poverty (SERP) – mNDCC, India | Society for the Elimination of Rural Poverty (SERP) is using mNDCC (mobile Nutrition Day Care Centers) to strengthen health and nutrition services delivered by community health workers to mothers and children in rural Andhra Pradesh, India. *By 2015, mNDCC will expand from its current use in 4,200 NDCC villages to all 38,000 villages in Andhra Pradesh.* |
| VillageReach – Chipatala cha pa Foni ("Health Center by Phone"), Malawi | VillageReach is piloting a toll-free hotline, "Chipatala cha pa Foni," (CCPF) to improve case management of maternal and child health and increase uptake of community and facility-based services in rural areas. *By 2015, CCPF will be available to approximately 400,000 women and children in 3 districts of the southeastern zone of Malawi.* |

*Source: mHealth Alliance.*

## Annex 7: Health information management – Application architecture

Figure A.7.1 below depicts a health information management application architecture detailed view, including all components necessary to instantiate a health information communication, storage, aggregation and reporting solution. The following subsections provide a more detailed description at each of these components.

**Figure A.7.1: Application architecture detailed view**



### Health information creators, consumers and channels

Several groups of people make up the target producers and consumers of healthcare data and services. Constituents can provide data and available services in a number of care settings, using diverse channels.

**Constituents** make up the individuals that produce and consume healthcare data and services. Table A.7.1 below describes some of the key constituents of the health ecosystem.

**Table A.7.1: Constituents of the health ecosystem**

| Constituent | Description |
|---|---|
| Care providers | Individuals/entities that provide healthcare related services to patients, such as community health workers. They work in medicine, nursing, or other related field of healthcare. |
| Patients | Individuals who are the recipients of health care services. |
| Ancillary service providers | Individuals/entities specialized in meeting the needs of a specific population. They fall into one of these three groups:<br>Diagnostic – Services in this group include laboratory testing and imaging services. An example would be a laboratory drawing blood for a broken arm.<br>Therapeutic – Group of services that help restore or maintain a patient's health. For instance, a physical therapist helps rehabilitate a patient's broken arm.<br>Custodial – Services that work to improve or maintain a patient's health. A skilled nursing facility would provide longer-term care for rehabilitation, for example. |
| Case manager | Works with patients and their families to aid in the process of assessing, planning, facilitating, evaluating and coordinating care. They may serve as an advocate for options and services, and provide education and available resources for cost-effective outcomes. |
| Stewards | Are typically charged with specific accountability for maintaining the integrity and quality of health information data. |
| Researchers | The ability to mine the health information data is critical to the advancement of healthcare. An example is the analysis of the most effective therapies and outcomes to treat a particular condition. |

**Care settings** serve as the geographic location that provides healthcare services, such as hospitals, clinics, laboratories, pharmacies, home, etc.

**Delivery channels** are the mechanisms in which information is passed through devices and made available to different care settings for constituents.

### Representative ICT applications and services for RMNCH

A list of representative ICT Applications and services for RMNCH is provided in Table 4.

### Service orchestration

Service orchestration utilizes state and workflow control to be able to integrate applications and leverage shared services amongst applications and other services. This approach allows for the assembly of more granular, specialized capabilities that reduce point-to-point integrations between applications that are very hard to manage, monitor and maintain.

Service orchestration plays a critical role in a world of composite applications that leverage service oriented architecture (SOA) and/or software as a service (SaaS) design principles. By assembling a combination of service iterations, a developer is able to create a higher-level business service in a quicker, more maintainable, and standards-based manner. Key service orchestration components are described in Table A.7.2 below.

**Table A.7.2: Service orchestration components**

| Component | Description |
|---|---|
| Application Programming Interface (API) | Software–to-software interface that has a clearly defined method of communication, as well and inputs and outputs, if any. An example of an API would include using the EMPI (Enterprise Master Person Index) exposed interface to add, update, and merge patient records, and to query the database. |
| Business rules | A rule or set of rules that define or constrain a business operation. |
| Frameworks | An abstraction of software that provides general functionality, which can be altered, through programming, to provide a specific functionality. Leveraging frameworks facilitates software development by allowing the developers to focus on the business needs rather than on the lower level details of providing a working solution. |
| Integration | Combines commonly used capabilities from disparate solutions into a single coordinated solution. |
| Validation | Process that is used to verify the validity of both inputs and outputs of the service orchestration. |
| Consent enforcement | Process that verifies whether the person or service that is accessing potentially sensitive information is actually permitted to gain access to it. |

### Information security services

In general, Information security services are a group of methods to intelligently control access to resources, enforce policies, secure information and log/audit who has accessed what resource and for what purpose. When dealing with information security there are several key capabilities that need to be considered. These capabilities can be implemented and leveraged at a local solution level, scaled up to an enterprise wide solution, or any combination in between.

As described in Table A.7.3, there are four key capabilities necessary to enable better management and utilization of electronic health information, so as to facilitate secure storage and the exchange of data between consumers, providers, and other healthcare organizations. This data exchange will need to be conducted in ways that safeguard the availability, integrity, confidentiality, and accuracy of the information.

**Table A.7.3: Information security capabilities**

| Capability | Description |
|---|---|
| Access and identity management | Deals with identifying individuals and controlling their access to resources within a system (country, network, enterprise, or individual solution) by associating user rights and restrictions to the established identity. |
| Cryptography and digital signatures | An essential part of any communication transmitted over an untrusted medium, including different types of networks and especially, the public Internet. Cryptography can serve many purposes including:<br>**Authentication** – Providing one's identity;<br>**Privacy/Confidentiality** – Ensuring only the intended message recipient can read the message;<br>**Integrity** – Ensuring that the message has not been altered in transit from the sender to the receiver;<br>**Non-repudiation** – Method to assure the impossibility of a sender or receiver to deny his or her actions upon their completion. |
| Consent management and enforcement | Process that manages a set of policies, allowing patients to determine the information that will be accessible to specific potential information consumers. |
| Logging, auditing and attribution | Provides documentary evidence of a sequence of actions. This can and should contain actions such as system login, patient information access, and system restarts, among many others. |

Information exchange can involve exchanges between two organizations in a community, between several organizations in a region, in several regions, or even across country boundaries. Exchanging organizations need a structured approach to information security that will enable their information systems to protect health information before, during, and after the exchange. All aspects of data usage, including collection, storage, modification and destruction will require security and privacy protection.

Protecting a patient's privacy and securing their health information is of paramount importance, given that trust is a critically important business asset. Without this trust, patients will be less likely to confide in their care providers and disclose necessary and relevant health information vital to accurately and effectively treat the condition(s). Once members of this network lack trust, due to a perceived or actual risk that the heath information is inaccurate or incomplete, the value of viability of the network quickly breaks down.

### Health, administrative and reference information shared services

This is a category of shared services that are more specifically related to and supporting the healthcare domain. Table A.7.4 below provides some examples of those services.

**Table A.7.4: Examples of health, administrative and reference information shared services**

| Service | Description |
|---|---|
| Registry services | Typically, refer to services that collect and disseminate specialized information related to patients, providers, and organizations, among others. Examples of patient specific registries and related services would include immunization, disease, citizenship, birth and death, among others. |
| EHR services | Provide services related to the persistence of a longitudinal medical record for a patient that may cross enterprise or even national boundaries. |
| Alerting and notification | These services enable an application to autonomously notify users or other applications when certain conditions occur. Alert notification services are necessary due to the increased options of delivery, such as e-mail, instant messaging, and SMS for cell phones that are used for receiving an alert. |
| Domain repository services | Services that enable access to specific information about a patient including, but not limited to, encounters, medications, and immunizations. |
| Health profile | This type of profiles can be used to determine the characteristics and health of a specific population. They include personal and community health profiles, among others. |
| Record locator service | Contains metadata about where patient information can be found. They are used also to support interoperability in a decentralized healthcare environment. |
| Scheduling services | A centralized scheduling service, whether online or over the phone, has many benefits, including convenience, economies of scale, accessibility and affordability to name a few. |

### Electronic health record and shared resources

This component includes knowledge resources, registries and domain repositories. **Knowledge resources** are those items that can be used for efforts improvement, including measures to guide improvement, standards specifications, and audio and video, as well as paper-based training material, among others, as described in Table A.7.5.

**Table A.7.5: Examples of knowledge resources**

| Resource | Description |
|---|---|
| Standards | Method to facilitate communication between disparate systems and organizations. This includes both the method of communication, as well as the message/document contained within the communication. |
| Policies | Can be defined as the "decisions, plans, and actions that are undertaken to achieve specific healthcare goals within a society." |
| Reference libraries | Comprehensive collection of materials related to all matters of healthcare. |
| Coding systems | Comprehensive collection of coding systems related to all matters of healthcare. |
| Training | Materials used to enable a person to gain knowledge, skills, and/or competencies. |
| Search indexes | Method to optimize the ability to locate documents being queried. |

**Registries** are a specialized subset of data related to patients, providers, organizations, etc. Registries are used, directly or indirectly, to increase the understanding of patient outcomes, determine clinical effectiveness, measure and monitor safety and harm, as well as quality of care, among other things. Table A.7.6 below provides some examples.

**Table A.7.6: Examples of registries**

| Registry | Description |
|---|---|
| Enterprise Master Person Index (EMPI) | In healthcare, there are typically two EMPIs that are considered, the first being a patient centric index, and the second being a provider centric index.<br>**Master Patient Index** – Maintains patient identification information and verifies the patient demographic data in a system. The registry also handles patient merge and unmerge.<br>**Master Provider Index** – Service that obtains provider identification information and connects the provider to facility information. |
| User | Holds account information for system users. This information includes user ID and password, among other data. |
| Consent | Keeps track of a patient's approval for their health related information to be used by specific providers, organizations, etc. |
| Disease | Subset collection of data related to patients with a specific condition, diagnosis or who have had a specific procedure performed. |
| Birth and death | Data collection activities to capture birth, death and cause of death registration, which allows countries to assess, manage and understand current, past, and trends of population health and health sector performance. |
| Citizenship | Manages citizen identification and verifies the citizen demographic data in a system. |

**Domain repositories** are specific collections of data referring to the same domain, that is, to the same specialized sphere of knowledge, influence or activity. The areas or domains described in Table A.7.7 below are examples of such repositories.

**Table A.7.7: Examples of domain repositories**

| Domain | Description |
|---|---|
| Shared health record | Collection of patient records typically provided by many clinically related sources systems and also made available for consumption by those who have the necessary rights and need to see the information. |
| Encounter | Data pertaining to an interaction between a patient and health care provider for the purpose of assessing the health status of a patient or for providing patient service(s). |
| Clinical documentation | Component of the patient's medical record that documents clinical observations and services. |
| Medications | Information pertaining to a patient's medication history. This includes those medications taken at home, prescribed medications, as well as those administered in care settings such as a hospital or an outpatient clinic. |
| Immunizations | Records of a patient's immunization history. |
| Laboratory | Contains results of tests performed on clinical specimens. These results are then used to gain insight into the health of a patient pertaining to a diagnosis, treatment or prevention of disease. |
| Imaging | Contains the results of studies performed on patients, including images of the body, as well as annotations and other textual result information provided by a clinician. |

### Core infrastructure

Core infrastructure references those components on which every business transaction rides. It is the physical hardware used to interconnect computers, software and users, as described in Table A.7.8.

**Table A.7.8: Core infrastructure components**

| Component | Description |
|---|---|
| Networking | A combination of hardware, software and services that provides the communication path and services between users, applications, services, processes and external networks. |
| Communications | Information routed between a sender and one or more receivers. This information could be anything from voice to data. |
| Hosting | Business of providing backup, maintenance, monitoring and various other services, as well as the necessary servers, software, storage, and networking equipment to support a software solution. |
| Intranet/ Extranet/ Internet | **Intranet** – The generic term for a collection of private computer networks within an organization.<br>**Extranet** – A computer network that allows controlled access from the outside for specific purposes.<br>**Internet** – The worldwide network of computers that is publically accessible via an Internet Protocol (IP) address. |
| Physical devices | Tangible servers, routers, firewalls, storage devices, etc. that make up the physical network. |

### Foundation principles

Foundation principles are the corner stones to the success of almost any cross-organizational healthcare initiative. Focusing on these principles at the onset of an initiative is key, given the complexities surrounding these areas. Foundation principles assist with reaching an agreed upon approach, which will have a substantial impact on the solution design, delivery and use. Table A.7.9 describes some of the key areas covered by these principles.

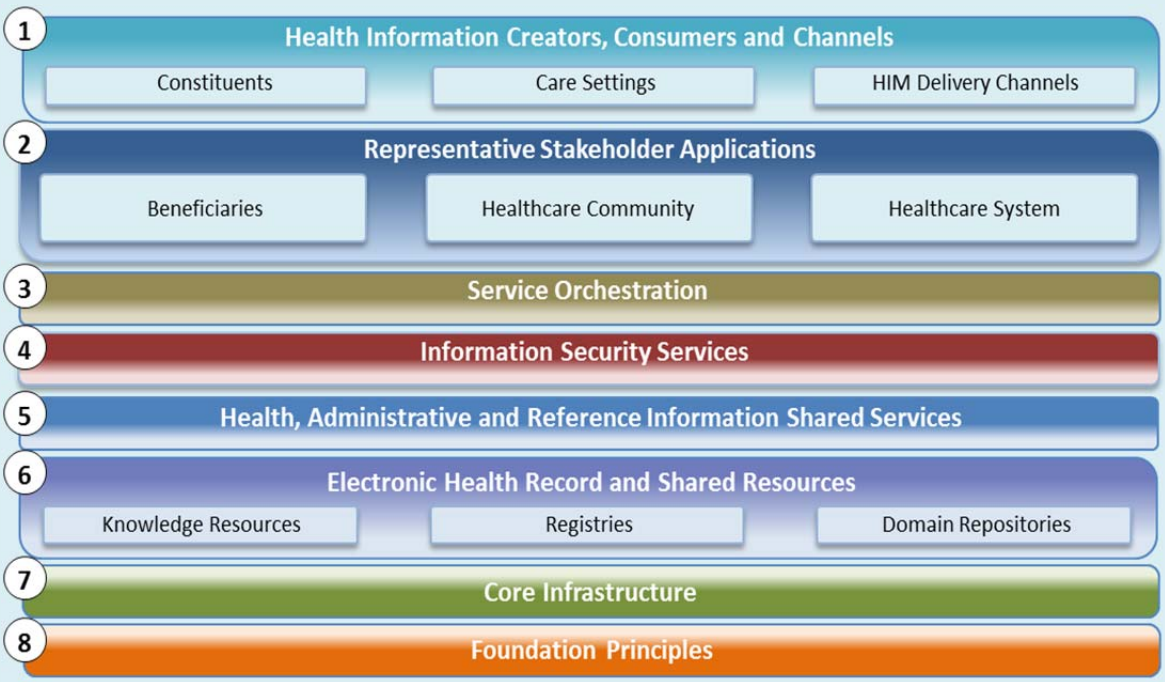
**Table A.7.9: Key areas covered by the foundation principles**

| Area | Description |
|---|---|
| Security and privacy | Principles of safeguarding systems and data from those who have not been authorized appropriate access. |
| Collaborative governance | Principles of involving key stakeholders in the process and agreement in key areas of data quality, data management, data policies, business process management, and risk management. The goal is to create policies and procedures that define a consistent and proper handling of healthcare and administrative data. |
| Federation | Principles to manage a decentralized deployment pattern, with the intent of creating a high degree of flexibility, reduced complexity, and increased solution agility. This effort requires an extremely disciplined approach to identifying and managing common/shared architectural components, as well as identifying what and how to integrate disparate components, systems, and data. |
| Interoperability standards | These standards define communication methods, message formats and coding systems to allow the exchange of information among diverse systems and organizations. |
| Regulatory and policy compliance | Adherence to laws, regulations, and internal policies. |

### Health information management – A user scenario

This section describes a scenario relating to the use of the diverse application architecture components of a health information management system, as described above. It illustrates it with the example of a community health worker who conducts a home visit, identifying the steps and resources he/she utilizes from among the diverse HIM application architecture components.

**Figure A.7.2: Application architecture components: User scenario**



A Community Health Worker (CHW) who is performing his home visits for the day needs to determine the next patient appointment. To this end, the CHW utilizes a mobile application that lets him access information about the patient, geographic location and time of the next appointment. He finds out that the next appointment is with an expectant mother at her home. During the visit, the CHW is tasked with enrolling the expectant mother in a programme that will deliver electronic and/or paper-based education materials related to expectant and new mothers. The CHW also performs a progress check to verify the pregnancy is progressing as expected.

During the visit, the CHW uses a mobile device to log into a mobile application to access the patient's electronic health record. He also documents the patient's information, including her current health status and progress since the last visit. At the conclusion of the visit, the CHW works with the patient to schedule an appointment with a physician at a nearby clinic for a follow up within a month. The above scenario is a use case that demonstrates the process steps tied to the high level components of the application architecture, as described in Table A.7.10 below.

**Table A.7.10: Examples of application architecture components accessed during a patient's visit**

| Application architecture components accessed* | User scenario |
|---|---|
| (1) Constituents | A community health worker and the patient are both constituents (1) of the health information creators, consumers and channels group. |
| (2) Scheduling application &<br>(3) Services orchestration<br>(4) Information security services | When the CHW accesses the scheduling application (2), through the use of service orchestration (3), he is required to validate (4) whom he is, to verify his right to get access to the requested information. |
| (3) Service orchestration<br>(4) Information security services<br>(2) Representative applications<br>(6) Electronic health record and shared resources | During the visit, the CHW enrols the expectant mother to receive electronic education material. The enrolment process, through service orchestration (3) provisions a new user account for the expectant mother (4) and gives her access to an educational resources application (2) where she will gain access to knowledge resources (6) to educate the expectant mother on many topics related to expectant and new mothers. |
| (2) Representative applications<br>(4) Information security services<br>(3) Service orchestration<br>(5) Health, administrative and reference information shared services<br>(6) Electronic health record and shared resources | The CHW then gains access to the expectant mother's clinical record to see what her status was at her prior visit, to determine if the mother and baby are progressing as expected. Accessing the clinical record would require the specific application (2) to validate the user's credentials and rights to view the requested data (4) via service orchestration (3). The application used to view the clinical record leveraged shared reference information (5), as well as their own domain repositories (6) to gain a complete picture of the patient's medical history related to this condition. |
| (5) Health, administrative and reference information shared services<br>(6) Electronic health record and shared resources | At the conclusion of the visit, the CHW would document current status of the expectant mother and baby into the domain repository (6) and leverage shared services (5) to schedule a follow-up appointment with a care provider (6). |
| (7) Core infrastructure<br>(8) Foundation principles | The scenario above would not have been possible without the core infrastructure being in place (7) and without embracing the foundation principles (8). |

** Note: The number between brackets refers to the application architecture component being utilized.*

## Annex 8: Examples of standards applied to ICT-based interventions to measure CoIA-related RMNCH indicators at the community or facility levels

| Example of ICT-innovation intervention | Type of data or indicators collected and transmitted | Examples of relevant standards |
|---|---|---|
| eHealth/mHealth service: Notification system for maternal deaths | • Deaths during pregnancy, childbirth and puerperium | • Health Level Seven (HL7) Version 2.x and Version 3 for vocabulary<br>• International Classification of Diseases (ICD10/ICD) for diagnosis |
| eHealth service: Facility data and discharge data management | • Caesarean delivery | • Health Level Seven (HL7) Version 2.x and Version 3 for vocabulary<br>• International Classification of Diseases (ICD10/ICD) for diagnosis |
| eHealth services: Facility stocks management information systems | • Management of essential medicines and medical products available for mothers and children at care facilities such as antiretroviral prophylaxis, uterotonic agents, DPT vaccine, antibiotic treatment for pneumonia, and contraception<br>• Rapid diagnostic test for malaria<br>• Vitamin A<br>• Oral rehydration package,<br>• Insecticide treated bed nets | • Biomedicine, healthcare, drug Standards, such as UMLS RxNorm<br>• Unified Code for Units of Measure (UCUM)<br>• Uniform facility codes and related facility registry elements<br>• ISO/TC 215 Standards List |
| eHealth service: Human resources information system | • Midwives qualified to administer lifesaving interventions;<br>• Health workers, trained and living in community, providing essential basic care<br>• Number of live births attended by skilled health personnel<br>• Trained providers | • International Standard Classification of Occupations (WHO/ILO) |
| eHealth service: Laboratory and diagnostics information systems | • Screening/tests related to HIV, syphilis and other diseases | • Logical Observation Identifiers Names and Codes (LOINC) for test orders and results<br>• Unified Code for Units of Measure (UCUM) for units of analysis<br>• Health Level Seven (HL7) Version 2.x and Version 3 for vocabulary<br>• Digital Imaging and Communications in Medicine (DICOM) |
| mHealth services: Appointment reminders, counselling, and testing services locator | • Antenatal and immunization reminders<br>• STI/HIV counselling, testing and service delivery points | • Uniform facility codes and related facility registry elements<br>• Geographic latitude and longitude |

*Source: WHO.*

## Annex 9: Compendium of eHealth projects for RMNCH implemented in CoIA countries (Recommendations 1 to 3)

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 1 | Rec. 1 | **e-Districts Project for services of births and deaths registration in district of Kapurthala, India** | Integrated electronic service supported by automation workflow, backend computerization, and data digitalization. The objective is to ensure that the defined process of service delivery of birth/death certificates is adequately and timely followed. http://pbhealth.gov.in/e-district.crs.pdf | Civil registration | India |
| 2 | Rec. 1 (Rec. 2) (Rec. 3) | **MAMA** | Mobile-based information to new and expectant mothers. www.babycenter.com/mama | SMS-based public health information and education | Bangladesh South Africa India |
| 3 | Rec. 1 | **MOVE IT** | Mobile-based registering of pregnancies, recording of births, deaths and cause-of-death, using text messaging system. www.who.int/healthmetrics/news/MOVE_IT_Africa_Board_Paper_21.2.12.pdf | Civil Registration and Vital Statistics | Ghana |
| 4 | Rec. 1 (Rec. 2) | **Project Mwana** | Mobile application based on RapidSMS, used by community health workers (CHWs) to register new births and monitor community health events related to malaria, diarrhoea, and immunizations in children under five years old and expectant mothers. http://projectmwana.posterous.com/ | Birth registration Data collection | Malawi Zambia |
| 5 | Rec. 1 (Rec. 3) | **SMS alerts for Infant vaccinations** | eVaccination alert system connected to 'Hospital Kiosks' where parents register the birth of their child. Alerts on vaccination dates and details on their importance will be automatically sent to the mobile phone numbers of parents. www.healthunbound.org/content/sms-alerts-infant-vaccinations | Birth registration SMS reminders | India |
| 6 | Rec. 1 | **Universal Birth Registration** | Mobile birth registration system focused on informing and educating the public about the birth registration processes. http://plan-international.org/birthregistration | Birth registration | Liberia |

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 7 | Rec. 2<br>(Rec. 3) | **Aceh Besar midwives** | Mobile phones to improve the quality of health services and reinforce positive health behaviour change, such as child spacing.<br>www.mobileactive.org/files/file_uploads/final-paper_chib.pdf | SMS-based health education | Indonesia |
| 8 | Rec. 2 | **AMUA** | SMS is used to send monthly service reports for 12 services in a single text, using a numeric code. Data can be viewed on a Web-based real time reporting system, and exported as PDF or CSV files.<br>http://mariestopes.org/ShowContent.aspx?id=430 | Health Information System (HIS) | India |
| 9 | Rec. 2<br>(Rec. 3) | **ChildCount+** | Mobile application based on RapidSMS to monitor children under five years old.<br>www.childcount.org/ | Data collection<br>Community-based healthcare | Kenya |
| 10 | Rec. 2<br>(Rec. 3) | **mCare** | Mobile phone and database technologies used to improve registration and monitoring of pregnancies, as well as neonatal and post-partum care.<br>www.mobileaware.com/solutions/mobile-self-service/ | Data collection<br>Community-based healthcare | Bangladesh |
| 11 | Rec. 2 | **M-CHANJO** | Mobile health application that seeks to reduce the rate of child mortality. The system works by sending automated reminders via SMS to parents to keep them informed on any future immunization dates and appointments for their children.<br>http://mchanjo.org/ | SMS-based health education<br>SMS reminders | Kenya |
| 12 | Rec. 2 | **mUbuzima** | Cell phones are used to enable community health workers (CHWs) to provide real-time data concerning community health indicators.<br>http://mubuzima.gov.rw | Data collection<br>Health Information System | Rwanda |
| 13 | Rec. 2 | **Online reporting System of NRHM** | Electronic portal of the rural health mission of Punjab for data collection.<br>www.pbnrhm.org/online_reporting.aspx | Health Information System | India |
| 14 | Rec. 2 | **RHEA** | Health information system to improve maternal and child care in Rwanda at health centre level.<br>http://rhea.jembi.org | Health Information System | Rwanda |

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 15 | Rec. 3 | **AIM-Health** | Mobile phone application for 7-11 timed and targeted counselling as a specific human resource management tool. http://global-health.tcd.ie/research/projects/aim-health.php | Health education | Sierra Leone |
| 16 | Rec. 3 | **AMANECE** | Mobile phones are used to detect warning signs and typical symptoms of high-risk pregnancies, to support primary health workers in providing monitoring and follow-up for high-risk pregnancy cases, and to ensure timely obstetric and newborn care interventions. www.salud.carlosslim.org/SoluInte/amanece/Paginas/AMANECE.aspx | Patient monitoring<br>Point-of-care support and decision support system | Mexico |
| 17 | Rec. 3 | **AMREF** | Reference & information hub providing a platform for health workers in Africa to access appropriate information. www.amref.org | eLearning for healthcare professionals | Africa |
| 18 | Rec. 3 | **ASARA-HMRI** | Telemedicine pilot project aimed at reducing maternal mortality among remote tribal women. www.hmri.in/oursolutions-telemedicine.html | Telemedicine<br>Remote patient monitoring | Kenya |
| 19 | Rec. 3 | **BabySMS** | Free SMS-based pregnancy advice service to help raise awareness and encourage expectant mothers to attend clinic visits regularly. http://babysms.mobi/index.php | SMS-based health education<br>SMS reminders | South Africa |
| 20 | Rec. 3 | **Cellphone4 HIV** | SMS is used to expand the uptake of HIV testing and follow-up in PMTCT. www.cell-life.org/ | SMS-based health education | South Africa |
| 21 | Rec. 3 | **Changamka Medical Smart Card** | Smart Card provides sustainable financing for delivery, and post-natal services at participating facilities. http://changamka.co.ke/ | Financial services | Kenya |
| 22 | Rec. 3 | **CliniPak** | Automatic text message reminders for patients receiving ongoing treatment and for mothers requiring post-natal care for themselves and their infants. www.vecnacares.org/technology/index.shtml | SMS reminders | Kenya |

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 23 | Rec. 3 | **CommCare** | CHWs use electronic forms to access real-time guidance through key counselling points, decision support, and simple referral algorithms. www.CommCareHQ.org | Data collection<br>Community-based healthcare<br>Point-of-care support<br>Referral system | 17 countries in Africa, Asia, and America |
| 24 | Rec. 3 | **CycleTel: Family Planning via Mobile Phones** | Standard Days Method (SDM) displayed directly to a user's cell phone. SDM is a fertility awareness-based method that requires the user to avoid unprotected sex during days 8-19 of her menstrual cycle. www.coregroup.org/storage/CycleTel_mHealth_WG_Jan2011-1.pdf | Health education | India |
| 25 | Rec. 3 | **eFamily Planning (eFP)** | Electronic job aid on mobile phones for CHWs to effectively counsel, screen and refer patients for family planning, HIV and STI ((sexually transmitted infections) services. http://healthmarketinnovations.org | Point-of-care support and decision support system | Tanzania |
| 26 | Rec. 3 | **EhealthPoint** | Tele-medical services providing referrals to district-based hospitals for situations like childbirth, acute trauma, heart attack, cancer, and accident related emergencies. www.ehealthpoint.com/ | Referral system | India |
| 27 | Rec. 3 | **e-IMCI** | Electronic job aid on PDA to improve adherence to the Integrated Management of childhood Illness (IMCI) protocols. www.d-tree.org/our-projects/imci-tanzania/ | Point-of-care support and decision support system | Tanzania |
| 28 | Rec. 3 | **eNutrition** | Mobile decision support tool for nurses providing outpatient therapeutic care (OTC) for children with severe acute malnutrition (SAM). www.d-tree.org/wp-content/uploads/2010/08/D-tree-Excerpt-Innovation-Report-Sept-2011.pdf | Point-of-care support and decision support system | Tanzania |
| 29 | Rec. 3 | **FANC** | Short Messaging Service (SMS) platform that allows for two-way exchange of key FANC messages between health personnel and pregnant women. www.fanc-africa.org/ | SMS-based health education | Kenya |
| 30 | Rec. 3 | **GlobalMama** | Blog dedicated to maternal health. http://blogs.medscape.com/mhtfglobalmama | Health education | Global |

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 31 | Rec. 3 | **HealthLine** | Toll-free number for health workers to learn about a variety of topics through audio transmission in native language. www.cs.cmu.edu/~healthline/ | Health helplines | Pakistan |
| 32 | Rec. 3 | **Health Systems 20/20** | Mobile-based financial services for interventions in financing, governance, operations, and capacity building to strengthen health systems. www.healthsystems2020.org/ | Mobile financial services | Global |
| 33 | Rec. 3 | **Hospitalsworldwide** | Database of hospitals worldwide with over 15,000 entries of hospitals and health clinics throughout the world. www.hospitalsworldwide.com/ | Directories for health care providers | Global |
| 34 | Rec. 3 | **inSCALE** | Mobile-based system to improve support supervision, data submission with automated individual feedback and regular motivational messages on how to improve performance and appropriate treatment of children. www.malariaconsortium.org/inscale/pages/implementation-sites/uganda | Data collection<br>Community-based healthcare | Mozambique<br>Uganda |
| 35 | Rec. 3 | **Jaroka Tele-Health care Services for Lady Health Workers** | Mobile platforms to extend (1) tele-healthcare based services, including SMS, MMS, GPRS/Edge and VSAT; (2) medical advice to local health workers in the field by connecting them to a network of specialists. http://tele-healthcare.org/implementation/jaroka-tele-healthcare-in-rural-mardan/ | Telemedicine | Pakistan |
| 36 | Rec. 3 | **KimMNCHip** | Mobile health initiative to offer pregnant women in Kenya more choice, control and care during their pregnancy, and improved medical care for women and their babies during and after delivery. www.ghf12.org/?p=2154 | Health education | Kenya |
| 37 | Rec. 3 | **m4RH** | Mobile-based system using an opt-in SMS-based health communication programme that provides information about nine family planning methods as well as a clinic database. http://m4rh.fhi360.org/ | SMS-based health education<br>Directories for health care providers | Kenya<br>Tanzania |
| 38 | Rec. 3 | **mDhil** | Health information via SMS as well as original health videos viewable on mobile phones, including maternal health. www.mdhil.com/ | Health education | India |

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 39 | Rec. 3 | **Medic Mobile (Frontline SMS)** | Mobile-based technology to bridge between patients and physician, mainly for family planning and maternal and child care services. http://medic.frontlinesms.com/ | Patient monitoring<br>Community-based healthcare | Bangladesh |
| 40 | Rec. 3 | **mHealth for Safe Deliveries** | Mobile phone app for midwives that leads a midwife through the Zanzibar Ministry of Health care guidelines and allows them to screen pregnant mothers to identify risks, find the closest health centre and identify a means of transportation to reach the clinic. It also uses mobile banking to pay for the transportation and alerts the clinic that an expectant mother is on the way. www.globalgiving.org/projects/safedelivery/ | Point-of-care support and decision support system<br>Directories for health care providers<br>Mobile financial services | Tanzania |
| 41 | Rec. 3 | **Mobile Finance to Reimburse Sexual and Reproductive Vouchers** | Mobile phone-based short message service (SMS) money transfer system to increase poor people's access to voluntary family planning services. www.mariestopes.org | Mobile financial services | Madagascar |
| 42 | Rec. 3 | **MoTech** | Mobile-based health system that improves management patient data, enhances worker performance, and provides last-mile supply chain and patient adherence. www.grameenfoundation.org/what-we-do/technology/mobile-health | Health education<br>Community-based healthcare<br>SMS reminders<br>Supply chain management | Ghana |
| 43 | Rec. 3 | **OBGYN.net** | Information platform on gynaecology including blogs, forums and online courses. www.obgyn.net | Patient information | Global |
| 44 | Rec. 3 | **Pesinet** | Mobile phone-based system monitoring information on mother and child health. www.pesinet.org/ | Patient monitoring<br>Community-based healthcare | Mali |
| 45 | Rec. 3 | **RAFT** | Tele-expertise, ultrasonography with remote supervision by specialists, particularly for supporting diagnosis for pregnant woman, and collaborative development of educational on-line material. http://raft.hcuge.ch/ | Telemedicine<br>Remote patient monitoring | Congo<br>+ 17 other countries in Africa |

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 46 | Rec. 3 | **RapidSMS** | SMS based system to track pregnancies and support maternal, neonatal and early child health. http://rapidsms.moh.gov.rw/ | Data collection<br>Community-based healthcare<br>SMS reminders | Global |
| 47 | Rec. 3 | **RPMS Electronic Health Record** | The Indian Health Service new Electronic Health Record (EHR) system, designed primarily for IHS, Tribal, and Urban (I/T/U) Indian health care facilities. www.ihs.gov/ehr/ | Electronic Health Record (EHR) | India |
| 48 | Rec. 3 | **SHINE** | Web and mobile-based system addressing the data management needs of doctors, nurses, midwives and allied health professionals. www.shine.ph/ | Referral system<br>Health Information System | Philippines |
| 49 | Rec. 3 | **SMART** | Small battery-operated printers programme to receive and print early infant diagnosis test results to strengthen early infant diagnosis services by speeding up results delivery and treatment eligibility. www.sms2printer.co.uk/pages.php?pageref=clinton-foundation_3 | Diagnosis support | Cameroon<br>Ethiopia<br>Kenya<br>Malawi<br>Mozambique<br>Papua New Guinea<br>Tanzania<br>Uganda<br>Zimbabwe |
| 50 | Rec. 3 | **SMS for Life** | Public-private project that harnesses everyday technology to eliminate stock-outs and improve access to essential medicines in sub-Saharan Africa. www.rbm.who.int | Supply chain management | Tanzania |
| 51 | Rec. 3 | **SMS Tech for Health txt4Enat** | Mobile-based system to inform women about pregnancy and collect information transmitted via the handsets to a central computer system. https://smsinaction.crowdmap.com/reports/view/162 | SMS-based health education<br>Data collection | Ethiopia |
| 52 | Rec. 3 | **TulaSalud** | Telemedicine and mobile phones for remote diagnostic and decision-making support from physicians in urban centre and receive calls from people in communities seeking for care. www.tulasalud.org | Telemedicine<br>Point-of-care support and decision support system | Guatemala |

| # | Related Recommendation | eHealth project | Description | ICT application | Country |
|---|---|---|---|---|---|
| 53 | Rec. 3 | **UNICEF Reminder Mother System** | Mobile phones to increase antenatal care and prevention of mother to child transmission by educating communities.<br>www.texttochange.com | Health education<br>SMS reminders | Uganda |
| 54 | Rec. 3 | **Wawared** | Mobile technology solutions to support maternal and child care by improving access to health services for low-income pregnant women.<br>www.wawared.andeanquipu.org/ | SMS-based health education | Peru |
| 55 | Rec. 3 | **Wazazi Nipendeni** | Free SMS service for expectant mothers and families that provides appointment reminders and tips on keeping mothers and newborn babies healthy.<br>www.texttochange.org | SMS-based health education<br>SMS reminders | Tanzania |

## Acronyms

| | |
|---|---|
| **3G/4G** | 3rd Generation/4th Generation (mobile phone technology) |
| **AIMS** | Aid information management system |
| **AMP** | Aid management platform |
| **API** | Application programming interface |
| **CAGR** | Compound annual growth rate |
| **CCM** | Coordinated country mechanisms |
| **CDC** | United States Centers for Disease Control and Prevention |
| **CDR** | Central domain repository |
| **CHWs** | Community health workers |
| **COD** | Cause of death |
| **CoIA** | Commission on Information and Accountability |
| **CRS** | Creditor reporting system |
| **CRVS** | Civil registry and vital statistics |
| **CSOs** | Central statistical offices |
| **DAC** | OECD Development Assistance Committee |
| **DCCs** | Data Content Committees |
| **DHIS** | District health information system |
| **DHS** | Demographic and health survey (USAID) |
| **DICOM** | Digital Imaging and Communication in Medicine |
| **DSMOs** | Designated Standard Maintenance Organizations |
| **EDGE** | Enhanced Data rates for GSM Evolution |
| **EHR** | Electronic health record |
| **EMPI** | Enterprise Master Person Index |
| **GIS** | Geospatial information system |
| **GPRS** | Global positioning response signal |
| **HIMS** | Health information management systems |
| **HIS** | Health information system |
| **HIT** | Health information technology |
| **HIV-ARV** | Human immunodeficiency virus - antiretroviral therapy |
| **HL7** | Health Level Seven |
| **HRT** | Health Resource Tracker (Rwanda) |
| **ICD-10** | WHO International Classification of Diseases |
| **ICT** | Information and communication technology |
| **iERG** | CoIA independent Expert Review Group |
| **ILO** | International Labour Organization |
| **IMR** | Infant mortality rate |
| **IP** | Internet protocol |
| **ISO** | International Organization for Standardization |
| **IT** | Information technology |
| **ITU** | International Telecommunication Union |
| **IVR** | Interactive voice response |
| **IWG** | Innovation Working Group |
| **J2ME** | Java 2 Platform, Micro Edition |

| | |
|---|---|
| **LOINC** | Logical Observation Identifiers Names and Codes |
| **M&E** | Monitoring and evaluation |
| **MDGs** | Millennium development goals |
| **MDR** | Maternal death review |
| **MDSR** | Maternal Death Surveillance and Response Systems |
| **MICS** | UNICEF Multiple Indicator Cluster Survey |
| **MMR** | Maternal mortality ratio |
| **MMS** | Multimedia messaging service |
| **MNCH** | Maternal, neonatal, and child health |
| **MoH** | Ministry of Health |
| **NGN** | Next generation network |
| **NGOs** | Non-governmental organization |
| **NHAPT** | WHO National Health Accounts Production Tool |
| **NORAD** | Norwegian Agency for Development Cooperation |
| **NPI** | National Provider Identifier |
| **OECD** | Organization for Economic Co-Operation and Development |
| **PRS** | Poverty reduction strategy |
| **RIM** | Reference information models |
| **RLS** | Record locator service |
| **RMNCH** | Reproductive, maternal, neonatal, and child health |
| **SaaS** | Software as a Service |
| **SAP** | Structure adjustment programs |
| **SIM** | Subscriber Identity Module |
| **SMS** | Short messaging service |
| **SOA** | Service oriented architecture |
| **SSOs** | Standards Setting Organizations |
| **SWAp** | Sector-wide approaches |
| **UCUM** | Unified Code for Units of Measure |
| **UN** | United Nations |
| **UNICEF** | United Nations Children's Fund |
| **USAID** | United States Agency for International Development |
| **VA** | Verbal autopsy |
| **VSAT** | Very Small Aperture Terminal |
| **WHO** | World Health Organization |
| **WPRO** | WHO Western Pacific Region Office |

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