

e-HEALTH

IN LATIN AMERICA AND THE CARIBBEAN:

Progress and challenges

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(editors)



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Introduction



This publication, “e-Health in Latin America and the Caribbean: progress and challenges” was prepared in the framework of the programme “@LIS2 –Alliance for the Information Society 2– Inclusive political dialogue and exchange of experiences”.

The purpose of @LIS2 is to encourage political and regulatory dialogue between Latin America and Europe in order to facilitate the formulation of regional, subregional and national strategies aimed at the development of the information society in Latin America, drawing inspiration from the eEurope experience. One of its specific objectives is to contribute to the formulation, implementation and monitoring of the Regional Action Plan for the Information Society in Latin America and the Caribbean (eLAC), by engaging different sectors in a regional cooperation framework.

Following the first and second phases of the World Summit on the Information Society (Geneva, 2003 and Tunis, 2005), the countries established a political consensus and a common strategic vision at the Rio de Janeiro Regional Conference (2005), redefining the goals of the Global Plan agreed to in Tunis to reflect the specific needs of the region. This gave rise to the first Regional Action Plan for the Information Society in Latin America and the Caribbean (eLAC 2007), which was signed by 33 countries.

The eLAC 2010 Regional Action Plan was signed at the Second Ministerial Conference on the Information Society, held in San Salvador in 2008, as the second step in the eLAC process leading up to 2015. This renewed plan reflects an important change of direction, moving away from corporate-centred ICTs towards integrated human and social development: development that uses ICTs to promote growth with equity.

Indeed, it is essential to consider the potential contribution of ICTs to social and economic development, knowledge generation and integration among countries. ICTs can help to reduce inequality and overcome poverty, as well as to guarantee economic, social and cultural rights (ESCRs). They are tools that can be used to bridge gaps and provide citizens with opportunities, such as broader access to quality health care.

Although there has been a boom in public and private initiatives in the region over the past decade, most have been small-scale projects that were not incorporated into national public health and ICT strategies. However, some progress has been made and is taking shape in the form of national or subnational plans that typically focus on modernizing management of health-care services and procedures, providing distance learning to enhance the skills of health-care teams, and expanding the use of telemedicine.

The Latin American and Caribbean region now faces the challenge of incorporating ICTs to maximize their potential for enhancing the quality of health care for their populations. This requires State leadership and commitment, particularly at the sectoral level, as well as public-private collaboration that brings together specialized professional teams to integrate medical, public-health and ICT knowledge. Also needed in this process is citizen engagement and participation in health-care issues.

Frequent use of ICTs for health-care applications entails new forms of organization, learning and information, as well as new social relationships, with improved health serving as a stepping stone for strengthening democracy and social oversight in the region. Moreover, ICTs have a positive contribution to make to the health-care economy (ECLAC, 2010a). For example, as the demographic make-up of Latin America and the Caribbean shifts towards a larger elderly population, the ability of ICTs to provide more effective treatment and increased well-being for the chronically ill and their families takes on increased importance.

The use of ICTs in health care is part of a cultural evolution occurring in the region. These technologies transform people's spatial and temporal reference points (ECLAC, 2010a) and reduce physical and cultural distances, while bridging the most extreme gaps in health-care vulnerability —among rural and indigenous populations and in isolated areas with limited access to goods and services.

To address the health-care challenges faced by the region, including that of incorporating the use of ICTs, the eLAC 2010 plan provided for the creation of a Health-care Working Group (HWG), coordinated by Nancy Gertrudis (Mexico) and charged with encouraging the implementation of national strategies, taking advantage of lessons learned from experiences to date.

This book is an outgrowth of the workshop “Regional e-Health and Telemedicine Goals and Policy Follow-up”, hosted in part by ECLAC¹ and held in Santiago, Chile on 30 November and 1 December 2009. The workshop served as the first meeting of this multi-stakeholder group, which included specialists from Argentina, the Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, Peru and Uruguay. Participants discussed progress and challenges relating to the development of e-Health and telemedicine in their countries. There was also discussion of the current situations in some Caribbean countries —Trinidad and Tobago, the Dominican Republic, Grenada, Belize, the British Virgin Islands, Saint Lucia, Jamaica and the Cayman Islands. In keeping with the aim of @LIS2 to promote dialogue between Europe and Latin America, a description of progress in Spain is also included.

The book is divided into 15 chapters. The first chapter, “Potentials of e-Health in the social and epidemiological context of Latin America and the Caribbean”, describes population trends that underscore the need to incorporate ICTs more decisively into health care in the region. This chapter describes, from a development perspective, the promise that e-Health holds for meeting health-care challenges through expanding access to quality health care.

The impending challenges for the public policies on ICTs in health care stem from major inequalities which create access barriers to timely and quality health care for much of the population in Latin America and the Caribbean. These barriers are related to both the characteristics of the health system in each country and factors specific to patients and their families. The chapter discusses inequalities through the lens of health-care indicators relating both to individuals and families and to characteristics of the different health-care systems.

The second to thirteenth chapters examine the progress and challenges in the area of e-Health and telemedicine in 12 Latin American countries and 8 countries from the Caribbean subregion.

These countries have a wide range of projects, either completed or in progress, relating to the promotion of health care for remote areas, the connection of primary health centres with specialists in more complex units, epidemiological surveillance systems, training personnel in remote areas and management improvement, among others. These projects show the wealth of initiatives throughout the region, which seems to point towards the consolidation of e-Health in the coming years.

¹ Through the e-health component of the @LIS2 programme.

The fourteenth chapter, “The e-Health experience in Spain: lessons for Latin America and the Caribbean”, discusses the status of e-Health and telemedicine in Spain, as well as the country’s involvement in other European cooperation projects. The status of the Spanish National Health System is also described with particular reference to its autonomous communities. The current situation in Spain is considered in the broader context of European Union cooperation on health care, particularly the European Patient Smart Open Services² (EPSOS) project.

The concluding chapter of the book presents thoughts and proposals that the authors hope will be useful in preparing the new Regional Action Plan for the Information Society, eLAC 2015, as well as for authorities and professionals from the health-care sector working daily to provide healthier lives for their countries’ populations. It is the authors’ further hope that the present work will contribute to the forging of agreements in political forums engaged in regional convergence efforts, as well as to other multilateral and cooperation-related spheres.

THE EDITORS

² Smart open services for European patients.

I.

Potentials of e-Health in the social and epidemiological context of Latin America and the Caribbean



The challenges facing the health-care sector in Latin America and the Caribbean are such that e-Health should have great potential in the region. In principle, in many cases, e-Health appears to offer the most equitable, effective and efficient way to improve access, provide timely care and early warnings, achieve cost savings and ensure more effective diagnosis and treatment.

The challenges arise chiefly from inequalities in access to and quality of health care, demographic and epidemiological changes in the population (COM, 2006), the pressure exerted on health-care systems by shortages of resources (professionals, infrastructure, supplies, etc.), and public expenditure sustainability issues (COM, 2001; Álvarez, 2002).

There are at least three avenues by which to approach the matter of access: usage, health insurance or social security coverage, and the probability of receiving effective and appropriate health care when needed (Savedoff, 2009). The first two approaches are limited insofar as they do not consider the population's real ability to access health services. The third approach is known as "effective coverage" (Shengelia and others, 2005). It considers the availability of resources and is defined as a probability, applicable to both populations that make continuous use of health-care services and those that do not. Thus, the third perspective is defined as the fraction of potential health improvement that the health system could contribute with the services that it presently offers (Lozano and others, 2007).

Based on this, four factors are identified that condition access to health services. First, the availability of resources: properly trained health professionals, facilities, equipment and medicine must be available for the treatment of illnesses. A second factor is locating these resources close to the population requiring them. Third, access may be limited by the cost of health care for patients and their families. Fourth, the way health-care services are delivered may not mesh with the beliefs or social rules of the population, which may inhibit demand for cultural reasons.

ICTs can be very useful in improving the state of play with regard to these four conditioning factors. For example, telemedicine, understood as “the provision of health-care services by means of ICTs in situations where the health professional and patient (or two health-care professionals) are located in different places” (COM, 2008: 4), is a tool with undeniable value for increasing access to health care, especially in the case of the first two aforementioned factors.

ICTs increase the availability of medical resources by optimizing health-care processes and bringing the knowledge of scarce specialists closer to distant localities through teleconsultation (remote access), in both real time and deferred time. It is therefore possible to reduce the need to move patients, while at the same time receiving timely care and cutting costs for families and the health system. In practice, this is applicable to all medical specialties: teleradiology, telecardiology, telepathology and others.

Likewise, several studies (COM, 2004; Álvarez, 2002) consider the capacity of ICTs to create citizen-centred health systems that respect these citizens’ cultural and linguistic traditions. Among other benefits, these technologies can contribute towards reducing the number of medical appointments, tests and referrals, which may be a stumbling block for patients who do not speak a country’s official language (Álvarez, 2002).

One of the most interesting applications is the electronic medical record (EMR), understood as a set of documents containing data, assessments and information of any kind related to the situation and clinical evolution of a patient throughout the health-care process (Carnicero, 2003). The EMR is linked to the efficacy dimension in at least three aspects. First, it contributes to diagnosis and treatment considering the patient’s full clinical background. Second, it enables the generation of medical warnings based on complementary work with remote monitoring and the prescription of medication that does not have any undesirable side effects on patients (Wootton and others, 2009). Lastly, it increases epidemiological surveillance possibilities as it generates a database that is updated on an ongoing basis.

The advantages of EMRs over conventional medical records include simultaneous and remote access, record security and confidentiality and data processing. EMRs help to improve a number of areas: order and standardization of documents; accessibility of information, by making it legible, inalterable and available; and guarantee of confidentiality and ease of separating clinical data from patients' personal data, thus enabling information and knowledge management without invading people's privacy (Carnicero, 2003 and 2004).

In addition, within a context of greater population ageing and the subsequent increase in the prevalence of chronic illnesses, remote monitoring may be a more effective control of such ailments than traditional health services. Thus, it is possible to detect symptoms and abnormal health parameters before a routine or emergency medical appointment, facilitating the adoption of corrective measures before more severe complications arise (COM, 2008).

The use of ICTs in education facilitates the training of health professionals. This is especially important when these professionals are working in isolated areas and also improves the exchange of knowledge between study centres. In turn, remote continuous updating³ encourages professionals to settle and stay in these places.

As data volumes grow and information and knowledge management become more complex in the area of health, it is essential to expand capabilities to store, aggregate and analyse data and integrate administrative, clinical and health information, not only to increase efficiency, as noted above, but also to support decision making in any health organization.

One noteworthy feature is the potential of ICTs to create common health spaces that favour citizen mobility, enabling these citizens to make use of health services and systems regardless of their place of origin. The adoption of interoperability standards is vital for this potential.

Applications such as the EMR and the individual health card are paradigmatic cases that create a common health space. This greatly facilitates the integration of several health-care centres at national and international level. The EMR needs to share patients' health-related information in a simple and safe manner, ensuring that the original meaning of the information is not altered (Carnicero, 2003).

A greater understanding of the health characteristics and transformations of a population can be achieved through the use of increasingly complex

³ An interesting initiative is the Pan American Health Organization Virtual Campus for Public Health.

databases enriched with the data entered by EMR and remote monitoring devices. Among other potentialities, this provides new epidemiological surveillance possibilities as it strengthens capabilities for the description, modelling, analysis and monitoring of trends in health status (Wooton and others, 2009).

Reforms and other structural determining factors

The 1980s were a decade of deep-reaching health system reforms in Latin American countries. These reforms reflected the need for State modernization and health system transformations aimed at “increasing effectiveness, guaranteeing financial sustainability, promoting decentralization and assigning a more important role to the private sector” (PAHO, 2007).

Reform in Latin America changed focus by the late 1990s and beginning of the 2000s. There was a major tendency towards recovering the State’s role as system provider and regulator despite greater decentralization of service management and the promotion of private sector participation. In general, attempts were made to integrate public and private health subsectors at different territorial levels (Arriagada, Aranda and Miranda, 2005).

■ Table 1 ■
Reforms and decentralization in Latin America

Transformations	Transformation period		
	1980-1989	1990-1999	2000 to date
Start of reform	Chile (1987) Mexico (1987) Uruguay (1987) Venezuela (Bolivarian Republic of) (1987) Brazil (1988)	Argentina (1993) Costa Rica (1994) Colombia (1991) Panama (1994)	Ecuador (2008)
Constitutional reform	Chile (1980 Constitution) Brazil (1988)	Colombia (1999) Ecuador (1998) Venezuela (Bolivarian Republic of) (1999)	Ecuador (2008)
Decentralization process	Chile (seventies until 1988) Mexico (1984- 1988)	Argentina (1998) Brazil (1993- 1996) Colombia (1990-1993) Costa Rica (1997-1998) Mexico (1994- 2000) Panama (1998-1999) Venezuela (Bolivarian Republic of) (1990-1999)	Brazil (2000-2001) Ecuador (2001-2002) Uruguay (2001 -2002) Venezuela (Bolivarian Republic of) (2000)

Source: Prepared by the authors on the basis of Mesa-Lago (2005) and PAHO Health Systems Profiles.

Within this framework of health reforms and with the incentive of progress made in electronic government policies, information and communication technologies (ICTs) have been gradually incorporated into health systems in the region.

However, reforms that ultimately seek to improve access to health care for the population must overcome significant inequalities in health care which are the result of multiple factors, including the economic capacity of States and their public policies, human resource allocation and sanitation conditions.

Public expenditure on health is an indicator for the first of these factors, since it expresses economic capacity, political will and social consensus reached throughout the institutional history of each country. As illustrated in the following table, public expenditure on health in the region varies between 1% and 11% of GDP with an average of approximately 3.5%. Despite substantial growth over the past 18 years, this is still far below the European average which is over 6%.

■ **Table 2** ■
**Latin America and the Caribbean (selected countries):
public expenditure on health**

Country	Institutional coverage	1990		Circa 2007	
		As % of GDP	Per inhabitant in 2000 dollars	As % of GDP	Per inhabitant in 2000 dollars
Argentina	GN, GP and local governments	4.33	252	5.07	474
Bolivia (Plurinational State of)	Non-financial public sector	3.19	35
Brazil	Federal, State and Municipal	3.59	121	4.94	220
Chile	Central government	1.76	54	3.35	209
Colombia	Central government	0.93	20	1.94	58
Costa Rica	Total public sector	4.96	155	5.82	302
Cuba	Central government	4.58	152	11.82	515
Ecuador	Central government	1.45	19	1.26	21
El Salvador	General government	1.12 *	20	3.44	90
Guatemala	Central government	1.04	13	1.18	20
Honduras	Central government	3.07	33	3.44	47
Jamaica	Central government	2.14	75	2.42	87
Mexico	Central government budget item	2.77	150	2.80	198
Nicaragua	Central government budget item	3.07	21	3.71	33
Panama	Non-financial public sector	5.27	155	5.69	240
Paraguay	Central government budget item	0.22	3	1.50	23
Peru	1990: Central government budget item. 2007: General government	0.89	15	1.17	34
Dominican Republic	Central government	0.88	16	1.57	56
Trinidad and Tobago	Central government	2.49	108	3.41	376
Uruguay	Central government consolidated	2.83	141	4.46	364
Venezuela (Bolivarian Republic of)	Central government budget item – agreed	1.52	74	1.79	96

Source: Economic Commission for Latin America and the Caribbean (ECLAC), based on information extracted from the social expenditure database, 2009.

* For El Salvador, 1993.

In this context, it has been stated that one of the greatest challenges facing the region is to combine the contribution-based (linked to the formal labour market) and the non-contribution-based regimes in order to reduce the exclusion mechanisms that affect large population groups (ECLAC, 2007). In addition, as described below, there are growing demands on the sector resulting from the progressive ageing of the population, which will take place to a greater or lesser extent in accordance with each country's stage of transition.

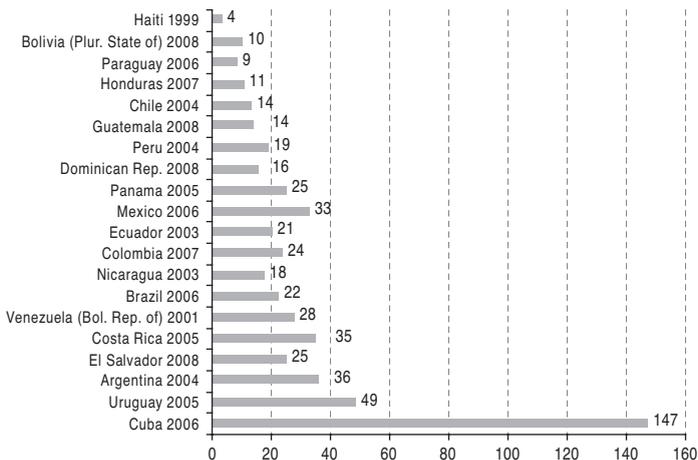
Indeed, people's greatest expenditure on health occurs during the final decade of their lives. For this reason, health systems allocate a significant part of their resources to the provision of curative and palliative services. Within this scenario, countries in Latin America and the Caribbean are expected to increase their expenditure on health between 3% and 9% of GDP by 2040 (ECLAC, 2010b).

In addition, countries' ability to provide proper health care for their population also depends on their skilled human resources. The recommended density⁴ for covering a minimum level of mother-and-child health care is 25 medical staff per 10,000 inhabitants. Half of the countries in Latin America and the Caribbean fail to meet this criterion (WHO, 2006).

■ Figure 1 ■

**Latin America and the Caribbean (selected countries):
density of human resources in health**

(Number of doctors and professional nurses per 10,000 inhabitants)



Source: PAHO, Table generating system, 2009.

⁴ The density of human resources in health is an index created based on two indicators available for all countries: doctors and nurses per 10,000 inhabitants.

Problems of access to health associated with the aforementioned low density are exacerbated by two structural elements. First, an important part of these resources are used by the private sector in the provision of care for wealthier sectors. Second, these resources tend to concentrate on the largest cities.

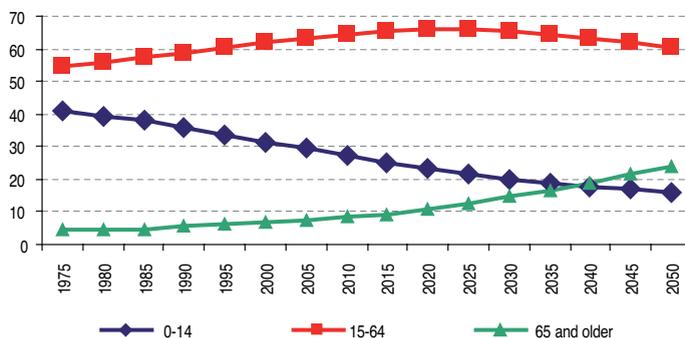
Information and communication technologies have an important role to play, both in reducing health-care costs and in organizational innovation to optimize the allocation and distribution of human resources.

Demographic and epidemiological trends

Latin American and Caribbean countries are experiencing different demographic transition stages, and thus different challenges. The concept of demographic transition is defined as an evolving process characterized by an important and normally non-synchronized drop in birth and mortality rates that determines the growth of human populations (ECLAC, 2006). Subsequent methodological reviews (ECLAC, 2008) specify classification criteria using the following indicators: Total Fertility Rate (TFR), Life Expectancy (LE) and Natural Growth Rate (NGR).

Population ageing is one of the most important expressions of demographic transition. Figure 2 shows how the three groups have evolved and will continue to do so, highlighting that by 2040 the percentage of children under the age of 15 will be the same as the over-65 age group.

■ **Figure 2** ■
Latin America and the Caribbean:
population distribution by major age groups, 1975-2050
(Percentages)



Source: Prepared by the authors on the basis of data from CEPALSTAT, 2008.

The ageing trend is expressed differently in Latin American and Caribbean countries and defines new scenarios for health-care demand structure. It is interesting to note that the number of children under the age of 15 will drop by one third over the next thirty years, while the number of persons over the age of 65 will increase more than threefold.

The epidemiological transition is closely related to the demographic transition. The former is primarily an expression of changes in morbidity and mortality by causes, as well as distribution of age at death. This process is characterized by a percentage drop in deaths from communicable disease and during the perinatal period, giving rise to the relative prevalence of deaths due to chronic and degenerative illness, as well as those due to external causes. This is influenced by the more significant drop in mortality resulting from the first group of causes, which primarily affect children, and changing population age structures that lead to an increase in the number of deaths among the elderly (Chackiel, 2004).

Despite empirical problems⁵ and aspects arguable in theoretical terms, the epidemiological transition theory is still used as a conceptual scheme for the identification of changes in mortality patterns per cause (ECLAC, 2010b).

Latin America and the Caribbean are peculiar. The region's health profile shows the following traits: (i) overlapping stages (high incidence of communicable and non-communicable diseases), (ii) counter-transition (breakdown of the unidirectional transitional principle), (iii) long-winded transition (epidemiological stagnation), and (iv) epidemiological polarization (heterogeneity between social groups and geographic areas in each country). The region currently faces the typical dynamics of a "modern" context, coexisting with an important number of elements characteristic of "old" models (ECLAC, 2010b).

Given the present relationship between age structure, morbidity, and especially mortality, the concept of demographic transition is essential when it comes to understanding epidemiological changes. The greater representation of older persons leads to an increase in the population at risk of dying from chronic diseases. Countries with greater relative weight of the 0 to 14 year-old age group show high mortality rates due to communicable diseases.

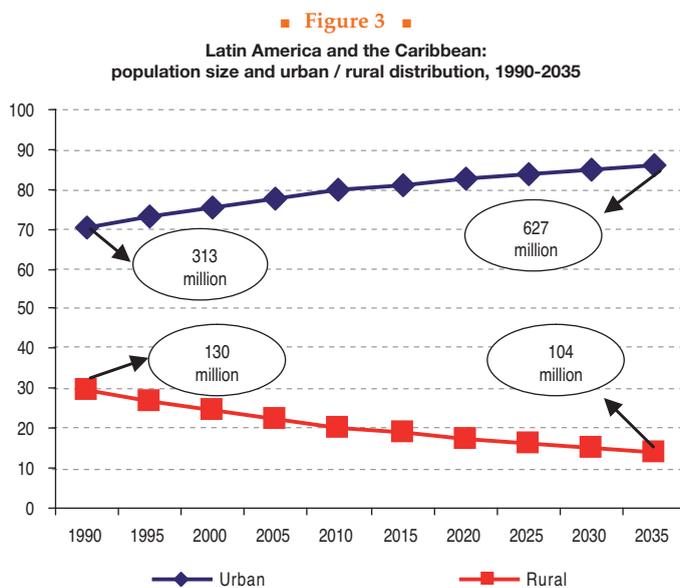
⁵ An unexpected drop in mortality levels due to some degenerative illnesses together with an increase in morbidity and mortality of certain infectious diseases and the reappearance of others, such as tuberculosis.

Trends in the spatial distribution of the population

To design public health policies and their complementary ICT strategies, geographically determined access barriers to health and their impact upon inequalities suffered by the most vulnerable sectors must be taken into consideration.

Latin America and the Caribbean is a highly urbanized region, with almost 80% of the population residing in cities. Its urban population has increased almost sevenfold over the past 60 years and presently amounts to over 470 million people. The growth pace has recently slowed, but is still relatively high (1.51% for 2010-2015).

In turn, the rural population has stagnated over the last two decades, amounting to approximately 125 million people (ECLAC, 2004). This figure is still considerable since one in five inhabitants live in rural areas despite the regional trend towards urbanization, as illustrated in the following graph. By 2030, one in six will be rural residents.



Source: World Urbanization Prospects, 2009.

One of the peculiarities of the urbanization process in the region is that city systems are structured around large cities in most countries. In fact, one out of every three persons in the region lives in a city with 1 million or more inhabitants (ECLAC, 2004). In addition, urban systems tend to have a

primate city, since the capital city in most countries is home to more than a quarter of the population and over one third of the urban population, and thus carries a heavy economic, sociocultural and political weight (Cuervo and González, 1997).

It is often stated that the existence of gigantic cities, with outstanding demographic size from a global perspective, is a characteristic of urban systems in the region. At present, there are eight cities with more than 5 million inhabitants, home to 16% of the population, as well as 55 large cities (between 1 million and 5 million inhabitants), where 19% of the Latin American and the Caribbean population live (see table 3).

An important element to be considered is the internal dynamics of the peripheral growth of the metropolis, because this can result in inequalities. In Latin American countries, the main actors in the peripheral expansion of cities are the poor, who gradually expand the urban radius of cities. This socioeconomic biased peripheral expansion implies that metropolitan areas in Latin America accumulate deficiencies, underprivileged populations and prejudices expressed in various dimensions (Rodríguez, 2002).

The increased weight of metropolitan populations over national and urban populations stems from the high net inward migration rates observed in the past. However, since the 1990 census, the net migration rate in all cities dropped significantly, thus increasing the proportion of vegetative growth. Intermediate cities currently evidence important growth patterns, strengthening their relative weight (see table 3). Consequently, fundamental focus must be placed on the effects this phenomenon will have on health-care demand structure.

■ Table 3 ■

Latin America and the Caribbean:
population growth 2010-2025 per size of cities

Size	Indicators	Year		Variation 2010-2025
		2010	2025	
5 million or more	Number of cities	8.0	8.0	
	Population (millions)	92.8	101.9	9.7%
	% total population	16.0	14.8	
1 million to 5 million	Number of cities	55.0	63.0	
	Population (millions)	111.7	140.3	25.6%
	% total population	18.8	20.4	
500,000 to 1 million	Number of cities	58.0	63.0	
	Population (millions)	40.9	47.0	14.9%
	% total population	6.9	6.8	

Source: World Urbanization Prospects, 2010.

The outlook is certainly not identical in all the countries. In countries that experienced earlier urbanization, growth is concentrated in cities of smaller relative size. In contrast, in those with later urbanization, the largest or capital city will continue to evidence substantial growth.

Health inequalities and exclusion

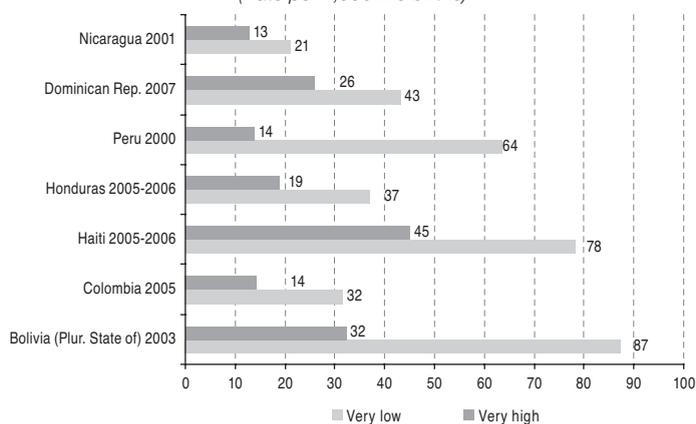
• Child mortality

Although national averages in countries throughout the region show a significant drop in child mortality and in the mortality rate of children under the age of five over the past 20 years, there are still uneven trends that show the effects of gaps in terms of ethnic group, area of residence, mother's educational level and household socioeconomic status. This indicates that major inequalities persist in terms of both access to health services and quality of care.

In households with a lower level of welfare, the child mortality rate can be as much as four times greater than that of higher-income households (see figure 4). The strong correlation between welfare and family income shows how much the economic gap affects access to health care. Furthermore, the quality deficit is evident from the fact that, even in high-welfare households, child mortality far exceeds the average rate for Europe, which is approximately 6.8 deaths per 1,000 live births.

■ Figure 4 ■

**Latin America and the Caribbean (selected countries):
child mortality by level of household welfare**
(Rate per 1,000 live births)



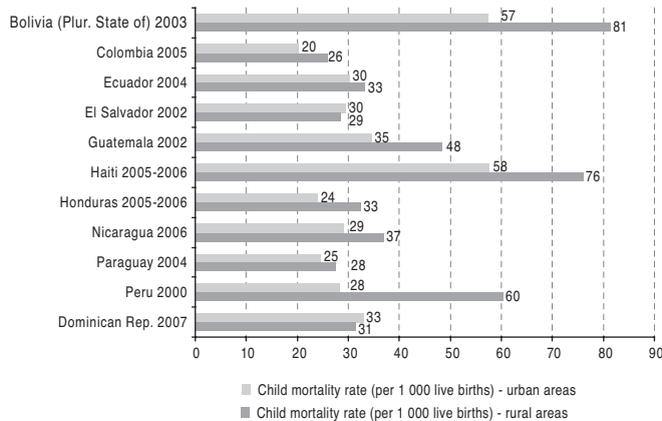
Source: Macro International Inc, 2009. MEASURE DHS STATcompiler.

With regard to the economic gap, attention must be focused on the growth of intermediate cities. In the absence of active land-use planning policies to limit spatial segregation, it is very probable that the pattern of peripheral growth experienced by cities and its aftermath of poverty and deprivation will be replicated in many cases.

Child mortality rates in rural households can double those of urban households, which is evidence of geographical access difficulties (see figure 5). This is due not only to a shortage of health-care resources in rural areas (physicians, infrastructure, facilities, etc.), but also to the fact that rural household incomes are lower. It is well known that cities, especially major cities, concentrate these resources. This often forces rural populations in need of medical centres to travel long distances over inadequate road and public transport infrastructure.

■ Figure 5 ■

**Latin America and the Caribbean (selected countries):
child mortality by area of residence**
(Rate per 1,000 live births)

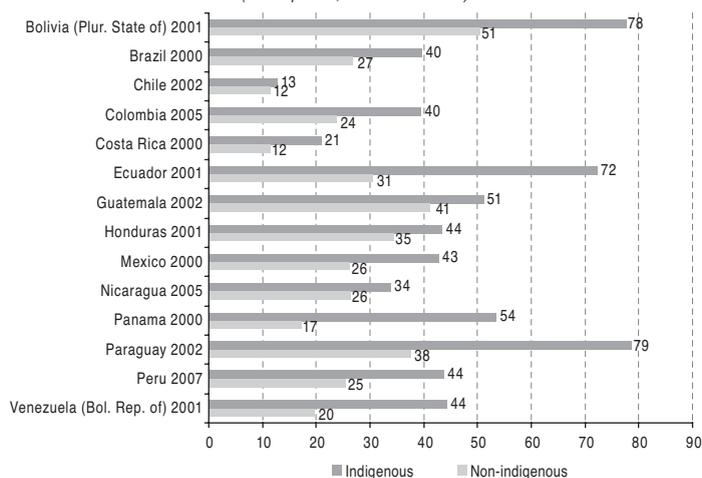


Source: Macro International Inc., 2009. MEASURE DHS STATcompiler.

Ethnic origin is an indicator that shows the effect of cultural barriers on access to health care. The following figure shows that child mortality in indigenous populations is more than double the rate in the non-indigenous population. However, due to the strong correlation between ethnic origin and income, this indicator has elements of the economic gap, as well. It also overlaps with geographical gaps, since much of the indigenous population live in rural areas.

■ Figure 6 ■

**Latin America and the Caribbean (selected countries):
child mortality by ethnic origin**
(Rate per 1,000 live births)



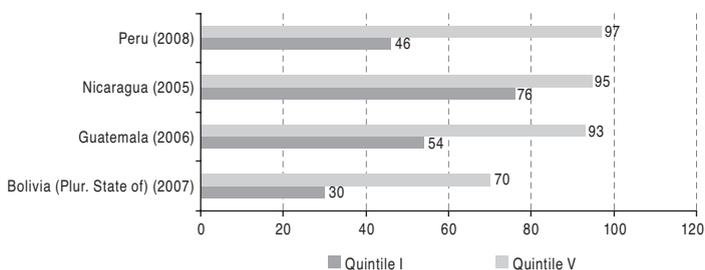
Source: Latin American and Caribbean Demographic Centre (CELADE) – Population Division of ECLAC, special processing of census microdata.

• Access to medical care

Another indicator that illustrates this inequality is the prevailing type of care received. Higher-income households (fifth quintile) have greater access to health care provided by a physician, while lower-income households (first quintile) are generally cared for by paramedics. The following figure shows that a much smaller proportion of the lower-income population has access to medical care than the higher-income population does.

■ Figure 7 ■

Latin America (selected countries): access to general medical care by income level
(Percentage of the population in each group)

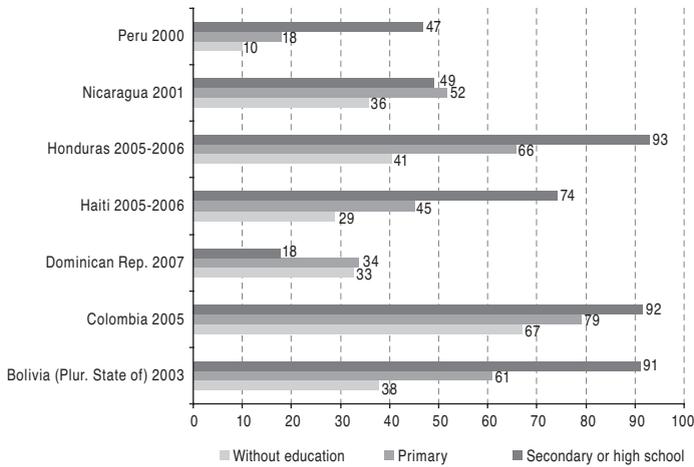


Source: Economic Commission for Latin America and the Caribbean (ECLAC), household survey processing, 2009.

Likewise, the mother’s educational level affects the type of prenatal care received. The following figure shows that the higher the level of education, the greater the probability of having a prenatal care administered by a doctor. As noted earlier, the education variable is also correlated with income and these data consequently reflect the existing socioeconomic gap in terms of access to better quality health care.

■ Figure 8 ■

**Latin America (selected countries):
access to prenatal medical care by mother’s educational level**
(Percentage of the population in each group)



Source: Macro International Inc, 2009. MEASURE DHS STATcompiler.

II.

Background information and e-Health applications in Argentina

*Nora Oliveri*⁶



Argentina had a population of 40.27 million in 2009. The urban population accounts for the largest part of the total population and it is concentrated in the main cities in the country, primarily Buenos Aires which is home to 12 million people.

The child mortality rate in Argentina is 13.3 per 1,000 inhabitants. However, this rate varies throughout the country, since provinces with fewer resources exhibit child mortality rates of between 17 and 20 per 1,000 inhabitants. Average life expectancy at birth is 75 years but this, like child mortality, varies geographically. In the province of Chaco, for example, as well as in other, even poorer provinces in the north of the country, life expectancy is lower than 70 years.

Argentina has an average of 41 hospital beds per 10,000 inhabitants. In addition, the country has approximately 150,000 doctors and 40,000 nurses, which gives a ratio inverse to the ideal scenario of three nurses for every doctor. Careers in nursing are being promoted throughout the country in an attempt to correct this imbalance.

⁶ Nora Oliveri was the president and founding member of the Medical Informatics Foundation and the Argentine Association of Medical Informatics.

■ Table 1 ■

Health systems: doctors per 1,000 inhabitants

Countries	Doctors per 1,000 inhabitants
Chile	1.1
Brazil	1.3
United Kingdom	1.6
Canada	2.3
United States	2.8
France	3.0
Argentina	3.1

Source: Lembo, NA and Califano, JE. Economía y Salud. Ediciones Ciudad Argentina 11/2005.

■ Table 2 ■

Health Infrastructure in Argentina

Number of doctors	~150 000
Number of doctors per 1 000 inhabitants	3.01
Number of nurses	~40 000
Number of nurses per 1 000 inhabitants	1.01
Hospital beds per 1 000 inhabitants	41
Total expenditure on health (% of GDP)	10.20%

Source: PAHO. Health Situation in the Americas. 2009 basic indicators.

In Argentina, health expenditure amounts to 10.2% of the national budget (total health expenditure as a percentage of GDP). Investment in ICT infrastructure is 6.38% of GDP.

Twenty-five per cent of the population has fixed telephone lines, while mobile telephone penetration is much higher, reaching more than one device per person. Ten in every 100 inhabitants have a personal computer and almost 3 in every 100 people use the Internet at home. In the workplace, over 80% of employees have access to the Internet.

■ Table 3 ■

ICT Infrastructure in Argentina

ICT expenditure as % of GDP	6.38%
Fixed telephone lines per 100 inhabitants	24.43
Mobile telephone lines	46 508 800
Mobile telephones per 100 inhabitants	116.61
Personal computers per 100 inhabitants	9.04
Internet users	11 212 200
Internet users per 100 persons	2.8

Source: International Telecommunications Union (ITU) 2009.

Within a global context, Argentina ranks 49 out of 159 on the ICT development index (IDI). The IDI is a composite index made up of 11 indicators. It was constructed to measure the level and evolution over time of ICT developments (relating to access, use and skills). The ITU and SICENTER (2009) time distance analyses show that the digital divide is still important.⁷ The results illustrate that the gap between developed countries and developing countries in terms of ICT indicators is relatively small.

Health care in Argentina is provided by the public sector, social security, *Obras Sociales*⁸ and the private sector, which are financed from State funds and contributions by workers, individuals and companies.

In terms of the composition of the Argentine health system, the public sector accounts for 22% and social security accounts for 11%. In turn, *Obras Sociales*, which are financed from worker and employer contributions, form the largest sector and account for 51% of the total system. Lastly, the private sector represents 16% of the total. Despite this, it is worth noting that many of the people who contribute to the private subsystem also contribute to the compulsory social work system.

■ Table 4 ■
The Health system in Argentina

Areas	Funding	Institutions
Public	State	National Ministry of Health Provincial ministries Ministry of the City of Buenos Aires Public hospitals
Social Security	State	National Institute of Social Services for Retired Persons and Pensioners (PAMI)
Obras Sociales (OS)	Workers and employees	Wage workers with agreement. Main OS: Pension fund for trade employees and civil activities (OSECAC) Wage workers with no agreement. Main OS: Pension fund for the organization of direct corporate services (OSDE)
Private	Individuals and companies	Prepaid medicine companies Insurance companies Community hospitals

Source: Prepared by the authors.

⁷ International Telecommunications Union (ITU) and Socio-economic Indicators Center (SICENTER) based on ITU and UNICEF data.

⁸ *Obras Sociales* covers specific groups of formal workers and are part of Argentina's social security system.

e-Health development in Argentina

The first e-Health initiative in Argentina appeared in 1986, thanks to individual efforts and particularly the first e-mail exchange between Dr. Alberto Barengols, Nuclear Medicine Service Director at Ricardo Gutiérrez Children's Hospital and Dr. Trevor Craddock, responsible for the LARG*net in London, Ontario, Canada.⁹ However, despite growing interest for communication between health centres, there was insufficient support and the government did not approve its implementation.

In 1986, the Pan American Health Organization (PAHO) became involved in the area and supported the development of the National Academic Network between Washington and Argentina. This was followed by the creation of a user-friendly software (PCCORREO), which was installed in all hospitals. In 1989, Argentina followed Canada in the ranking of online health institutions. In just three years, the country had connected more than 2,000 of its institutions.

In 1992, the Medical Informatics Association hosted the First World Congress on Medical Informatics with the number of enrollments exceeding 900 participants. There was already an interest in telemedicine and health informatics and Argentine professionals were very enthusiastic about taking part in this process.

Once communication networks were installed to link the hospitals, they were encouraged to access information and use e-mail (1993), despite the fact that complete Internet services were not yet available. Through PAHO, the United States National Library of Medicine (NLM) and the United States National Cancer Institute (NCI) signed agreements in Washington, which facilitated access to the information for health professionals.

In the case of NLM, the BITNIS Project enabled bibliographical searches by e-mail, using codes that were subsequently shared out among the participating organizations in the Argentine health system by the Medical Informatics Association (Oliveri, 1995).

In 1994, a cooperation agreement was signed between the United States National Cancer Institute and the Medical Informatics Association, continuing with the policy of low-cost access to medical information and the redistribution of ONCONET data in Argentina. This provided free and unrestricted access to NCI databases for both professionals and patients. One noteworthy feature of the project was that all information provided by NCI was translated into Spanish (Oliveri and Rajman, 1997).

⁹ Alberto Barengols. Argentine Health Network. See *Pioneers in Internet*. <http://pioneros.comunica.org/?p=127>.

Commercial Internet was launched in 1996 and consequently both projects were discontinued over the following years. Although the Internet is a more complete resource featuring multiple possibilities, e-mail searches provided a simple, cheap and effective way to access information that is important for medical work.

The number of information access networks continued to grow starting in the year 2000. The year 2005 marked a milestone with the incorporation and certification of Argentina in the SciELO network through its virtual health libraries. In 2006, Argentina started operating regularly as an official SciELO¹⁰ site and as a part of the BIREME¹¹ project.

The National Network of Information on Health Sciences (RENICS)¹² is another up-to-date and relevant network for accessing information in Argentina. It is managed by the National Medicine Academy and has 88 centres that independently generate academic content (for example, magazines) and meet the standards set. RENICS gathers all the information generated and includes it in the National Academic Network.

As previously mentioned, PAHO provided substantial support for Argentina in the task of facilitating access to information for health professionals, in which it was later backed by private initiatives. Special emphasis has been placed on support provided by the pharmaceutical and informatics industries in this field. This joint effort was one of the building blocks for the training process of doctors. Between 1992 and 1997, the Roche laboratory taught over 12,000 doctors throughout the country how to use the Internet and e-mail and conduct bibliographical searches.

Towards the end of the decade and as a result of the boom in the number of Internet sites, medical associations started to develop their own projects, computerize their libraries and publish online magazines and courses.

Another important milestone was the first online Virtual Congress of Cardiology in 1999, which was organized by the Argentine Federation of Cardiology (FAC).¹³ Together with the Medical Informatics Association, FAC

¹⁰ Scientific Electronic Library Online is an e-library that makes up an Ibero-American network of scientific journal collections featuring complete texts, as well as free, open and unregulated access.

¹¹ BIREME is the official acronym for the Regional Library of Medicine, currently the Latin American and Caribbean Center on Health Sciences Information. This is a specialized centre managed by PAHO established in Brazil in 1967 in collaboration with the Ministry of Health, the Ministry of Education, the Health Secretariat of the State of São Paulo and the Federal University of São Paulo.

¹² This has been defined as a set of information units that process material in a decentralized manner. RENICS integrates and coordinates resources and services throughout the country in order to facilitate exhaustive and rational use of biomedical literature for health professionals at local, regional and national levels.

¹³ First Virtual Congress of Cardiology (PCVC) <http://www.fac.org.ar/cvirtual/index.htm>.

held another event the following year using the same model: the First Ibero-American Virtual Congress of Medical Informatics, known as Informedica 2000 (Oliveri and others, 2001).

This new way of disseminating knowledge through virtual media has enabled medical associations to participate in such events, thus affording access to a large number of professionals who could not have attended in person (Ortego and others, 2008). In the case of the cardiology congresses in particular, the number of professionals and countries participating increased at each event, starting with 7,574 participants from 75 countries at the first meeting and reaching 27,996 participants from 139 countries at the sixth event in 2009.

e-Health in Argentina

Telemedicine¹⁴

Given that Argentina is a vast country and medical staff is concentrated in its major cities, there are numerous telemedicine initiatives in the country. In addition, high complexity health centres can offer very limited assistance to doctors in provinces, particularly due to costs. Numerous telemedicine initiatives have been implemented in Argentina, for example, at the Garrahan Hospital¹⁵ and the Instituto Zaldívar ophthalmic centre.¹⁶

The Garrahan Hospital remote diagnosis telemedicine programme is a pilot project consisting of three phases:

- The first phase was carried out within the hospital to test technology and train doctors.
- The second phase involved connecting Garrahan Hospital and Castro Rendón Hospital, which is located in Neuquén, a province in the Argentine Patagonia.
- The third phase provided coverage to the main medical centres participating in the communication at a distance programme.

¹⁴ According to Bioethical Document No. 271 of 6 October 2007, the Ministry of Health of the Nation states that telemedicine is the exercise of long-distance medicine. Interventions, diagnosis, treatment decisions and recommendations are based on data, documents and other information transmitted by means of telecommunication systems. Telemedicine, telehealth and long-distance medicine are different names for the same activity.

¹⁵ Garrahan Hospital is a high complexity hospital that treats children from all over the country.

¹⁶ The Zaldívar Institute is an ophthalmic ambulatory surgical centre located in the Argentine province of Mendoza.

At present, the Garrahan Hospital programme is in the third phase of the project. The institution has provided consultation services via e-mail for 12 years. It is currently implementing a communication at distance programme to support geographically remote health centres by means of high complexity consultations.

There are two principal aims of creating and implementing this programme. First, to provide patients anywhere in the country with access to excellent primary health care and the possibility of having consultations and referrals to higher complexity centres. The second aim is to guarantee access to medical care at the place of residency, in order to continue carrying out control and follow-ups and to provide specialized care for pathologies that require immediate short-term treatment.

The Instituto Zaldívar teleophthalmology service is a private initiative and an example of another successful project. It provides teleconsultations, videoconferences, instant access to electronic health records and it also has a remote platform. The consultations are carried out in real-time and store-and-forward mode.¹⁷

Ophthalmic centres have been pioneers in implementing telemedicine. The first successful project recorded was the computerization of all electronic health records at the Dr. Nano Clinics in the municipality of San Miguel, in the Argentine province of Buenos Aires. The three clinics are currently linked by satellite antennae.¹⁸

Distance medical education

At present, there are several projects in the area of distance medical education in Argentina, but the real availability of programmes is rather limited. The range of courses throughout the country is varied and on the rise.

One example of these initiatives is the wide selection of online postgraduate courses offered at the Virtual Medicine Faculty (FMV) at the University of Buenos Aires. Other institutions that also provide online distance education for health professionals are the Isalud University Institute, the Hospital Austral, the Hospital Italiano, the Hospital Francés and the Hospital Alemán, the University of Morón, the University of Córdoba, the University of Barceló, the University of Maimónides, the Interamerican Open University, the National University of General San Martín and the University of Rosario.

¹⁷ Ricur, G. Videoconference in Informedica 2004.

¹⁸ Nano, H. Presentation at the First International Congress on Medical Informatics held in Buenos Aires, Argentina in 1992.

However, online education is not only offered by universities. Professional and civic organizations offer a wide selection of continuing medical education courses. One example is EduVirAma, an online education programme founded by the Argentine Medical Association (AMA). These courses are also offered as part of other distance activities within the programme on virtual conferences, like for example, the course on Epi-Info and Linux within the framework of the Virtual Congress of Medical Informatics (Informedica) and the courses on biostatistics, research methodology and cardiovascular prevention offered by the Virtual Campus of the 6th Virtual Congress of Cardiology (Pacher and others, 2008). Another successful example of online medical education was the International Atrial Fibrillation Symposium, which had over 15,000 participants and was conducted entirely online.¹⁹

Likewise, the Hospital Italiano offers residencies for professionals on medical informatics and the Vélez Sarsfield and Manuel Roca hospitals both hold residencies in biomedical informatics. Since early 2009, the National Commission for University Training and Accreditation (CONEAU) in Argentina is evaluating a draft proposal for a Masters in Telemedicine, which once approved, will be offered as an online programme by the National University of Entre Ríos. In parallel, the University of Salvador has been offering a postgraduate course on medical informatics for over 10 years. Lastly, the Faculty of Exact, Physical and Natural Sciences of the National University of Córdoba includes a medical informatics course as part of its bioengineering curriculum. The University of Barceló offers the Medical Informatics Technician course.

Electronic health records

Even though all the organizations have some degree of computerization, the implementation of electronic health records in Argentina, as in the rest of the world, is slower than expected due to the number of challenges that have to be overcome, for example:

- Lack of legislation
- Lack of standards on use, storage, processing and exchange of electronic health information
- Structural and technical barriers
- Financial barriers
- Sociocultural barriers

¹⁹ Virtual Atrial Fibrillation Symposium. Available at <http://www.af-symposium.org>.

At present, there is no clear legislation on the implementation of projects or any definition of ad hoc standards indicating what contents should be included in an electronic health record. There are also structural and technical barriers, as well as budgetary issues (definition of the destinations for the financing item). Finally, Argentina faces sociocultural barriers. Hospital staff must be informed of the scope of this process, since a misconception remains that the computerization of health records will eliminate many administrative positions. This is a very negative idea and one that is hard to change. In other words, setting up electronic health records requires a lot of prior fieldwork, which includes overcoming sociocultural barriers, among others.

A good example of the successful implementation of electronic health records in Argentina is that of the Ministry of Health of the City of Buenos Aires. This portfolio has several very interesting features in that it connects 43 hospitals to the network and they all depend entirely on the ministry. In addition, they are located in the province which has the best funding and resources. Some of the factors facilitating this initiative include highly trained management in the area of public health, a team of specialists in informatics and a strategy to computerize hospitals. In addition, this initiative has electronic health records for primary care, as well as a referencing and counter-referencing system.

Lastly, most health institutions have some level of computerization of health records. However, these records are not yet completely integrated and in most cases there is no interoperability between the different services and institutions. One of the main challenges faced is to achieve standardization and interoperability.

Health portals

In Argentina, almost all Ministries of Health have an Internet portal, although development varies from ministry to ministry. Not all of them provide the same quantity or quality of information. Many focus on providing institutional information and supporting health promotion and prevention campaigns. For example, the Ministry of Health of the Province of Buenos Aires even has educational videos for patients on different diseases such as dengue and malaria.

Electronic health goals

Some of the future guidelines and challenges for electronic health in Argentina are to:

- Ensure that all health system stakeholders are interconnected.
- Have an emergency system that incorporates all information and processes data from the hospital's central system.
- Further technologies for optimizing computers by means of touch screens, light pen or voice recognition.
- Develop software and hardware for automatic invoicing and administrative procedures.
- Give professionals remote access to information registered online should they require it.
- Automatically evaluate all information on treatments and medication administered in order to avoid adverse reactions and side effects.
- Improve communications infrastructure linked to the reduction of service costs enabling development and implementation of health-care networks.
- Improve access to information so that medical services focus, in particular, on prevention.
- Train professionals in the use of ICT.
- Develop epidemiological surveillance and disease monitoring systems enabling close monitoring of the entire population.
- Implement applications for mobile devices in order to provide better monitoring and follow-up for patients with chronic diseases such as diabetes or hypertension, as well as elderly patients.

Background information on Argentina Social Development Division, ECLAC, United Nations

Argentina is a country with a high percentage of urban development, which is above the regional average. A large percentage of its population is concentrated in the country's capital city, Buenos Aires, although medium-sized cities such as Córdoba and Mendoza are becoming increasingly important.

At present, Argentina is highly advanced in demographic terms. This is indicated by the country's growth rate of less than one, its total fertility rate and progressive ageing of the population observed in the past five-year periods. Argentina's total dependency ratio²⁰ was 57.4 in 2005 (CELADE, 2006).

As regards its epidemiological profile, chronic illnesses, especially those related to the circulatory system, stand out among the main causes of mortality, as well as some kinds of transmissible diseases (respiratory diseases).

The most recent Millennium Development Goals Report (United Nations, 2010) indicates that 5.8% of the population in urban areas was living in extreme poverty in 2008. Compared to the figure reported in 1990, this indicates that the country's progress in terms of overcoming extreme poverty and hunger was 58.5%. However, the country report of 2009 indicates that the goal of reducing poverty by at least 20% was reached in the second half of 2008. Over the same period, people living in extreme poverty represented 4.4% of the total population.

The increase in poverty and extreme poverty at the start of the millennium is associated with lags in some health-related Millennium Development Goals. For example, although the under-five mortality rate went from 30.1 per 1,000 live births in 1990 down to 14.9 in 2009 (United Nations, 2010), giving a percentage of progress of 75.6%, there are still pending actions relating to meeting these goals.

Maternal health has improved in terms of the rate of births assisted by qualified health personnel and so it is near to achieving its target. However, Argentina is behind in reducing the maternal mortality rate. According to the target, this indicator evidences negative progress, since the ratio of 35 deaths for every 100,000 live births recorded in 2000 increased to 43.7 deaths in 2007 (United Nations, 2010). Data recorded in 2007 indicates that the main cause of maternal mortality is miscarriage, accounting for 24% of all deaths reported that year (CNCPS, 2009).

Sources:

CELADE, 2006.

CEPALSTAT, 2010.

National Council for the Coordination of Social Policy, Presidency of the Nation (2009). Republic of Argentina. Millennium Development Goals. Country Report 2009.

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

²⁰ The dependency ratio expresses the number of inactive persons who are financially dependent on active persons. Total dependency is calculated by adding the population aged under 15 and over 64 and dividing the result by the population between the ages of 15 and 64, multiplied by 100 (CELADE, 2006).

III.

Telehealth initiatives in Brazil

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J.L. Ribeiro Filho, N. Simões²¹*



The Brazilian telehealth initiative enables videoconferencing, diagnosis and formative second opinions, as well as continuous education, by linking family health teams and specialists based at universities. There are two major telemedicine projects in Brazil: the Telemedicine University Network (RUTE)²² and the National Telehealth Primary Care Programme (Telesalud de Brasil)²³ implemented by the Ministry of Science and Technology and the Ministry of Health respectively. Municipal, state-owned, national and international health institutions coordinate collaborative research, innovation, development, management, education and medical care projects.

The Telemedicine University Network

The Telemedicine University Network (RUTE) was created in 2006 by the Ministry of Science and Technology in Brazil and received support from FINEP (Studies and Projects Funding Body) and ABRAHUE (Brazilian

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²² www.rute.rnp.br.

²³ www.telessaudebrasil.org.br.

Association of University Hospitals). It was coordinated by the National Teaching and Research Network (Rede Nacional de Ensino e Pesquisa, RNP). The Telemedicine University Network connects teaching hospitals through the National Teaching and Research Network.

The main objective of RUTE is to expand and consolidate existing telemedicine networks in the country by providing connectivity, informatics and communications teams. Thus, university and teaching hospitals in different regions of the country that are developing telemedicine projects are able to communicate, and national and international research groups can collaborate through RNP, which is based on the use of advanced applications (Dos Santos and others, 2009). Other objectives of RUTE are to:

- Connect university and teaching hospitals to the national research and education network backbone utilizing a 1 Gbps City Fast Ring for research and educational institutions.
- Create a telemedicine nucleus in each hospital.
- Set up a videoconferencing room.
- Create initial infrastructure for teleconsultation and telediagnosis.
- Train personnel on web conferencing and videoconferencing.
- Create and encourage participation in special interest groups.

In its first phase, which started in January 2006, RUTE funding was allocated to 19 university hospitals.²⁴ The second phase, which started in January 2007, provided for 38 institutions such as university hospitals from all federal universities in all states, as well as 26 embryonic institutions in accordance with an agreement between RUTE/RNP and the Ministry of Health with the Brazilian National Telehealth Programme. The third phase started in May 2009 and incorporated 75 institutions, including all certified public teaching hospitals, federal health institutions and the Federal Indigenous Health Agency.

Advanced network infrastructure

The Telemedicine University Network implements communications infrastructure at university and teaching hospitals in the 53 largest cities in Brazil, facilitating the establishment of telehealth centres by investing in equipment, connectivity and the preparation of virtual learning environments.

²⁴ RUTE – Telemedicine University Network, Convênio Encomenda-FNDCT Ação Transversal ref. 2738/05, (UFPR, Unifesp, Pazzanese, Unicamp, Ufes, UFBA, Ufal, UFPE, UFPB, UFC, UFMA, Ufam, FioCruz, HC-FMUSP, HU-USP, ISCMPA, Uerj, UFMG, UFSC). January 2006.

The project aims to facilitate use of the National Education and Research Network by all participating hospitals for the execution of telehealth applications. This enables exchange of information via videoconferencing and web conferencing, talks, continuous education, formative second opinions and teleconsultation, thus laying the foundation for collaboration between hospitals and training them in remote cooperation.

The Education and Research Community Network (Redecomep) implemented communication infrastructure in the 27 capital cities of each state in Brazil through points-of-presence (PoPs),²⁵ which will be expanded to another 10 cities in the near future. The project aims to connect all public universities and important research centres in the country with fibre optics managed by a local consortium made up of these institutions and RNP. State and municipal government participation in research and evaluation networks is opening up the possibilities of including public schools and health centres.

These metropolitan networks have already been deployed and are expected to be fully operational in the country's major cities by late 2010. At present, Redecomep is operating in 16 cities connecting a total of 290 institutions through the National Research and Evaluation Network backbone with a current Gigabit connection capacity of 10 points-of-presence (PoPs) (10Gbps for Rio de Janeiro, Sao Paulo, Brasilia and Belo Horizonte and 2.5 Gbps for Porto Alegre, Florianopolis, Curitiba, Fortaleza, Recife and Salvador).²⁶

RUTE operating methodology

Organizational and technological infrastructure must be established prior to installing the operating methodology for the Telemedicine University Network. This involves national coordination, a consulting committee made up of experts from the country's leading teaching and research institutions, special interest groups and teams responsible for communications and for the maintenance and operation of the national and local telemedicine and telehealth network. An advisory committee is also needed to recommend procedures for innovative use of the network.

Each member institution establishes telemedicine and telehealth centres in a specific area, under the responsibility of a particular team. In addition, these institutions must establish special interest groups to promote and conduct collaborative activities on specific telemedicine and telehealth issues.

²⁵ www.redecomep.rnp.br.

²⁶ <http://www.rnp.br/backbone/index.php>.

Finally, they must organize workshops to encourage national integration in terms of education, research and improvement of health services for the population by means of widespread assimilation of collaborative work.²⁷

RUTE Results

At present, 158 health-care institutions are part of RUTE member projects. The network connects 36 telehealth centres at 36 teaching hospitals and 31 fully operational embryonic centres.

RUTE conducts daily web conferences and videoconferences on radiology, oncology and pediatric urology, child and adolescent health, dermatology, cardiology, ophthalmology, etc., at least once a month for each speciality. There are 30 special interest groups operating and by 2010, there will be at least 12 more. In 2009, approximately 250 special interest group sessions were carried out. During the same year, institutional participation in these groups rose by 137% (from 89 to 211 institutions). There have been groups of up to 400 people in remote areas for specific sessions on intensive nursing.

The Mining Telehealth (*Telesalud Minas*) programme, which is financed by the State Governmental Health Department and coordinated by Professor Dr. Beatriz Alkmin, guarantees electrocardiogram (ECG) reports for each of the 600 municipalities. It runs 12 hours, 7 days per week, as part of a joint effort with the following national hospitals: Federal University of Minas Gerais (UFMG), Federal University of Uberlandia (UFU), Federal University of Triangulo Mineiro (UFTM), Federal University of Juiz de Fora (UFJF) and State University of Montes Claros (Unimontes), with over 900 consultations per day.

International collaboration

The sustainable development of this initiative is supported by a number of sources, including the cooperation agreement signed by Internet2 and the National Teaching and Research Network in Health Sciences; the American Academy of Dermatology and the University of Miami's programme for Innovative Continuing Medical Education in Dermatology; the Laboratory of Excellence and Innovation in Telehealth for the Americas and Europe in

²⁷ Brazil's Ministry of Science and Technology, Ministry of Education and Ministry of Health. "Os Hospitais Universitários e a Integração Educação, Saúde e Ciência e Tecnologia" Seminar, 1-2 August 2007, Brasília. Telemedicine and telehealth workshops promoted by the Federal Medicine Council for the regions of Brazil: North, March 2007, Manaus; North-east, May 2007, Recife; Central, July 2007, Brasília, and Congresses hosted by the SBIS, Abrahue and CBTMS in 2006/-7/-8/-9.

Belo Horizonte; the implementation and launch of an International Society of Orthopedic Surgery and Traumatology Science (SICOT) education centre in Rio de Janeiro and finally, the Inter-American Development Bank's Project Public Policies for Telehealth in Latin America, which started in March 2010 with the following countries: Brazil, Colombia, Ecuador, El Salvador, Mexico and Uruguay. RedClara will be responsible for its articulation and dissemination in Latin America.²⁸

The Brazilian National Telehealth Programme

The 1988 Brazilian Constitution states that health is a human right and it is the State's responsibility to guarantee this. The principles of the Unified Health System (SUS) are universal and equal access, comprehensive and unified care, regionalized services networks and public participation.

These principles were implemented in primary health care in 1994 with family health teams made up of one doctor, two registered nurses and four or six community health workers. At present, there are 30,000 family health teams caring for 90 million people (approximately 60% of the Brazilian population).

The Brazilian Telehealth Programme was created in 2007 as a pilot project to provide for nine states through a state university known as Telehealth Centre. The main objective of this project was to create 100 hotspots at basic health units (UBS) in municipalities, as well as technical schools, hospitals and research institutions (called Telehealth Points), allocating telemedicine resources for educational and welfare activities.²⁹

The family health team professional assigned to the basic municipal unit included in the programme can send clinical consultations and the Telehealth Centre in each state is responsible for providing a structured answer based on the best clinical and scientific evidence, as well as suitable references. This structure is known as a formative second opinion, since it does not only refer to answers, but also to decision-making and technical training. Second opinions improve health-care quality and avoid unnecessary referrals, thus primary care goes beyond solving cases and cutting costs.

Every centre has specialists to formulate and send responses to the connection points distributed in the different municipalities. These centres encompass all health specializations and connect the professional and technical

²⁸ ATN/OC-11431-RG, Protocolos Regionais de Política Pública para Telessaúde, 30/10/09, Fundep/UFMG, Inter-American Development Bank.

²⁹ Dos Santos, Alaneir. Op cit. page 33.

staff with the knowledge-generation source, based in universities. A health library focused on primary care was launched to provide access to collections of interest, as well as a Collection of Formative Second Opinions (Wen and Castro Filho, 2010) generated during the programme implementation. Access to this information is free for all health-care staff and technicians and the site is currently being translated into Spanish and English.³⁰

At present, the programme is being expanded and it is hoped that telehealth will be used in the remaining states. Due to high child mortality rates, priority is being granted to the states in the Nordeste and Amazonia Legal divisions in Brazil.

Conclusions

Previous research projects connecting remote care, education and collaborative research, supported by @LIS³¹ results, including RedClara and carried out at universities in Brazil, have encouraged government actions and public investment in communication, telemedicine and telehealth infrastructure.

The principal reasons for the success and continuity of the network are federal coordination and initiative, state initiatives, integration and synchronization of the two projects with the main complementary members: RUTE (Ministry of Science and Technology) and Telehealth Brazil (Ministry of Health).³²

In September 2009, the Brazilian Telehealth Programme reached 8,531 formative second opinions, which were indexed according to the patient cared for and the occupational status (professional, technical or community worker). The average number of requests for a second opinion in the two-year pilot programme amounted to approximately eight applications per point (900 points throughout nine states). The most noteworthy issues are used for the production of educational material for each occupational category, which will be used for distance learning.

A voluntary survey on use of the portal³³ was conducted. It revealed that portal contents were most accessible in the area of specialized health (37.5%), followed by nursing (28%), medicine (24%) and dental health (9.8%). The occupational category that provided the most answers to the survey

³⁰ Brazil Telehealth Programme at www.telessaudebrasil.org.br, accessed in February 2010.

³¹ IV European Union – Latin America and the Caribbean Ministerial Forum on the Information Society, @LIS. An Alliance for Social Cohesion through Digital Inclusion. Rio de Janeiro, 22-23 November 2004, Rio de Janeiro Declaration, VI Forum in Lisbon, 28-29 April 2006, Lisbon Declaration.

³² RUTE Forum, HU-UFRJ, RJ, 10-11/08/2009.

³³ Two hundred answers were received.

was nursing (31.5%), but even health administrators participated (3.5%), characterizing the programme as a tool for health management.

The health specializations that were subject to the largest number of second opinion requests or seasonal nature, epidemic or pandemic issues may need specific educational material and structured courses. In some cases, there were requests that the portal be made available in Spanish and English.

The process of extending the programme throughout the country will provide continuity to the creation of educational material, expanding the Virtual Library and allowing family health teams to provide the aforementioned services.

It can be concluded that the formative second opinion strategy, which was specialized and structured for primary health care, has been effective in meeting the expectations of family health teams' medical and technical staff. Likewise, its potential to cut costs and improve the quality of health care has generated interest among the administrators.³⁴ In addition, international events facilitate the exchange of these initiatives for a more widespread implementation of global standards for structuring collaborative work (Dubler and others, 2009).

³⁴ See Ludwick and others, 2010 and Perschbacher and others, 2010.

Background information on Brazil **Social Development Division, ECLAC, United Nations**

Brazil has a high level of urban development. Three metropolises and 18 major cities are concentrated in Brazil, which increases the regional average in terms of population concentration in this kind of settlements. Likewise, the country has a large number of medium-sized cities, evidencing a highly dynamic urban network.

In demographic terms, the country is in a stage of advanced transition. Although its natural growth rate is not as low as that of other countries in Latin America and the Caribbean classified in the same stage (for example, Argentina, Uruguay, Trinidad and Tobago), its low overall birth rate (1.9 children per woman for the five-year period 2005-2010) and a life expectancy at birth of 72.4 years for both sexes, evidence that demographic transformations are deepening significantly. According to CELADE, the country's overall dependency ratio reached 51.2 in 2005.

The principal causes of mortality in Brazil relate to illnesses linked to the circulatory system (ischemic heart disease and cerebrovascular disease), although perinatal conditions and violence also feature.

The percentage of the population living in extreme poverty has decreased significantly, thus Brazil could reach the Millennium Development Goal on poverty and extreme poverty set for 2015. This indicator decreased from 23.4% in 1990 to 7.3% in 2008 (United Nations, 2010). This reduction is evidenced by reduced urban and rural poverty throughout the nation.

In relation to the Millennium Development Goals on the right to health, Brazil's maternal mortality rate was 73.3 for every 100,000 live births in the year 2000 (United Nations, 2010), thus recovering from exacerbation of this indicator over the past decade. However, this rate increased to 77.2 in 2006 (United Nations, 2010), making it difficult to estimate whether the country will be able to reach the target of reducing its maternal mortality rate by 75% by 2015.

As for the under-five mortality rate and based on the 81% progress towards reaching this indicator in 2009 (United Nations, 2010), this goal will most likely be reached by 2015.

Source:

CELADE, 2006.

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

Brazil MDG Report (2010). Millennium Development Goals. Brasilia.

IV.

Information and communication technologies in health care: enabling projects and applications in Chile

*Misael Rojas*³⁵



The introduction and planning of how to incorporate information technologies in Chile started during the administration of Ricardo Lagos Escobar (2000-2006). The health reform process also started during his mandate and at the same time the Ministry of Health (MINSAL) Digital Agenda Department was created, which is an information technologies reference point for all public health services throughout the country. The information technologies incorporation strategy, known as the Blue Book,³⁶ was established within this framework. It was adopted mainly to support the implementation of the health reform and the State modernization process.

The health reform incorporated guarantees into the Auge Plan (Plan for Universal Access with Explicit Guarantees), which provides the population with supply, access, quality and financial coverage guarantees for specific groups of diseases. The supply guarantee commits to providing care within a certain time period, thus forcing the network of health-care institutions to improve coordination between each other. The incorporation of ICTs,

³⁵ Misael Rojas was responsible for the Ministry of Health Digital Public Health Agenda up until April 2010.

³⁶ This document is the result of participatory work of the members of the Digital Health Agenda. It aims to provide policies on technology which form part of the health-care objectives put in place to meet the health-care targets for Chile. See <http://www.estrategiadigital.gob.cl/node/78>.

particularly those which facilitate rapid voice and data communication, is largely responsible for improving this coordination.

The Blue Book strategy defined two kinds of projects to address this subject. The first, known as enabling projects, aimed to establish a communication network throughout the country, as well as a sectorial network and a project for providing computer equipment at all establishments. The second project involves applications as such.

As part of this reform process, two areas were formed within the Ministry of Health. The first area is responsible for providing health-care services and is directed by the Undersecretariat of Social Networks. The second area, relating to health-care authority, is governed by the Undersecretariat of Public Health, which should aim to ensure all persons the right to health protection by exercising regulatory, legislative and control functions on behalf of the State of Chile. The information systems embrace both undersecretariats or areas of concern.

Enabling projects

As regards enabling projects, the sectorial communications network was launched four years ago and it has been almost fully implemented. There is a network that covers all public health-care institutions, from hospitals to primary health-care centres. However, it still does not include emergency medical centres in rural areas where there have been technical feasibility problems. Despite this, most of the establishments are connected to this network and are endowed with the right communication capacities.

To enable the realization of the communications network, and considering the difficulty of obtaining new resources, all of the health services in the country (a total of 29) jointly agreed to make funding available for the project, for as prior to this, they financed telecommunication services individually, whether it was fixed telephony, data transmission or other services. Therefore, the project did not require new financial resources.

One significant problem was the availability of computers in each institution as they had to compete for financial resources with other areas of interest within the hospital, such as medical equipment, medication, etc. The strategy to ensure that health-care institutions would have access to computer equipment was to create a centralized plan for hiring computer equipment. The hiring contract included maintenance services, a help desk, Windows and Office licenses, antivirus software and continuous updating of these tools. At the end of the three- or four-year contract, a new contract was set up under which all the equipment was upgraded and so this resolved the problem of

obsolete technology. By centralizing the process of contracting large volumes of equipment, significant economies of scale were achieved.³⁷

The communications network had a number of objectives, but it was aimed primarily at interconnecting all institutions and providing a voice, data and image transmission service with an acceptable level of telecommunications and more efficient use of financial resources.

In brief, the communications network connects approximately 200 public hospitals throughout Chile, nearly 650 primary health-care centres and a number of other public health administrative entities (which do not provide direct patient care), such as the Public Health Institute (ISP), the National Supply Centre (CENABAST) and the National Health Fund (FONASA). There are approximately 1,450 interconnected localities all together. This network provides localities and institutions with internal communications (local area network, LAN), so forming a large private communications network.

At present, the network has 60,000 voice connection points, telephone extensions and 40,000 data nodes, or points where there are computers connected. There are now over 100,000 connection points throughout the country.

The voice communications system enables, by means of telephone extensions, the direct communication between two posts at any of the establishments linked to the communications network, without national long distance traffic charges. This enables more rapid and timely communication, as well as more efficient use of resources. Likewise, there is no additional variable cost for data exchange between institutions.

Internet access in Chile's capital city, Santiago, is provided by means of the Ministry of Internal Affairs through an arrangement known as State Intranet. The current Ministry of Health network is linked to this Intranet which it is used to provide Internet access to all institutions in the country which form part of this network.

The network has web portal services. There is a sectorial Intranet, which is a virtual space for sharing all types of information such as legal, clinical and administrative data. In addition, the network provides e-mail services with a current 28,000 active accounts. According to the contract, this number of accounts may increase to as many as 40,000.

³⁷ In addition to economies of scale, more services were provided using the same resources in the case of the communications network project. For example, a videoconferencing network was implemented and there was no additional cost for the first 34 rooms. The videoconference rooms were located in each of the 29 health-care services and the 15 Regional Ministerial Secretariats.

The contract with the current service provider (Telefónica) expires in November 2010. The next tender is expected to be contracted for four more years, the main objective being to stabilize the network by improving the implementation of bandwidths and security levels, increasing telemedicine applications and standardizing IP technology, among other aspects.

Application projects

The Ministry of Health established a framework agreement through ChileCompra³⁸ so that health services could contract applications for their health-care institutions directly. Since 2009, 8 health services out of a total 29 have started implementing five information system modules in all of their health-care networks. These modules are:

- An appointment scheduling system that includes a medical schedule.
- A referral and counter-referral application which enables patients to be referred from one institution to another for medical care, as well as the transfer of all relevant information and subsequent processing of their medical care record at the original institution.
- An emergency unit.
- A pharmacy unit.
- A record for the population under control (records of activities associated with chronic patients).

In 2010, there will be a new invitation to tender in order to increase the portfolio of providers and include new information system modules.

In late 2008, a new Minister of Health was appointed who, as part of the government administration, was committed to decreasing waiting lists for patient care at public hospitals. Accordingly, the ministry considered contracting more doctors, increasing surgery hours and providing greater access to medication, among other aspects. An interim waiting list register system was created that year and at the same time, 12 of the 29 health services implemented medical agenda and referral/counter-referral systems.

The aforementioned ICT applications should be fully operational in the 29 health-care services by 2010. Based on the results obtained, there are plans to increase the level and rate of implementation in 2011 by means of

³⁸ The Ministry of Health received funding from the Ministry of Finance. Tenders were submitted through ChileCompra, an institution that ensures transparency in public procurement. Alert, Quintec, Intersystems and Saydex are the companies that were incorporated into this framework agreement by means of the public bidding process.

tenders that provide solutions for managing operating rooms, hospital beds, blood banks, supply and fund-raising, among others. The objective is to have effectively operational applications at most hospital institutions and primary care medical centres within the next four years. This means that all clinical, administrative, financial and logistics processes must be automated using gradually implemented modular information systems.

An information system is being set up at the Regional Ministerial Health Secretary (SEREMI³⁹) in order to make all personal and corporate procedures normally carried out in person available online.⁴⁰

■ **Table 1** ■
Online Procedure System

Area	N	Name of procedure
Formalization	1	Health approval of food establishments
	2	Health report for a facility
	3	Industrial activity qualification for a facility
	4	Approval for waste treatment and/or disposal
	5	Approval of rat control certificate for demolition
Air quality	6	Unit records (fixed sources)
	7	Unit authorization (fixed sources)
	8	Unit emission declaration (fixed sources)
Foreign trade	9	Customs destination certificates for imported products
	10	Approval for the use and/or disposal of imported products
	11	Free sale of goods certificate
Information, complaints and suggestions office (OIRS)	12	Complaints, suggestions, enquires, greetings, requests

Source: Misael Rojas, "Digital Health Agenda", Presentation at Follow-up and Analysis of Regional e-Health and Telemedicine Policies and Goals workshop, Santiago, Chile. November 2009.

The information, complaints and suggestions office (OIRS)⁴¹ is a service that was included along with the eleven procedures already mentioned. Any citizen can go to one of the offices to make an observation or suggestion about the health services.

³⁹ A health authority that represents the Ministry of Health in the region and which is managed by the Undersecretariat of Public Health. It also collaborates directly with the Regional Governor (maximum Government authority in the region) in matters relating to health care. This institution is directed by the Regional Ministerial Health Secretary.

⁴⁰ SEREMI duties include, among others, supervising the observance of health-care standards, plans, programmes and policies established by the authority; executing actions aiming to safeguard the population's health and adopting the corresponding health-care measures; overseeing the proper execution of public health actions and updating the regional epidemiological diagnosis.

⁴¹ This is a participatory system that enables the exercise of citizen rights. It provides a communications route with the Health Service and facilitates access to information about the functioning of and health care provided by institutions. The purpose of this is to guarantee citizens the right to be informed, make suggestions or complaints and/or congratulating institutions for meeting health-care demands and providing excellent care.

A system known as Transparent Government was implemented in 2009 for online procedures. Any citizen can ask public institutions, including health-care institutions, to inform them of any issue containing public information, for example, salaries of any employees or authorities or documentation regarding the institutions.

The idea is to increase the online procedures and health-care network applications offered over the next years. For example, all additional procedures will be included with the 11 initial procedures that are already carried out at the Regional Ministerial Health Secretariats, and information systems that operate OIRS and Transparent Government applications will be implemented in all health services and their respective health institutions.

Telemedicine

Having a telecommunications network that covers all primary care medical centres, as well as high- and low-complexity hospitals, has paved the way for the implementation of telemedicine applications. One example is an initiative that started in 2008 and involved the implementation of 100 devices for carrying out osteopulmonary tests at low-complexity health institutions connected to the communications network. Some hospitals and primary care medical centres have already transmitted images produced by these devices and the quality of the images sent from medical centres to more complex hospitals has been verified. For example, in the Magallanes region of the country, images are sent from the low-complexity Hospital de Porvenir to a high-complexity hospital in the city of Punta Arenas and they are received in excellent condition. This is also the case in the Chilean archipelago of Chiloé. Images from three low-complexity hospitals (Achao, Queilén and Ancud) are sent to Castro. In addition, remote diagnosis is carried out and results are then sent to the hospital of origin.

The principal task for 2010 is to ensure that all health-care institutions with osteopulmonary devices implement this telemedicine application, thus improving access to patient care, care quality and resource use efficiency.

Background information on Chile

Social Development Division, ECLAC, United Nations

The population of Chile is highly urbanized with 87.52% of the inhabitants residing in urban areas in 2010. Most of the population is concentrated in relatively dense built-up areas. For example, 34.3% of the country's total population lives in Santiago, the capital city. (United Nations Global Urban Indicators Database).

Chile meets the conditions to be described as an advanced demographic transition country (ECLAC, 2008). The country's life expectancy at birth is one of the highest in Latin America and the Caribbean, with an average of 78.5 years for both sexes. The overall dependency ratio in Chile in 2005 was 48.9.

As regards the epidemiological profile, chronic diseases associated with the circulatory system and malignant neoplasms are the most significant causes of death. However, communicable diseases linked to respiratory illnesses are also among the major causes of death.

Within the framework of the Millennium Development Goals, Chile has made substantial progress in terms of the population living in extreme poverty indicator, which decreased from 13% in 1990 to 3.7% in 2008 (United Nations, 2010). According to the 2008 country report, Chile has met the goal to half the percentage of the population whose income is less than one dollar per day between 1990 and 2015. Figures reveal that the percentage decreased from 3.6% in 1990 to 1.1% in 2006.

However, the country still has important challenges to overcome in terms of income distribution, especially considering that Chile's 2008 country report reveals its Gini concentration index was 0.54 in 2006. Indeed, vulnerability and poverty incidence conditions evidence significant differences in Chile. According to the same report, the poverty incidence for the population under the age of 18 and inhabitants belonging to ethnic groups is higher than for the rest of the population.

Chile has made substantial progress relating to the Millennium Development Goal on the right to health, particularly by reducing under-five child mortality rates from 19.1% in 1991 to 8.5% in 2009 (United Nations, 2010). However, the situation is different regarding the maternal mortality rate. In 2000, the value of this indicator was 18.7 for every 100,000 live births and in 2007 it was 18.2, revealing a very slight progress towards reaching the target of reducing maternal mortality by 75% between 1990 and 2015 (United Nations, 2010).

Despite this, when the performance of additional indicators relating to universal access to reproductive health care is observed, Chile's 2008 Millennium Development Goal report suggests that the challenge is to bridge sexual and reproductive health gaps. In particular, this refers to induced abortion, adolescent pregnancy and HIV/AIDS, which affect vulnerable social sectors more than others (socioeconomic marginality, female heads of household and

the adolescent population). There is a pressing need to increase the use of birth control methods for fertile women from 31.6% in 1990 to 60% by 2015 (UNDP, 2008).

Source:

United Nations Global Urban Indicators Database.

CELADE, 2006.

ECLAC, 2008.

United Nations (2010), *Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges*, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

UNDP (2008). *Millennium Development Goals. Government of Chile Second Report*.

V.

e-Health in Colombia: regulations, applications and challenges

*Jorge Vélez*⁴²



The present status of information and communication technologies (ICTs), e-Health, telemedicine and telehealth in Colombia, as well as in Latin America and the Caribbean is largely based on the previous work carried out during the early 1980s by the Pan American Health Organization (PAHO), the Organization of American States (OAS), the Canadian Government, summits—particularly the summit in Ottawa—and the connectivity agendas of the countries of the Americas, among others.

As regards the incorporation of ICTs, the connectivity agendas generated a significant impulse within the countries and different government sectors, as well as within non-governmental and civil society organizations.

As a result of the regional work of the aforementioned institutions, academic interest groups were created at different study and research centres throughout the country. In 2004 and 2005, several doctors and researchers with a particular interest in the area of e-Health were invited to meetings and seminars⁴³ to discuss and work on the formulation of public policies aimed at incorporating and developing ICT in health care. An interactive videoconferencing system was used on a number of occasions.

⁴² Jorge Vélez is founder and Director of the Colombian Telemedicine Centre. He was Secretary of the American Telemedicine Association, Latin-American & Caribbean Chapter (ATALACC).

⁴³ In the Colombian cities of Popayán, Cali, Medellín, Bogota, and in some other cities of the Atlantic Coast and in the Los Santanderes region.

Regulatory and legal framework for e-Health

Important changes have taken place in e-Health regulation in Colombia since 2000. These are clearly visible in Resolution 1448 of 2006, Law 1,122 of 2007, the 2007-2010 National Public Health Plan and the National ICT Plan of 2008.

The Ministry for Social Protection's Resolution 1448,⁴⁴ which established regulations for the provision of telemedicine services, is to some extent the result of regional work carried out in the country starting in the 1990s. In practice, this resolution has been put to the test and a number of questions have arisen in the short period since it was implemented, which are relevant to the development of the services themselves. A new definition of the status, roles and responsibilities of health-care professionals, as well as patients and/or patients associations, among others, is needed to incorporate ICTs into health care.⁴⁵

Another piece of relevant legislation is Law 1,122 of 2007. This law reforms the General Social Security System in Health (SGSSS), encourages telemedicine services in difficult to access territories and ensures the public resources and mechanisms through which these funds shall be allocated for this purpose.⁴⁶

Furthermore, the sector is regulated for the next few years by the current Public Health Plan. This plan includes the development of telemedicine by outlining programmatic guidelines and concrete results relating to priority health problems in accordance with the present health-care diagnosis.⁴⁷

Telemedicine is promoted in one way or another through a series of decrees and agreements. For example, one of the social security health-care system accounts deals with catastrophic events, traffic accidents and emergencies and supports telemedicine services.⁴⁸

⁴⁴ Published in Official Gazette 46,332 on Monday 17 July 2006. The resolution defines telemedicine as "[...] the provision of remote health services, including promotion, prevention, diagnosis, treatment or rehabilitation, by health-care professionals using information and communication technologies that enables them to exchange data in order to facilitate access to these services for the population who have limitations on the provision of these services in their geographical area".

⁴⁵ For example, it is one thing to generally regulate telemedicine service provision and another to regulate the participation of a group of stakeholders committed to using technologies designed to provide greater information, knowledge and better quality of care.

⁴⁶ Law 1164 of 2007 referring to human talent complements former laws in the area of training. It refers to the importance and ability of human talent and thus proposes the need for training health-care professionals to do telemedicine tasks.

⁴⁷ The National Public Health Plan 2007-2010 was implemented by means of Decree 3039 of 2007 (Official Gazette, CXLIII. No. 46716. 10 August 2007. Page 8). The Plan proposes allocation of 0.3% of the capitation payment unit in order to coordinate and finance telemedicine services.

⁴⁸ Agreement 357 of 2007 by which resource distribution criteria for the Catastrophic Events and Traffic Accidents Subaccount (ECAT) allocated to strengthen the National Emergency Network in force as of 2007 were approved (Official Gazette, CXLIII No. 46,625, Friday, 11 May 2007).

In 2008, the Ministry of Communications was renamed the Ministry of Information and Communication Technologies. This change implies a major shift in portfolio structure, as well as in terms of the ministry's mission, goals and objectives.

Within this framework, one of the sections of the National ICT Plan of 2008 refers to the use of these technologies in the field of health care. Although the incorporation of telehealth in this plan is a major step forward, it does not necessarily mean that Colombia can report any major achievements at present. Conscious of its limitations, the country is making interesting progress and is generally setting out to achieve the Millennium Development Goals and meet eLAC commitments.

Facilitators

The legislation (laws and/or regulations) creates better conditions for the adequate incorporation and development of ICTs in health care. However, this is not the only variable and it must be complemented by infrastructure and connectivity, among others.

Accreditation, mandatory epidemiological surveillance and quality guarantee systems, the integrated information system for social protection, eTraining strategies for health-care professionals and telemedicine services, depend on the provision of infrastructure, as well as standards and connectivity of information and communication systems.

In many cases, there are high expectations of ICTs and health care, but the infrastructure and connectivity in countries throughout the region inhibit their effects. At present, Colombia is working to create programmes to overcome these challenges.

It is important to consider how prepared the country is to use the opportunities provided by ICTs. According to the World Economic Forum Connectivity Index, Colombia showed significant improvement between 2006-2007 and 2007-2008, and is currently in ninth place in Latin America and the Caribbean. The country has achieved considerable development but still faces major challenges in this regard.

Current lines of work in Colombia

The aforementioned lines of work and those which are currently being developed in Colombia are based on recent information from scientific events, such as the Cartagena Telemedicine Conference hosted in 2009.

The progressive incorporation of telemedicine in countries throughout the region since the late 1980s and early 1990s has led to the creation and consolidation of programmes in the most prominent universities in Colombia, for example, the National University, the University of Antioquia, the University of Caldas and other study and research centres. Special emphasis has been placed on the work of the Colombian Telemedicine Centre of Cali in conjunction with the Javeriana University and the Icesi University, which are all located in Cali. These programmes have incorporated educational strategies in telemedicine, telehealth and e-Health studies at undergraduate to postgraduate levels. In addition, the Colombian Telemedicine Centre manages a telerehabilitation initiative in order to support indigenous communities in Colombian Amazonia, in collaboration with the Ottawa University and Hospital Telerehabilitation Centre, Laval University and the Quebec University Hospital Centre (CHUQ), the IDEAL Foundation for Comprehensive Rehabilitation and the Amazon Health Services of Colombia.

As regards the programmes, there are generally several working groups developing telemedicine applications. They aim to educate health-care professionals, develop electronic health records and electronic medical records and clinical applications, among others.

For years, universities have used videoconferencing to work with groups of health-care professionals, provide e-learning and even to provide patient care via teleconsultation. In the area of telehealth, rising importance has been afforded to remote care for chronic diseases such as diabetes and the use of ICT for oncological treatments, among others. Work is currently being done in Colombia to encourage the use of interactive tools focused on the exchange of information between different actors, aiming to improve the access to information as well as health care.

In Colombia there is a lot of social networking on the issue of health and this has helped to strengthen relations between health-care professionals and groups of patients.

Telemedicine challenges in Colombia

At present, Colombia faces major challenges regarding telemedicine and the incorporation of ICT in health care. How can the existing regulatory and legal guidelines be used over the coming years? How can the allocation of resources needed to bring about solutions be safeguarded without experiencing too many problems?

Different working groups must be encouraged to exchange information and knowledge and interventions in order to strengthen e-Health in Colombia.

For example, the Colombian Federation of Municipalities has sufficient financial resources to provide telemedicine services for almost the entire population of Colombia over the next 15 years. This is because interaction between different health-care service providers in Colombia, all of which belong to the social security health scheme, is generated at municipal level.

This is a major challenge. To overcome it, the goals involving health-care professionals and citizens must be reached to incorporate ICT in health care on a massive scale.

The second major challenge is to overcome a number of barriers to access and equity, mainly in remote areas far from the major cities, where health-care promotion companies and health risk administrators provide coverage. Remote areas do not have the same access to technology or even to basic health-care services.

The third challenge is to maintain and/or increase market growth by incorporating ICT in health care. Otherwise, public policies in the area will not suffice. Considering the potential benefits and profits, this is a very important market. There are increasingly more private organizations interested in implementing ICT in countries throughout the region. This is particularly noticeable in the case of health care. For example, the Colombian Ministry of Information and Communication Technologies has invited tenders⁴⁹ for a satellite contract that will, among other applications, be used to develop the telehealth component of the ICT Plan in Colombia, among other issues.

The last challenge is to continue fostering the enthusiasm that this topic has generated and apply it to the creation of shared outlooks on e-Health. It is also very important to develop control, as well as the analysis and monitoring of the sector. Therefore, it would be interesting to amend Resolution 1448 to extend the provision of health-care services by means of other applications and technologies, such as allowing citizens to use their mobile telephone to access health care in the same way that these devices are used for entertainment.

Recommendations

- Encourage health-care institutionality, in particular with regard to e-Health, in order to encompass the wide range of existing organizations.

⁴⁹ The previous tender was declared void.

- Formulate policies —strategies, plans and goals— in order to identify objectives for the sector.
- Pay attention to the good management of existing funds at present in order to achieve the desired results and impacts.

Background information on Colombia Social Development Division, ECLAC, United Nations

In 2010, urbanization in Colombia was 78.5%, which is slightly below the average for Latin America and the Caribbean (79.4%). Over 35% of the population resides in cities with over 1 million inhabitants, while 24% of the population lives in intermediate cities —between 50,000 and 1 million inhabitants (World Urbanization Prospects, 2008).

Colombia is currently at an advanced stage of demographic transition, as indicated by its life expectancy index (69.2 years for men and 76.6 years for women) and overall fertility rate of 2.45 children per woman (ECLAC, 2008). The country's total dependency ratio was 56.1 in 2005.

Colombia's epidemiological profile reveals that violence and chronic diseases are the main causes of death. Indeed, circulatory system pathologies (ischemic heart and cerebrovascular disease) stand out among the chronic illnesses.

At the end of the 1990s, Colombia faced one of its most serious economic crises, with declining national production, soaring unemployment and lowering incomes. This increased the country's poverty index and led to lower social protection coverage and loss of human capital (UNDP Colombia, 2005). To achieve the Millennium Development Goals within the next five years, a strong drive in poverty reduction policies is needed, especially in terms of backlogged rural zones (DNP, 2010). These results were observed while monitoring the first Millennium Development Goal on eradicating poverty. The percentage of the population living in extreme poverty dropped from 26.1% in 1990 to 22.9% in 2008 (United Nations, 2010), even though the country is still a long way from reaching its goal of 8.8% (DNP, 2010). In addition, although poverty figures varied significantly between 1990 and 2008, there was a downward trend. In 2008, 46.8% of Colombia's population was living in poverty, down from 53.8% in 1991 (DNP, 2010).

As regards the Millennium Development Goals on health care, the indicator of maternal mortality rate has improved, decreasing from 104.9 for every 100,000 live births in 2000 to 75.6 in 2008 (United Nations, 2010). However, there is major geographical dispersion for mortality rates at departmental level: the 2007 mortality rate ranged between 566 for every 100,000 live births in Vaupés to 0 in Guainía (DNP, 2010).

As regards the percentage of babies delivered by qualified health staff, the goal of 95% was met in 2003 and has continued to improve, standing at 97.8% in 2007. However, that same year, the rate varied in each of the 32 departments in the country and eight of them failed to reach the goal (DNP, 2010).

The under-five child mortality rate has decreased significantly. This rate dropped from 42.5 for every 1,000 live births in 1991 to 25.3 in 2009, a 60.7% improvement towards the goal of 17 for every 1,000 live births (United Nations, 2010).

Source:

CELADE, 2006.

ECLAC, 2008.

National Planning Department - DNP (2010). Millennium Development Goals. Second Follow-up Report 2008. Bogota, Republic of Colombia.

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

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World Urbanization Projects, (2008).

VI.

Costa Rica's Telesalud programme: experiences and challenges

*Jaime Cortés*⁵⁰



According to official figures, the health system in Costa Rica is largely based on the Costa Rican Department of Social Security (CCSS), which covers nearly 80% of the country's population and receives contributions from employers and workers. In turn, private health-care sector development has advanced significantly over the last year.

As regards health care, Costa Rica has virtual education systems and virtual libraries, as well as online information systems for primary care and hospitals, and digital literacy courses designed to overcome reluctance manifested by professionals and specialists in the area.

As regards telemedicine, the most prevalent application is perhaps teleconsultation (or interconsultation with ICT support), which has helped to cut costs by removing the need to transport patients in rural areas to specialized centres in urban areas. Although Costa Rica is a small country, a medical appointment often means missing a day's work and consequently a day's wage, leading to a substantial income loss for many people. Making only necessary trips has a positive impact on patients' health. For example, it will have a positive social impact if patients can stay with their families at home. In addition, there is a positive medical impact in that it reduces the negative effects of moving traumatized or seriously ill patients.

⁵⁰ Jaime Cortés is the founder of the Telemedicine Project for the Costa Rican Department of Social Security.

At the same time, ICT in health care facilitates scientific exchange of knowledge between doctors in areas which are located at distance from urban centres. A good example is the pilot project in Extremadura, where the coordinator of a rural health centre stated that he had learned more during 4 months of interconsultations than in 20 years of continuing medical education.

The history of e-Health in Costa Rica

In 1994, the new president-elect was the main promoter of studies on telemedicine in the country, as well as of the first health teleconferences, which were product of collaboration between the Ministry of Health, the Costa Rican Electricity Institute and the State Open University. The first multi-point videoconference with dedicated links was held in July of the same year and the Costa Rican Electricity Institute provided the communication and other private companies supplied the equipment for it. It linked the Children's Hospital to a hospital for adults and the State Open University.

The Ministry of Health executed several pilot tests over the two subsequent years in order to gauge the feasibility of e-Health. Since then, work has been going on in the hospital telemedicine sector. The Telemedicine Technical Council was created that same year, the first recommendations were formulated and a strategic project was designed in order to create the National Telehealth Network, known as Telesalud. This aimed to cover hospitals, health-care areas and regional clinics, and basic teams of comprehensive health care (EBAIS) in three stages.

■ Table 1 ■

Health-care service organization and 1996 National Telehealth Network project stages

Stages	Health-care Services	
	Name	Number
First stage	National hospitals	8
	Regional hospitals	20
Second stage	Health-care areas	90
Third stage	Basic Teams of Comprehensive Health Care (EBAIS)	800

Source: Jaime Cortés and Juan Barrios (2009), "Technological Advances in Healthcare. Costa Rica, 2009". Presentation for the Follow-up and Analysis of Regional e-Health and Telemedicine Policies and Goals workshop held in Santiago, Chile, November 2009.

The project had two major technological components, a teleconsultation system and a videoconferencing system. The first enabled online consultation between specialists at national hospitals and doctors from regional hospitals by means of a point-to-point connection. The second system enabled exchange of scientific and technological information by means of virtual meetings and talks. It would use a device known as a multipoint control unit (MCU) for simultaneous connections.

In 1997, the Council Steering Committee provided resources so that the Ministry of Health could obtain the equipment needed to make intercommunication possible (computers, software, etc.). Since the administrative contracting law in Costa Rica is slow and bureaucratic, a tender may have several obstacles. For this reason, the Ministry of Health and PAHO made an international tender in Washington. Latin America must speed up and optimize purchasing processes in order to enable quicker access to services.

The first of the three stages was implemented in March 1998. It was exceptionally slow; the initial process design proposed acquiring and implementing 32 devices. However, only 10 of these devices were implemented and the remaining 22 were left pending until November 2000 (the second stage) and July 2001 (the third stage).

In contrast to the original design of 1996, there are currently 6 national hospitals operating, 18 regional hospitals, 10 health-care areas, 4 major clinics not considered in the original project and 2 rural basic teams of comprehensive health care (EBAIS). There is a technician, medical coordinator and telephone staff providing system support at each telemedicine site.

■ Table 2 ■

Sites with telemedicine applications

Sites implemented with telemedicine applications throughout the Metropolitan Area in late 2009	Estimated total in the country	
Clinics	4	--
National hospitals	6	8
Regional hospitals	18	20
Health-care areas and regional clinics	10	90
Rural EBAIS	2	800

Source: Jaime Cortés and Juan Barrios, "Technological Advances in Healthcare. Costa Rica, 2009". Presentation for the Follow-up and Analysis of Regional e-Health and Telemedicine Policies and Goals workshop held in Santiago, Chile, November 2009.

According to the plan, the implementation process was carried out in stages starting at the hospitals, followed by health-care areas (which bring together basic teams of comprehensive health care) and finally the EBAIS (in charge of health care at a local level and also rural health care).⁵¹

The project design included the concept of networks or mini-networks. Each specialized national hospital should operate a mini-network with other hospitals in its health-care area. The Children's Hospital, the Psychiatric Hospital and the Blanco Cervantes Hospital supported different hospitals in Costa Rica.

The implementation of the strategic project for setting up Telesalud provided some lessons. One of the lessons learned was the length of time that elapsed between the implementation of stage 1 and stage 3 (1998-2001), since this delay meant that the first equipment installed had already become obsolete by the second stage.

It is also necessary to address conflicts that arise in projects of this kind, for example, disputes between doctors and technicians about leading projects in information systems. These difficulties also affect project management, since the project must incorporate a manager who is a doctor so that health-care professionals consider the medical services were truly being provided. These disputes only delay or impair initiatives, and patients ultimately lose out.

Another important point relates to generating and strengthening institutionality, as well as defining project structure. There was a lot of willingness to cooperate when Telesalud first started, but institutionality at the time was inadequate, which hampered the project. More specifically, as for the goal of enabling the population to access telemedicine services, the equipment purchased was not used appropriately or as often as required. Thus, the useful life of the project was shorter because this equipment was only used non-intensively for four or five years, particularly in the case of teleconsultation. More intensive use was made of videoconferencing equipment.

In 2004, a teledermatology pilot programme was launched which helped to disseminate the benefits of using telemedicine. Another pilot project was implemented in 2006 at the Virtual Hospital. Finally, in 2009, new telehealth equipment was purchased and installed following a two-year tender product of a World Bank modernization project.

⁵¹ According to the author, and given the circumstances, the order of implementation could have been changed to start with those requiring the most support, such as EBAIS and clinics.

e-Health applications in Costa Rica

Costa Rica has been using telemedicine for specialized consultation and emergencies for almost a decade. However, despite the fact interconsultation using ICT has proven to be effective and efficient, this tool has only been used for a small number of cases depending on the willingness of the professionals involved.

The Costa Rican health system should regulate, control and enforce, when necessary, the use of interconsultation in order to ensure better use of the resource and in particular, to improve the quality of service provided for patients. In view of this, the present manager of Telesalud will issue a resolution indicating that teleconsultation is to be incorporated into pediatric care.

Distance learning, which is understood as virtual medical sessions, has also been launched in Costa Rica together with teleconsultation. It has covered illnesses such as diabetic foot, endocrinological problems and hypertension. The working arrangement means that doctors from different hospitals must allocate a morning or part of a morning to distance learning. Other distance learning applications have been implemented at community hospitals.

In a small country like Costa Rica with only one health system, another advantage of videoconferencing is that the community gets to know the medical team, system and technology used so that they become more familiar with the health sector and become part of the network.

The educational component has been very important in the Telesalud project. It is noteworthy that at the time of the AH1N1 flu pandemic, many conferences relating to the topic were based on ICT. At international level, videoconferences are often carried out in order to share work experiences on patient treatment. Another noteworthy project is the Costa Rica cooperation plan with Spain, Japan and the World Health Organization (WHO) in Geneva.

Institutions have made significant cost savings by using videoconferencing rather than traditional formal education. The use of this method has increased access to education and has promoted knowledge generation. This is particularly evident in the case of medical conventions, which are increasingly held via videoconferencing. There is also a strong trend of renewing qualifications by means of ICT. Therefore, careers have benefited from the use of this resource.

Another widespread ICT application in Costa Rica is the health management systems. The executive presidency of the Costa Rican Department of Social Security (CCSS) uses videoconferencing equipment for information sessions and as a knowledge tool.

Teledermatology pilot projects have been quite successful. There are two specialized hospitals, which have hospital and care centre networks, where patient are scheduled appointments for a consultation at a specialized centre. This project has successfully reduced the number of patients attending appointments with dermatologists in person.

The Virtual Hospital is a successful project that has been well received by both health-care professionals and the community. This hospital connected Puerto Jiménez and Golfito hospitals by means of wireless technology equipment. Despite the great distance between both health-care centres, professionals from the emergency department at Golfito Hospital assessed visits⁵² using ICT systems for inpatients at Puerto Jiménez Hospital. Puerto Jiménez is a relatively isolated hospital located six to eight hours from Golfito. The highway leading to the hospital is in poor condition and access via boat is not a very safe alternative for patients. Not only has the use of ICT improved access and the quality of care, but it has also increased the level of patient satisfaction.

There are electronic records at some hospitals, as well as clinics and EBAIS. Many of the external consultation services have electronic and some hospitalization records. The experience of e-Health in Costa Rica reveals that the use of ICT in health care is a form of alternative care that entails significant institutional savings.

Networks

In 1994, the Ministry of Health set up the first national network with public information on the Internet thanks to the Pan American Health Organization donation of a web server. The first application was for epidemiological surveillance. The official Costa Rican health sector website (nets@lud) is currently an information system with over 40,000 historical pages.

As regards virtual education, Costa Rica has open platforms (Moodle) for professional learning. Some examples are the Centre for Strategic Development and Information on Health and Social Security (CENDEISS) and the College of Physicians and Surgeons of Costa Rica Virtual Campus (CMC).

At present, the virtual education network is located at the Costa Rica Virtual Campus. Both the Costa Rican Department of Social Security Teaching and Research Centre and the College of Physicians have worked

⁵² The general objective of daily rounds is to observe the progress of health problems affecting inpatients in order to take measures to ensure faster recovery, while at the same time gradually training the patient and his or her family members, as well as all staff involved in this procedure.

on disseminating virtual courses and thus eliminating the distance between doctors from the metropolitan area and those living in rural areas that lack access to continuing medical education courses.

Main limitations

Despite the fact that ICTs have been used in health care in Costa Rica for over 10 years, their main limitation is doctors' lack of interest. The explanation for this is that over the past decade, emphasis was placed on technological aspects and not on medical aspects. For this reason, health-care professionals have not espoused the area.

Telecommunications barriers in the country are also a limiting factor. A lot of progress has been made, but it has been difficult to rely on high-speed links at all health-care levels.

The final limitation relates to legal aspects, since there is no legislation supporting the use of technologies. For example, this refers to digital signature, electronic medical documents, as well as patient confidentiality and consent issues.

Challenges

The first major challenge in the area of e-Health in Costa Rica is developing and strengthening institutionality. The National Telehealth Council and a technologies section of the Social Security Administrative Management both argue about who is responsible for the telehealth strategic. The programme is currently led by the Costa Rican Department of Social Security (CCSS) Medical Management Telehealth Council. However, if there is strong belief that the central role of telemedicine is to care for patients, then the project should be run by a unit that provides health-care services. Based on this premise, the unit responsible for management must be able to evaluate the type and quality of care provided.

The second challenge is to extend the telemedicine network in the framework of the Costa Rican Department of Social Security (CCSS). At present, equipment can be installed on IP and so with improved technology, each consultation centre, desk and office could be connected to the network. This could consolidate the development of teleconsultation.

The third challenge is to include telemedicine services in the data network of different centres.

The fourth challenge is to disseminate imaging services and incorporate them into online services connected to different hospitals throughout the country.

The fifth challenge lies in knowledge management. For example, in the year 2000 the Costa Rican Foundation for Sustainable Development and the Massachusetts Institute of Technology (MIT) jointly developed a portable telemedicine device that is very useful for access in remote rural areas and the EBAIS.

Into the future

A very small percentage of the Primary Care Technical Assistants from certain EBAIS or health-care areas visit houses and gather information about pregnancies, healthy children, chronic patients or deaths in order to update information available in databases at the end of the day. Communication technologies applications could improve this process.

Indeed, it is expected that the progress made as a result of Internet and Internet2 will undoubtedly provide a lot of alternatives for medicine in the short and medium term. Performing specialized procedures, for example, surgery, opens up a huge market for medicine. Improving telematic possibilities including image and sound quality will also support teleconsultation in several other medical specializations.

In addition, the possibility of using mobile devices for telemedicine will expand coverage and provide higher quality health-care services in Costa Rica. For example, an EBAIS technical assistant could feasibly carry out teleconsultations with doctors in the health-care area.

Opportunities arise for many health specializations to carry out telework activities. Training, continuing medical education and scientific exchange will be invaluable tools for all telemedicine options in the future.

Background information on Costa Rica Social Development Division, ECLAC, United Nations

In Costa Rica, 66% of the population lives in cities, positioning the country 13% below the region's urban development average. The country does not have any built-up metropolitan areas even though 29% of its inhabitants are concentrated in the country's capital city, San José.

Costa Rica is currently at an advanced stage of demographic transition. Its natural growth rate is 1.36 persons for every 100 inhabitants (for the five-year period 2010-2015) and the fertility rate is 1.97 children born per woman. The overall dependency ratio was 51.2 in 2005 (CELADE, 2006).

In epidemiological terms, the main cause of death is chronic illnesses, in particular, those affecting the circulatory system. HIV/AIDS (5%) and chronic obstructive pulmonary disease (4%) also feature among the main causes of death.

The percentage of the population living in extreme poverty in 2008 was 5.5%, which has significantly dropped from 10.1% in 1990 (United Nations, 2010). However, there are significant gaps between the degree of total poverty and extreme poverty. According to the first Millennium Development Goals Report in 2004, poverty affects children in particular. In 2003, 35.7% of those living in poverty were either boys or girls aged 12 years old or younger, while the percentage of children not living in poverty was 22.6% (UNDP Costa Rica, 2004).

As regards the decrease in maternal mortality, Costa Rica reported a rate of 35.8 for every 100,000 live births in 2000. This indicator dropped to 19.1 in 2007 (United Nations, 2010). The most frequent causes of maternal death were related to septicemia, toxemia and complications during the puerperium. In turn, the percentage of childbirths at hospital premises was 99.1% thus surpassing the goal of 2008 (MIDEPLAN, 2010).

The under-five mortality rate dropped from 18.4 for every 1,000 live births in 1991 to 11.2 in 2009, evidencing progress towards reaching the target for 2015 of reducing the rate by two-thirds (United Nations, 2010).

As regards the goal to fight HIV/AIDS, malaria and other illnesses, there has been progress made for some indicators. The mortality rate for tuberculosis fell from 3 percentage points to 1 between 1990 and 2007. The adult HIV prevalence rate (aged 15-49) increased by only 0.1% between 2000 and 2005.

Source:

CELADE, 2006.

Ministry of National Planning and Economic Policy – MIDEPLAN (2010). Costa Rica: Second Follow-up Report, 2009 Millennium Development Goals. San José, August 2010.

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

UNDP (2004). First report on progress towards the Millennium Development Goals in Costa Rica. Government Social Council, Republic of Costa Rica. United Nations System in Costa Rica. San José, December 2004.

VII.

e-Health development potentialities in Ecuador

*María Teresa Mijares*⁵³



The National Connectivity Agenda

e-Health initiatives in Ecuador were executed in an isolated manner for over a decade. In 2001, a baseline on the interests of institutions and people working in the area and their progress was established at the convocation and work on the National Connectivity Agenda (ANC).

A number of stakeholders joined the National Connectivity Agenda initiative. The government took an active role in the process and the community of medical, health-care informatics and biomedical staff, and users in general, started to learn about the advantages and uses of e-Health.

The Agenda established five important areas for development in the country, one of which was telemedicine. A diagnosis for each area was made and objectives, goals, and strategies were established, together with a short- and medium-term action plan. One of the telemedicine objectives in Ecuador which stands out is connecting and providing interactive communication between remote medical units and centres in major cities by means of a National Telehealth Network.⁵⁴

⁵³ María Teresa Mijares is President of the Ecuadorian Telemedicine and e-Health Foundation. She is also Director of the Telemedicine and e-Health Institute of the University of San Francisco in Quito, Ecuador.

⁵⁴ National Connectivity Agenda, June 2002, Page 14. Consulted at http://www.conatel.gov.ec/site_conatel/index.php?option=com_docman&task=doc_details&gid=1016&Itemid=.

Unfortunately, having an action plan for the National Connectivity Agenda was not enough for the rotating governments at that time to assign a budget for implementation of the activities. This meant that the initiative lost momentum a short time later.

In 2006, the Agenda was resumed with the so-called White Paper on the Ecuadorian Information Society. The paper introduced some changes to the existing plan and included new proposals. However, as in 2001, the plan was once again discontinued.

Private initiatives and NGOs

Even though no national budget was assigned for this purpose, some pilot projects were implemented at university level. Most of the projects were financed by international cooperation funds, with the same beneficiary institutions and communities as counterparts.

Pilot projects have mainly been focused on covering the needs of rural and marginal regions in Ecuador. Perhaps the only major weakness has been the lack of cooperation between Ecuadorian institutions and the consequent duplication of effort, since these projects were executed in an isolated manner. Some examples of these initiatives are:

- Telemedicine for mobile surgeries. The CINTERANDES Foundation project. University of Azuay, Cuenca. Directed by Doctor Edgar Rodas.
- A telemedicine pilot project for the Santa Elena peninsula. Developed by the Coastal Institute of Advanced Polytechnic Studies (Escuela Superior Politécnica del Litoral - ESPOL) in the province of Santa Elena.
- Telemedicine for rural sites. Executed by the Equinoctial Technological University in the provinces of Orellana (the Eastern Ecuadorian Region) and Galapagos.
- Use of telemedicine in medical care, virtual network of health libraries. A set of projects developed by the Faculty of Medical Sciences of the University of Cuenca (UC).
- Rural telehealth Tutupaly. A project being executed by the Private Technical University of Loja (UTPL), which provides health care for the province of Zamora Chinchipe in the eastern region of Ecuador.
- Experience of the Teletrauma Centre of the Ecuadorian Air Force and satellite connectivity support and other types of connectivity for national projects.

- A telemedicine project of the National Planning and Development Secretariat (SENPLADES), Ministry of Public Health (MSP), Telecommunications and Information Society Ministry (MINTEL), National Telecommunications Secretariat (SENATEL) and the Private Technical University of Loja (UTPL).
- A telemedicine network for isolated areas. Collaborative projects between various national institutions backed by international funding including the Andean Women and Family Foundation (FUNDAMYF), Telesalud Venezuela, the Andean Development Corporation (CAF), FUNDAMIGA, FUNDETEL and the Institute of Telemedicine and e-Health at the University of San Francisco in Quito (USFQ) which covers the provinces of Chimborazo, Cotopaxi and Esmeraldas.

In addition to the eight aforementioned examples, many higher education institutions in Ecuador have been assigned university hospitals or health clinics. Some of them also have cooperation agreements with public health institutions.

The Ecuadorian Telemedicine and e-Health Foundation (FUNDETEL)

Another important initiative in Ecuador was the creation of FUNDETEL in 2005. This is a non-profit NGO made up of a group of doctors and health-care professionals. FUNDETEL is an open institution that seeks to integrate organizations and people willing to work and provide human resources, funding and time. Its objectives include promoting and disseminating the use and benefits of telemedicine and e-Health, as well as creating a network for sharing information, knowledge and expertise for resource optimization.

FUNDETEL has collaborated on some projects in very impoverished areas which need both financial aid and health services. The foundation is currently developing strategic alliances to form multidisciplinary working teams with public and private universities and institutions at national and international levels. One of its achievements was an agreement with the University of San Francisco in Quito (USFQ) to include the academic sector in the work of the projects. This collaboration enabled the creation of the Institute of Telemedicine and e-Health at the University of San Francisco in Quito, as well as the Telehealth Medical Network within the College of Health Sciences.

In November 2006, the First International Symposium on Telemedicine and e-Health: An Expanded Outlook in Quito was a milestone in the

relationship between FUNDETEL and the University of San Francisco in Quito. It was a meeting for sharing experiences in Ecuador, as well as other countries, for example, Spain (the EHAS group), the Bolivarian Republic of Venezuela (Fundación Maniapure), Mexico (Social Security Institute), Panama and Cuba.

The advanced academic network in Ecuador

The Ecuadorian Consortium for the Development of Advanced Internet (CEDIA) is a private non-profit institution. It was created in September 2002 and currently brings together 20 national education, science and technology institutions distributed over the nine provinces in Ecuador. Many of these institutions have subsidiaries in the eastern provinces and the Galapagos Islands. Members of CEDIA⁵⁵ have conducted telemedicine and telehealth pilot programmes in Ecuador.

National Telemedicine and Telehealth Plan

The National Telemedicine and Telehealth Plan is managed by the Science and Technology Process (PCYT) of the Ministry of Public Health in Ecuador. In December 2006, the Ecuadorian Ministry of Public Health called for a commitment to support and work towards the National Telemedicine and Telehealth Plan. The commitment was formally agreed to by government institutions, universities and academic bodies which included the Army Polytechnic School (ESPE), the Private Technical University of Loja (UTPL), the Equinocial Technological University (UTE), the University of Azuay (UDA) and the University of San Francisco in Quito (USFQ),⁵⁶ among others.

Regulatory framework

The National Telemedicine and Telehealth Plan recognizes the following as regulatory support framework: the Political Constitution of the Republic of Ecuador; the National Plan for Living Well 2009-2013; the Organic Law on the National Health System and international telemedicine codes, declarations, agreements and resolutions.

⁵⁵ Members of CEDIA are interconnected by means of 50 Mbps fibre optics to a national SDH backbone with 7 STM-1 capacity. This backbone is also used for transporting Internet and CLARA services. See www.cedia.org.ec for additional information.

⁵⁶ This took place after hosting the Fifth Space Conference of the Americas in the city of Quito and the First International Telemedicine Symposium at the University of San Francisco in Quito. Both events took place in 2006.

The National Plan states that in the Political Constitution of the Republic of Ecuador, article 42 “refers explicitly to the right to health, and permanent and uninterrupted access to health services”; article 43 “guarantees medical care services for any person who needs them” and article 44 indicates that “the State will promote scientific and technological progress in the field of health care”.

In addition, the National Plan refers to the principles of equity, universality, solidarity, quality, plurality, efficiency, ethics and integrality contained in the National Plan for Living Well 2009-2013, as well as in the National Health Policy.

Lastly, the National Plan states that the Organic Law on the National Health System is the instrument which “establishes the legal, structural and functional conditions for the fulfilment and performance of the Constitution of the Republic and the National Health Policy” and the international telemedicine codes, declarations, agreements and resolutions⁵⁷ as the regulatory support framework for the Telemedicine and Telehealth Plan.

The promise of e-Health

According to the National Plan, telemedicine in Ecuador is considered a solution to a number of problems in the area of health care. These problems are linked to the lack of specialists, insufficient material resources and centralism in Ecuador, as well as the country’s isolation from the world and its significant geographical diversity, which makes internal communication more difficult.

The National Plan states that: “Telehealth is a health-care model which uses current and modern information and communication technologies in order to provide medical care to anyone requiring it in remote areas. It is basically the transfer of medical information by means of communication networks”. Telehealth can therefore help to solve one of the greatest problems currently faced by the health-care services network in Ecuador, which is relating to access to specialized consultations in remote areas, a demand that increases depending on the needs of communities and the services. The Plan also reveals that telehealth gives access to a second opinion when the specialist consultation can be provided in remote areas.

⁵⁷ As regards the promotion of telehealth and telemedicine, one example which stands out is the Declaration of San Francisco de Quito at the Fifth Space Conference of the Americas in 2006 and the World Medical Association Declaration on responsibilities and ethical standards for the use of telemedicine adopted at the Fifty-First General Assembly of the World Medical Association at Tel Aviv, Israel, in October 1999.

National Plan Objectives

The objectives of the National Plan are to establish telehealth criteria and regulations for the implementation of different forms of health research and to incorporate telehealth into medical practice and the organizations, units and centres that make up the National Health System.

National Plan Strategies

To make telehealth possible, the National Plan promotes programmes on training and evaluation of telemedicine techniques relating to quality of care, the doctor-patient relationship and cost efficiency.

As regards connectivity, the plan promotes enlarging the telemedicine network in order to establish clinical and technological reference centres, as well as to deploy new terminal systems and incorporate mobile solutions. There are also plans to incorporate medical care units and a continuing education platform into the network for health-care professionals.

In the area of procedures, the National Plan considers planning and implementing regulations, protocols and standards required for telemedicine, which should also be used as instruments for training doctors and other health-care professionals. This is a strategy for the national health-care authority and the appropriate specialized organizations. These legal regulations and protocols should be applied at national and international level and they encompass medical and legal problems, as well as the responsibility of the physician, the legal status of electronic health records⁵⁸ and the correct use of teleconsultations, among others.

In addition to the different actions proposed in the strategy, the National Plan promotes the development and implementation of human resources training, as well as the provision of health-care services for all sectors of the population.

Teleassistance within the National Plan

The National Plan proposes the provision of teleassistance services and specifically refers to:

- Consultations and remote consultations, in real or deferred time, in order to enable greater access to the country's specialized services.

⁵⁸ In Ecuador, the Ministry of Public Health has regulated the register of the medical records relating to handling physical documents. However, there are no standards for digital medical records to date.

- Second opinion consultations by specialists in order to give opinions and specialized diagnosis thus ensuring better quality patient care.
- Exchange of opinions between experts from two reference hospitals at national or international level.
- Generating remote evaluations of electrocardiograms (ECG), X-rays, ultrasound scans, etc.
- Enabling telephone transmissions of electrocardiograms (ECG) and evaluations in order to collaborate with doctors during emergency calls from households or during the transfer of patients and/or following accidents.
- Sending of images such as CAT scan (computerized axial tomography), DSA (digital subtraction angiography), US (ultrasound), mammograms, nuclear magnetic resonance, biopsy slides and pathological anatomy of patients studied at reference or diagnostic hospitals to other institutions that do not have this technology.
- Sending of digitalized images of organs in movement or the digestion tract between reference or diagnostic hospitals to institutions that do not have this technology.
- Creation of a database of images and cases studies of interest in image and diagnosis files at a reference centre for consultation by specialists and future research, as well as the production of catalogues and other publications.

Closing remarks

Telemedicine and e-Health are excellent tools for bridging the gap between the inhabitants of major cities and remote or rural zones that are almost always the areas with the greatest needs. This work should be the result of joint efforts between NGOs and private, public and government institutions in order to generate solutions that are cost efficient, measurable, reproducible and in particular, self-sustainable over long periods of time.

Background information on Ecuador **Social Development Division, ECLAC, United Nations**

In Ecuador, 65% of the population lives in urban areas, while 32% is concentrated in two large cities (with populations between 1 million and 5 million).

At present, the country is undergoing demographic transition as Ecuador's fertility rate (2.58) and average life expectancy (75 years of age for men and women) are both intermediate. Its overall dependency ratio was 61.6 in 2005 (CELADE, 2006).

As regards Ecuador's epidemiological profile, the two principal causes of death are ischemic heart disease and cerebrovascular disease, although both coexist with respiratory infections.

As for Millennium Development Goals, Ecuador's 2010 report evidences progress in terms of the urban population living in extreme poverty, which decreased from 26.2% in 1990 to 14.2% in 2008 (United Nations, 2010). The 2007 country report shows that the indicator for the population living in extreme poverty at national level evidences slight progress, dropping from 13.6% in 1995 to 12.8% in 2006 (UNDP, 2007). This report also indicates that poverty at a national level increased over the second half of the 1990s and then decreased in 2000 (UNDP, 2007). This is based on official ECLAC figures. National poverty dropped from 51.2% in 2004 to 42.7% in 2008 (CEPALSTAT, 2010).

As regards the Millennium Development Goals on health, the most noteworthy element is the decrease in the under-five mortality rate. This rate decreased from 65.5 per 1,000 live births in 1990 to 24.4 in 2009 (United Nations, 2010).

However, the status of the Millennium Development Goals on maternal health is different, evidencing a higher degree of fluctuation. The maternal mortality rate was 150 for every 100,000 live births in 1990; 130 in 2000 and 210 in 2005 (CEPALSTAT, 2010).

According to the Millennium Development Goals Report of 2007, institutionalization of existing public policies must be optimized in Ecuador in order to reach its goal (UNDP, 2007).

Source:

CELADE, 2006.

CEPALSTAT, 2010.

United Nations (2010), *Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges*, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

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VIII.

e-Health policies, programmes and projects in Mexico

*Nancy Gertrudis*⁵⁹



In Mexico, health services are provided by both the public and private sectors. The public sector is made up of several social security institutions⁶⁰ (the Mexican Social Security Institute (IMSS); the Government Workers' Social Security and Services Institute (ISSSTE); the Mexican State-owned petroleum company (PEMEX); the Ministry of National Defense (SEDENA) and the Ministry of the Navy (SEMAR) which provide coverage for workers in the formal sector of the economy (companies, public services and the Federal Government), retirees and their families; government social security institutions and services aimed at the population not covered by social security (State Health Services, SESA,⁶¹ Seguro Popular⁶² and IMSS-Oportunidades⁶³).

⁵⁹ Nancy Gertrudis played an active role in the Ministry of Health of Mexico e-Health initiative from 2003 to 2008.

⁶⁰ They provide outpatient, hospital and specialized health care, including medication and other supplies.

⁶¹ State Health Services provide different services, basic outpatient services at rural clinics and more complex services in capital cities.

⁶² Seguro Popular provides services for low-income persons who do not have institutional coverage for health-care services. This includes any person, for example, independent professionals, traders and homemakers, who does not have insurance with IMSS, ISSSTE, PEMEX or another institution. Seguro Popular does not have its own hospitals, but policyholders can receive care at State or Federation health clinics or with IMSS, PEMEX, Marina or an NGO if there is an agreement in place.

⁶³ IMSS-Oportunidades (created in 1979) is a programme that is part of the Mexican Social Security Institute and is financed by the Federal Government. The Institute is responsible for carrying out the programme in 17 federal entities and delegations. The programme provides primarily medical care at outpatient clinics and hospitals in rural areas. IMSS-Oportunidades is used to promote the right to health, individual and collective well-being of Mexicans who do not have access to social security services.

The private sector is based primarily on a lucrative model and thus is designed for people with the capacity to pay.⁶⁴ It is made up of private health insurance companies and service providers in health centres, clinics and private hospitals. This sector also includes non-governmental organizations and universities, as well as academic institutions that provide medical care and/or social assistance.

Although Mexico has extensive health-care infrastructure, the health services provided for the population depend on the institution they are appointed to. Any person who is insured by a social security institution has access to more benefits, while isolated rural communities have problems accessing specialized hospital services. The latter is due to the fact that specialized and highly specialized medical care is concentrated in hospitals located in large urban areas.

Moreover, while there is limited health-care staff in rural communities, there is a high concentration of doctors in urban areas in Mexico. In addition, patients have to wait for a long time before accessing hospital services.

Finally, technological innovation and development programmes and initiatives in the private and public sectors are being integrated into e-Health. They seek to help strengthen medical care services and bridge health-care gaps between different communities in the country.

Public services and e-Health

The Ministry of Health (SSA)

Since 1970 and for almost 15 years, the National Health Information and Documentation Centre (CENIDS) facilitated remote consultation of the Medical Literature Analysis and Retrieval System (MEDLARS) at the National Library of Medicine (NLM) in Bethesda, Maryland, the United States of America.⁶⁵

In 1985, the health education programme known as the Mexican Centre for Health Education through Television (CEMESATEL) was launched by Mexico Federico Gómez Children's Hospital. The Ministry of Health, the Ministry of Communications and Transport (SCT) and the National Autonomous University of Mexico (UNAM) actively participated in this programme. CEMESATEL aimed to complement and keep health-care

⁶⁴ According to the 2006 National Health and Nutrition Survey (ENSANUT), 25% of the unsatisfied social security insured population regularly uses private services.

⁶⁵ Its main limiting factor was the connection cost per minute.

professional up to date by providing free medical education services. Digital transmission services were incorporated in 2006. At present, the centre has coverage within Mexico and Latin American.

The Ministry of Health informatics development programme considered ICT as strategies for conducting the institution's substantive and administrative tasks more efficiently. By the early 1990s, the State System of Basic Information (SEIB) was centralized and covered the 32 States in Mexico. In 1992, SEIB and the Universal Vaccination Programme operations were automated and the first local networks were installed in Mexican States. In 2000, the National Y2K Information Centre was created for the health sector in order to assist informatics conversion.

In 1995, the National Epidemiological Surveillance System (SINAVE) was created and it was coordinated by the Ministry of Health and relied on the Single Information System for Epidemiological Surveillance (SUIVE). The latter has a number of components including: the Automated Single Information System for Epidemiological Surveillance (SUAVE), the Hospital Network for Epidemiological Surveillance (RHOVE), the Epidemiological and Statistical Mortality System (SEED) and at least 22 special epidemiological surveillance systems. SUAVE is the technological system that gathers weekly information on events of epidemiological medical interest from institutions that are part of the national health system. Every week, this system notifies of new cases of exanthematic, transmissible, infectious, respiratory, intestinal and parasitic diseases, as well as sexually transmitted diseases, vector-borne and zoonotic diseases, and lastly, diseases that can be prevented by vaccination.

Since it was founded in 2001, the Seguro Popular Programme sought to make use of electronic medical records, as well as a card known as TUSALUD. This card was implemented at different stages throughout the 32 states of the Republic⁶⁶ starting in 2005. It showed signs of success within the early stages of implementation by incorporating a significant number of pharmacies into the Seguro Popular to supply prescriptions.⁶⁷ However, within a short period of time, interoperability and maintenance problems were reported in at least 15 states and for this reason the programme was cancelled.

From 2000 to 2006, the Directorate-General for the Ministry of Health established a policy to adopt systems based on free software and started

⁶⁶ The States of Durango and Jalisco launched independent credentialisation programmes at the same time as this initiative.

⁶⁷ Credentials were financed by the Ministry of Finance and Public Credit (SHCP). The cost of each credential was approximately US\$ 8. In mid-2006 it was estimated that Seguro Popular had distributed 3.7 million family cards and incorporated 2,078 pharmacies. In turn, the public sector was to issue 180 million prescriptions per year, each with an average three medications and the card was to reduce medication spending by 20%.

developing the Hospital Administration System (SAHO).⁶⁸ This system included several processes grouped into four divisions: medical services, management services, management of catalogues and management of medical agenda by professional and speciality. By late 2005, nearly 20 hospitals were operating with the first version of this system.⁶⁹

In 2007, SSA started developing the Mexican electronic medical record⁷⁰ regulation in order to establish electronic health record system requirements encompassing interoperability, processing, interpretation and information security. The Ministry of Health proposed the components of the interoperability model to be implemented in six phases between 2007 and 2012.

The Government Workers' Social Security and Services Institute (ISSSTE)

The Government Workers' Social Security and Services Institute (ISSSTE) has extensive experience in the area of electronic health which goes back several years. The institute implemented the use of ICT in: (a) the Integrated Medical Information System (SIIM) that has been used to control statistical information generated at the three medical care levels since 1991; (b) the Automated Detection and Diagnosis Clinic (CLIDDA) which started operations in 1975 using automated medical records; (c) Hospital 20 de Noviembre, which implemented the hospital information system (SIAH) in 1995; and d) the Automated Clinics System pilot project in 1996, designed to automate the Family Medicine Clinics (CMF) in Xochimilco and eight clinics in the Federal District.

In 1995, ISSSTE launched the first institutional coverage telehealth programme. The programme was based on the use of satellite technology in order to reduce the cost of transporting patients to specialized and highly specialized centres concentrated in the principal cities of Mexico. Until 2007, this institutional network was used to conduct speciality interconsultation between 11 general hospitals and hospital clinics, 6 regional hospitals and 20 de Noviembre National Medical Centre. Distance learning services were also provided over this period. In 2007, the programme started a new stage by incorporating digital technologies at medical units of the three care levels, thus increasing the network to 177 units. Its main objective was to increase speciality service coverage and reduce unnecessary patient referrals.

⁶⁸ This was carried out by creating a community of developers stemming from the Ministry of Health: the Shared Institutional Software Programme.

⁶⁹ Implementation was completed in approximately 18 months and included staff training and retrofitting.

⁷⁰ Using (P-NOM) PROY-NOM-024-SSA3-2007.

The Mexican Social Security Institute (IMSS)

The Mexican Social Security Institute (IMSS) has a Family Medicine System (SIMF)⁷¹ that supports register and management of medical care at first level units. This system was developed in 2002 with the Engineering Faculty of the National Autonomous University of Mexico (UNAM) and was launched one year later. It is designed for family doctors, medical assistants, laboratory staff, X-ray staff, stomatologists⁷² and administrative staff in these units. The system enabled the statistical information from the first level units to be integrated into the Integrated Health-care Information System (SIAIS). In 2004, improvements and support were incorporated into the system for carrying out outpatient consultations for second and third level hospital units.

Hospital medical care processes including emergencies, are supported by IMSS, the Hospital Outpatient Information System (SICEH) and the IMSS-VistA Hospital Information System. In addition, hospital and specialized medical care services are supported by the Digital Imaging System, which facilitates storage and viewing of medical images in the DICOM standard. Systems that support auxiliary diagnosis and treatment services, such as clinical laboratories, blood banks and hemodialysis, are integrated by means of the electronic medical record using messaging based on HL7 version 3.0. In 2007, IMSS electronic medical record enabled the integration of medical notes, orders and auxiliary diagnosis and treatment results, hemodialysis, disabilities, stomatology, pharmacies and the medical agenda, among others. IMSS faces the challenge of integrating the wide range of systems that support medical care at different levels with the lowest costs and level of modifications into present applications.

Furthermore, in 2006 IMSS started operating the Digital Hospital that electronically integrates hospital services including critical areas and nursing. At administrative level, it facilitates monitoring of daily activities and productivity of the hospital. Indeed, the initiative to adopt electronic medical records at this institution is identified as a valuable intervention in its modernization plan and improvement processes.

Petróleos Mexicanos (PEMEX)

The Mexican State-owned petroleum company Petróleos Mexicanos (PEMEX) has focused on the management of sensitive areas including expenditure and accounts by means of the Institutional Pharmacy Management System (SIAP)

⁷¹ The main modules are appointment agendas, comprehensive care, PrevenIMSS (a health prevention programme), stomatology (odontology) and auxiliary diagnostic services.

⁷² This speciality is equivalent to odontology.

associated with the Institutional Hospital Management System (SIAH). This ensures centralized administration and generates pharmacy supply orders on a weekly basis. The digital prescription was operational at 44 medical units in 2006. The SIAH medical care module was connected with 11 Therapeutical Diagnosis Guides⁷³ in a readable interactive version for supporting diagnosis and treatment.⁷⁴ In addition, PEMEX has made important investments in the development of institutional electronic medical records.

The Ministry of National Defence (SEDENA)

In 1997, the Ministry of National Defence launched speciality units which incorporated a computer management system. From 2006 to 2008, it implemented the Women's Health Clinic Hospital Computer Management System (SIAHCEM) project. This project was made up of 32 modules which support outpatient appointment management and control the management of medication at the warehouse, pharmacy, hospital wards, administrative procedures and use of medical files.

National institutions and highly specialized reference and regional hospitals

The National Rehabilitation Institute (INR)

In 1997, the National Orthopedics Centre (CNO), currently known as the National Rehabilitation Institute (INR), began to explore ICT health care projects. The institute initially adopted an electronic medical record that enabled the control of medical agendas, thus facilitating management control and reducing waiting time for an appointment. This record has gradually been incorporating clinical and imaging areas.

In 2000, CNO had Automatic Hospital Information System (SAIH) outpatient appointment, clinical file, emergency, nursing and hospital admission modules. It incorporated telemedicine services that same year, becoming a pioneer in supporting medical teaching by means of videoconferencing. The administrative area systemization process started in 2003. INR continued integrating ICTs into its operations in 2009.

⁷³ Systemic arterial hypertension, diabetes mellitus, dispepsia, spastic colon, depression, dislipidemia, lower back pain, osteoarthritis, obesity, upper respiratory tract infection and urinary tract infection.

⁷⁴ Of mental health, diabetes mellitus, lifestyles, lower back pain and systemic arterial hypertension.

Bajío Highly Specialized Regional Hospital (HRAEB)

The Bajío Highly Specialized Regional Hospital (HRAEB) was founded in 2007 and since it was launched the Ministry of Health incorporated a management model based on a hospital information system implemented in Spanish health-care services. It is based on an enterprise resource planning (ERP)⁷⁵ system that features several business intelligence and clinical management modules, among others.

The National Institute of Respiratory Diseases (INER)

The National Institute of Respiratory Diseases (INER) finished installing its internal computer network between July and September 2004. In addition, it started implementing the Hospital Management System, a project designed to gain complete control of hospital operations, while cutting operating costs and helping to improve the quality of medical care services. INER also considered integrating its administrative and substantive medical areas by means of Government Resource Planning (GPR).⁷⁶

In 2006, the Hospital Management System was implemented which continually updated the web platform and was run as a pilot test in emergency services. GRP, the hospital information system, RIS-PACS imaging and laboratory services centralized their data in a single database.

The Salvador Zubirán National Institute of Medical Sciences and Nutrition

The hospital system developed by the institute's informatics department partially supports its operation, which is made up primarily of surgery, operating room, interconsultation, electronic record, medical note, laboratory and imaging modules.

The National Cancer Institute (INCan)

This Institute developed its electronic record system known as INCAnet between 2003 and 2008. In 2006, the system consisted of 40 different modules and by late 2007 there were nearly 400 computers connected to the network

⁷⁵ Enterprise Resource Planning. An ERP system contains information about the planning and manufacture control system, marketing, sales and finance, as well as communication with customers and providers.

⁷⁶ Government Resource Planning is a tool that seeks to make resources used for Government activities efficient.

with access to the electronic record, which included different integration levels with laboratory, pathology and X-ray services.

The National Institute of Perinatology

According to the institute's transparency portal, there was a significant investment in resources for the development and implementation of electronic clinical records in 2008.

The National Institute of Pediatrics

In 2006, the Institute began evaluating possible technological solutions for integrating hospital services and management systems. In 2007, the Institute began adopting electronic medical records for the 175 services offered.

Manuel Gea González General Hospital (HGMGG)

This hospital has been gradually incorporating information technology since 1996. A system for managing payrolls and partial inventory control systems was introduced in different areas (general goods, pharmacy, clothing, stationery and supplies) between 1998 and 1999. In 2005, the HGMGG started to implement software that facilitated management duties at the hospital (SIGHO). Until 2006, the system controlled general patient data, the date and at which service the patient entered, but did not incorporate medical care processes into medical records.

The National Transplant Centre (CNT)

In 2003, the National Transplant Centre (CNT) automated the national waiting list in response to the need for timely and reliable information in order to make organs available for transplant at national level. To do so, the centre drew inspiration from the experience of transplant services at the Salvador Zubirán National Institute of Medical Sciences and Nutrition.

Public services in the federal states

Implementing ICTs in public health services was initially designed for administrative management, as was the case in the private sector and social security. The use of electronic medical records has been limited. A number of

pilot programmes in the field of telemedicine have been launched and some of them have been integrated into health services. Some telemedicine programmes noteworthy of mention are those in the southern region of Mexico, in Chiapas and Yucatán and in Nueva León in the north of Mexico.

The State of Aguascalientes

From 2004 to 2006, the Institute of Health in Aguascalientes (ISEA) executed a project to improve processes, known as the Integrated Health Management System and, at the same time, adopted electronic medical records.⁷⁷ The system integrated federal health programmes,⁷⁸ and provided a productivity and medication supply report for all automated units on the principal illnesses detected, data on diabetics, hypertense patients and expectant mothers, information about studies and diagnostic supports, administrative information, care reports for patients insured by IMSS or ISSSTE and follow-up for patients referred.

The State of Chihuahua

In 2004, the Coordination of Development and Modernization of the State of Chihuahua indicated that electronic medical records had been implemented at the Children's, Central, General, Zubirán and Women's Hospitals. The information and communications technology system for health had three fundamental parts: electronic records, a hospital care system and telehealth. The state telehealth network is focused on medical micro-units located in la Sierra in Mexico and provides care for the indigenous population.⁷⁹

The State of Nuevo León

The Nuevo León State health services started a Telemedicine Programme in 2001 in order to address the scarcity of medical specialists. They launched the Penitentiary Telemedicine Programme in 2005, which included three state social rehabilitation centres.

⁷⁷ During this period, all outpatient consultation services at second level hospitals and 90% of the first level urban clinics made use of electronic medical records.

⁷⁸ Seguro Popular, Línea de Vida, Oportunidades, the Federal Commission for the Protection against Sanitary Risk (COFEPRIS), SIS quality indicators and statistics.

⁷⁹ In 2004 this featured a network comprised of 64 health microunits and work was done to establish a call centre service including chats and forums attended by a group of consultant physicians.

The State of Puebla

The first attempts to provide medical care and distance learning services in the State of Puebla were made in 2003. The initial services network included six general hospitals and four comprehensive hospitals.

The State of Colima

The State developed the Colima Medical Record Management System (SAECCOL) in conjunction with the Seguro Popular Programme.⁸⁰ Electronic medical records were first implemented in 2006 at hospitals employing the Hospital Management and Medical System (SIMAH) project. The Ciudad Guzmán Hospital started a pilot programme and in 2008 was operating the Tepatitlán, Puerto Vallarta, and La Barca Hospitals, as well as the Tala Women's Hospital. The system is designed to capture and consult medical/hospital records and facilitate administrative tasks at these hospitals.⁸¹

The State of Sinaloa

Sinaloa is probably the State programme whose electronic medical records have the greatest coverage and support. The informatics department of the State Ministry of Health developed the Medical Record System known as SiEC which was implemented and adopted at all first level State units in 2003.

In 2005, the Directorate General of Health Information (DGIS) of the Ministry of Health, together with Sinaloa State health services, promoted the development and implementation of the Hospital Management Information System (SIGHO) at Culiacán General Hospital. SIGHO⁸² was the result of the development of the SiEC initiative. Based on the results obtained at Culiacán General Hospital, SIGHO was established the management information system for the Ministry of Health hospitals at national level.⁸³ In January 2008, there were 1,519 health-care units with at least one SIGHO module,

⁸⁰ This is made up of four modules: first and second level outpatient consultations; first and second level agendas; configuration and statistics management; installation tools.

⁸¹ The system consists of three administrative modules and operative modules that include hospital admission, medical clinical record, blood bank, cash office, outpatient consultation, costs, nursing, laboratory, pharmacy, operating room, social work, emergencies, catalogues, security and interfaces.

⁸² Until January 2008, the SIGHO consisted of 12 modules: agenda, admission, hospitalization, tocosurgery, surgery, social work, laboratory, pathology, blood bank, cash office, switchboard and pharmacy.

⁸³ In 2005, the State of Jalisco adopted SIGHO at first level health-care units and is currently installing another five units. In March 2010, the State of Guerrero health-care services website reported the use of SIGHO at seven state hospitals and five health-care centres. The modules currently operating at the state health-care services and at different levels are: agenda, outpatient consultation, imaging and laboratory, admission, emergency, hospitalization, tocosurgery and social work.

2% of which provided some form of inpatient services, while the rest were primarily first level care units.

The State of Veracruz

The State health services developed the Comprehensive Health Care Management System (SIGAM).⁸⁴ The system was designed to integrate patients' electronic medical records and support medical care management. The programme started in 2006 and was implemented in 2008 and it is used at 2 hospitals and 36 primary care units located in the jurisdictions of Coatzacoalcos and Poza Rica.⁸⁵

Private health care services and e-Health

Private health-care institutions in Mexico have incorporated ICTs as they are a form of improving control of administrative management and they make cost-beneficial developments. The applications which are most often implemented by these organizations are Laboratory Information Systems (LIS) and Radiology Information Systems (RIS).

At present, local software development companies, which have limited training in the area of health care and process analysis, and distributors of systems developed overseas are catering for the laboratory information management systems (LIMS) market needs in Mexico and Latin America. For this reason, functionality of these systems is limited to meeting basic operational needs and they are not flexible enough to adapt to the specific processes of each laboratory. Furthermore, their development and implementation are generally complicated, slow and expensive, even when they do not interact with other systems.

CARPERMOR

As regards automated laboratory services in the private sector, perhaps the most relevant example is Grupo PROA which supports CARPERMOR reference laboratory operations and Chopo Medical Laboratories (Laboratorios Médicos del Chopo) services. The company started to develop its own LIMS in 1998, replacing the outsourced system that was inconsistent, expensive to operate

⁸⁴ The SIGAM consists of agenda, outpatient consultation, emergency, hospitalization, admission and social work modules. In addition, the Veracruz health-care services system platform includes a health-care intelligence system, virtual desk and 2.0 web knowledge portal.

⁸⁵ In September 2008, the Ministry had 50,000 electronic medical records.

and lacked local technical support. The company started to provide services to its customers online and in real time in 2000.

The ABC Hospital

The ABC Hospital is considered one of the most technologically advanced private institutions, with special emphasis placed on the use of telepathology and digital medical imaging services.

Torre Médica Hospital

The surgical services at this health centre stand out since they are supported by surgical robots and telepresence, which enable surgeons to perform and lead remote procedures from operating rooms and inpatient wards.⁸⁶

Universities, research centres and NGOs

Universities and NGOs provide health-care services using ICT. Not only are ICTs used for telemedicine, but they have also created their own electronic medical record systems. To do this, they require infrastructure and they generate technological models.

University Corporation for Internet A.C. and Internet2 Development (CUDI)

This corporation was established in 1999 to encourage cooperation between national and international projects on the Internet2 network. Since it was launched, it incorporated several universities that had faculties of medicine. In 2006, it created the Virtual Network that integrates 14 national health-care institutes. This network was used to develop health-care projects that require informatics resources based on Internet2 at national and international universities and health-care institutes.

⁸⁶ The resources and services are the result of work carried out by Dr. Adrián Carbajal, one of the pioneering doctors in the field of robotic surgery. He has directed the Da Vinci and Zeus projects with headquarters in Mexico City since 1996.

Anáhuac University

The Anáhuac University⁸⁷ Telemedicine Programme started in 2002, making use of mobile units for slums in the regions of Costa Chica in the State of Guerrero and Sierra Mixteca in the State of Oaxaca and providing services following Hurricane Stan and Hurricane Wilma. The specialities supported by telemedicine in this programme are gastroenterology, nutrition, internal medicine, surgery, pediatrics and gynecology.

Meritorious Autonomous University of Puebla (BUAP)

The Meritorious Autonomous University of Puebla (BUAP) started using telemedicine in 2002, setting up a satellite network that supported several virtual health-care programmes with national and international coverage. At the same time, the university installed teleclinics and operating rooms designed for telesurgery. The Electronic Medical Record Programme was incorporated into the Telemedicine Programme in 2004. In 2005, the Telemedicine Programme was incorporated into the Faculty of Medicine at the university and subsequently into the UNAM National Videoconferencing Network in 2006. Since 2007, the university has been actively participating on the inter-agency e-Health committee and it launched the Telemedicine and Telehealth Graduate Diploma Programme in 2009 in conjunction with the Open University of Catalonia (UOC). The programme had three teleclinics in the communities of Libres, Chignahuapan and Tehuacán in 2009, which were interconnected for specialist teleconsultations with the reference telecentre at the BUAP Faculty of Medicine. At present, the Faculty of Medicine at BUAP offers telescreening, telemonitoring and preventive telemedicine services. In addition, the university hosts an annual videoconference-based health-care distance learning programme.

The Autonomous University of Nuevo León (UANL)

The Autonomous University of Nuevo León (UANL) has developed its telemedicine programme by means of the University Hospital and its University Health-care Programme. In 2007, the programme had cable, fibre optics, microwave, ISDN and IP telecommunications systems. These interconnect five university clinics, four health-care centres, an IMSS family medicine unit and the state-managed Children's, Psychiatric and Metropolitan Hospitals, a dental unit, an IMSS specialities clinic, two university auditoriums, the State Secretariat public telemedicine network and the Esquipulas Clinic

⁸⁷ The entity is now known as Altius Foundation.

in the State of Chiapas. These are currently interconnected with national videoconferencing networks in the United States of America, Central America and South America. In 2007, teleconsultations were carried out for 17 health specializations and 21 subspecializations, providing teleconsultation services to three penitentiaries. The university has signed agreements with other States in order to provide health-care distance learning, particularly in Chiapas where nurses at highly specialized hospitals are trained.

National Polytechnic Institute (IPN)

Over the past decade, the National Polytechnic Institute (IPN) has helped to train health-care professionals by means of continuing education programmes. In 1999, the Directorate of Distance and Continuing Education (DECyD) launched distance medical education programmes, including graduate programmes, courses, conferences and certifications. Staff from the principal hospitals in Mexico, in particular Hospital Juárez de Mexico Association of Surgeons, has been working with the IPN since 2000. Until 2008, over 5,000 doctors and health-care professionals had participated in these programmes. At present, the IPN has 30 offices that make up its healthcare continuing education programme. Access to programme sessions is provided through streaming and the EDUSAT network.

Centre for Research and Advanced Studies of the National Polytechnic Institute (CINVESTAV)⁸⁸

The General Office for Information and Communication Technologies at this centre set up the initiative to become involved in the information society and has executed some projects relating to electronic medical records and their interoperability.

National Autonomous University of Mexico (UNAM)

This university is the most important in Mexico and its Faculty of Medicine (FM) participated in the development of e-Health by means of teaching and researching in the area of health and medical informatics.⁸⁹ The university is

⁸⁸ The centre's mission is to "contribute to the development of society through advanced scientific and technological research and the formation of high quality human resources".

⁸⁹ In 2007, the Faculty of Medicine had over 1,000 connection nodes to the UNAM network with a 1GB bandwidth. Its distance learning development and evaluation platform was based on *Moodle*. The faculty created the open correspondence course on medicine in 1979 and it broadcast medical programmes on a public television channel in 1984. In 1988, the faculty started national seminars with the medical refresher training series *Allis Vivere* broadcast by satellite television. The first online degree programme

a pioneer in promoting the speciality of medical informatics and courses on decision analysis and medical computer science in Mexico.⁹⁰

National Council for Science and Technology (CONACYT)

In recent years, the National Councils for Science and Technology and the Federal Council have encouraged the development of new technological networks for e-Health and ICT clusters, with a view to making multi-sectorial agreements on e-Health research projects a common practice. Among its objectives, CONACYT has considered creating online health-care education programmes for both the non-insured population and medical and paramedical areas.

Several initiatives have received CONACYT funding. For example, in 2004, the council collaborated on lines of research, teaching and assistance in teleassistance, teleclinic and teleconferencing projects led by South Medical Foundation (Fundación Médica Sur⁹¹). In 2006, the council provided support for the first telemedicine pilot project at Hospital General del Valle de Chalco Dr. Fernando Quiroz Gutiérrez and a telecare pilot project with eight patients. From 2007 to 2009, CONACYT helped to integrate medical devices with specific videoconferencing equipment using Med2VC software. At present, the council is working with the Ensenada Centre for Scientific

was executed in collaboration with the General Directorate for Epidemiology. The first online medical refresher training course "Anxiety disorders in general medical practice" was held in 2003. The faculty directed the clinical-therapeutical refresher training course as an interactive videoconference in 2004. In 2006, it introduced video on demand for conferences on the Medical Knowledge Processing course. Finally, in 2006, streaming services were launched with the gastroenterology refresher training course for general physicians (Márquez and Calderon, 2007).

⁹⁰ In 1985, a project was launched to set up the speciality of medical informatics at the Arturo Rosenblueth Foundation. This initiative led to the speciality of artificial intelligence in medicine. In 1990, the First Medical Informatics Convention took place at the UNAM Faculty of Medicine and in 1996, the first informatics graduate course applied to medical decision-making was launched. In 1995, computer science was added to the university's medicine curriculum to encourage medicine students to make use of databases and data banks such as Medline, Hemerobiblioteca and the national digital library of medicine. That same year, the School of Medicine at Jalapa University in Veracruz launched the first master's degree in artificial intelligence with a subject dedicated to medicine. The first graduate diploma programme in informatics applied to health care was offered in Tepic, Nayarit in 1997, with the participation of UNAM professors. In 1998, the Virtual Hospital project was launched to commission a team of specialists who would work online answering questioned asked by medicine students, doctors and patients. The specialities considered were pediatrics, obstetrics, gynecology, surgery, internal medicine and toxic substances control. In 2001, the UNAM collaborated with its Foundation in order to provide computer equipment to 43 hospitals that form part of the Faculty of Medicine teaching headquarters and the first Internet connections in the hospital setting. In 2010, the UNAM Faculty of Medicine, with support provided by the General Directorate for Academic Computing Services (DGSCA), established a 3D modelling laboratory in order to provide teaching tools for the university medical community. The Faculty of Medicine has developed 46 models for the anatomy, cellular and tissue biology, biochemistry, Centre for Surgical Teaching and Training, pharmacology, physiology, microbiology and parasitology departments.

⁹¹ The Foundation performed biomedical research and provided teaching, medical and social assistance.

Research and Higher Education (CICESE) on the Telemedicine Technology Transfer Project.

The National Institute of Public Health (INSP)

The National Institute of Public Health (INSP) was founded in 1922 and is one of the leading health-care research and education centres in Latin America. The institute launched its first Virtual Education Programme in 2005, aligning its objective to generate knowledge and innovation in health systems with human resources training for public health care. This programme offers professionals in remote areas, who wish to complete graduate programmes or refresher training courses, a number of educational alternatives.

The INSP has a geographical information system which is designed to be the access and visual interface for statistical information from the Centre for Collection and Analysis of Health Information (NAAIS). This centre uses a number of information sources, for example, demographic information from national censuses, economic data from income and expenditures surveys and social information from marginalization and health indicators obtained from national surveys.

The Autonomous University of Guadalajara

In 1997, the Department of Medical Informatics, together with the Civil Hospital of Guadalajara, started operating through the University Centre for Health Sciences. The first International Telemedicine Symposium was carried out in February 2010.

Panamericana University

In 2006, the university launched its first telemedicine initiative through the International Telemedicine and Innovation Symposium. It also created the Rural Generic Telemedicine Project (PROTEGER) and electronic medical record at a rural clinic in the State of Mexico. The First International Symposium on Virtual Medicine was held in 2009.

Autonomous University of the State of Mexico (UAEM)

The Virtual Diploma in Management of Electronic Medical Record Systems was launched in 2009 with the support of the UAEM Fund for Promotion and Development of Scientific and Technological Integration and the Ministry of Health General Directorate for Health Information (DGIS).

University of Colima

The university helped in the field of learning material and immersion in the medical area and online programmes.

Metropolitan Autonomous University

This university participated in the development of ICT in health care by means of specialized research at the National Research Centre in the area of medical instrumentation and imaging at the Iztapalapa⁹² unit headquarters.

e-Mexico

In 2000, the Government created a public policy designed to incorporate Mexico into the information and knowledge society. The *e*-Mexico National System was established as part of the 2001-2006 National Development Plan. This system aimed to bridge the existing digital divide and increase the country's competitiveness. Following the same line of work established by the *e*-Mexico system, the Ministry of Communications and Transport (SCT) signed intersecretarial connectivity agreements with the Ministries of Public Education, Health and Social Development, the National Institute for Adult Education and the Municipal Development Centre.

The e-Health Action Programme

As a result of the aforementioned public policy and considering the 2001-2006 National Health Programme, the Ministry of Health and the *e*-Mexico National System created an intersectorial working group to develop the first e-Health Action Programme. This group gave rise to the present Inter-agency e-Health Committee, which seeks to connect and integrate initiatives and stakeholders from the public and private health-care sectors interested in the development of e-Health.

The 2001-2006 e-Health Action Programme considers the use of ICT for medical care, public health, research, training, teaching and management of health-care services. The main objective of this programme is to increase health-care service efficiency and coverage, while making it available in the

⁹² The centre is made up of a number of laboratories designed to house instruments and infrastructure related to medical imaging and instrumentation. Its objective is to support research, human resources training and academic-corporate-health sector association for high impact projects in the field of biomedical engineering.

remotest regions without sacrificing quality and offering specialized online services that are affordable for the whole population.

Digital Community Centres (CCD)

One of the first actions executed by the *e*-Mexico National System was to provide Internet connectivity to support services for the different initiatives and sectors involved through the Digital Community Centres (CCD) network. In the case of health care, health centres located in rural communities were incorporated into the Internet satellite services network, highlighting the deployment of medical units belonging to the IMSS-Oportunidades programme. The health-care sector had 1,025 CCDs in 2007.

The e-Health Portal

Part of the *e*-Mexico National System's mission is to bring health care access closer to the citizens through the *e*-Mexico Portal. The portal is made up of four pillars: eGovernment, eEconomy, e-Health and e-Learning. It also included two major areas: DiscapaciNET⁹³ and *e*-Migrantes.

The e-Health Portal was created in 2003 and its aim was to keep the population informed of activities promoting and preventing damage to health, as well as supporting government procedures and management of health-care issues. In 2006, the e-Health Portal had become the official portal for the *e*-Mexico National System with the highest number of page views and the second most important portal in terms of overall contents available.

Legal framework

Several adjustments have been made to the legal framework in Mexico to enable the use of ICTs in the health sector. These amendments include different institutional and federal aspects relating primarily to the recognition of transactions and electronic signatures. However, security and confidentiality issues are yet to be reinforced.

First, IMSS put forward a number of reforms and additional regulations to the Social Security Law, which aimed to promote the practice of eGovernment. In 2001, the Congress adopted a new legal framework which

⁹³ The *e*-Mexico National System launched the DiscapaciNET Portal in 2003 to provide anyone with a disability, as well as their families and the population in general, with information and guidance about different disabilities, prevention, treatment, services, specialized doctors, establishments for sale and rental of aid equipment and devices.

gave legal validity and credibility to electronic transactions, patient electronic medical records, electronic signatures and written signatures, the population registration code (CURP) and identification numbers for all beneficiaries.

In 2000, the General Directorate for Information Technologies (DGTI) of the Ministry of Health created a regulation for the development of systems, in which it ensured the availability of source codes and licenses for the different informatics developments of the institution, their guidelines and the safeguarding of informatics resources, including software programmes.

The Official Mexican Standard (NOM) for medical records dates from 1999 and has undergone changes since the use of electronic devices was recognized as an auxiliary service for storing health information. In 2003, autonomous use of these devices was approved following further opening-up. The latter is always subject to compliance with legal provisions applicable. Amendments made to NOM that same year included privacy issues (discretion and confidentiality), as well as access to medical records.

As regards the law, NOM-024 included a plan to assess the impact of medical records on privacy and it was directed by the Federal Institute for Access to Public Information (IFAI). The plan was published in the Official Gazette in March 2010 and it evaluated primarily the functionality of electronic medical records and the minimum data recorded. It included the use of simple electronic signatures and in the case of interoperability services, it required the use of digital certificates.⁹⁴ Within this framework, IFAI proposed amendments to Article 16 of the Political Constitution of the Mexican United States relating to privacy. It protects citizen's rights to their personal data, and includes exceptions for national security reasons, public order and provisions, public security and safety, or for protecting the rights of third parties.

Discussion

Mexican health-care institutions adopted information systems first in administrative and research areas, and later in epidemiological surveillance, statistics and teaching.

Telehealth has experienced greater development in the private sector, particularly in the areas of teleradiology, telepathology and distance learning. These are mature telemedicine applications that are not very complex and do not require any major interaction between professionals and patients.

⁹⁴ It was estimated that it would take 60 days for the plan to take effect and achieve aims.

For the private sector, ICT supply is in the international market. Supply is very seldom domestic and is partly concentrated on the electronic clinical record (ECR⁹⁵). ICT infrastructure in private sector medical care units is heterogeneous. There are hospitals that make intensive use of technology, such as Torre Médica Hospital, the ABC Hospital, Hospital Médica Sur and the Hospitales Ángeles network.

The social security system has incorporated ICT by means of domestic and international market supply. However, the international market mostly features tailor-made solutions, especially in the case of information systems and technology for telehealth and telemedicine.

The Mexican Social Security Institute (IMSS) has gained extensive experience in the design and use of EHR in order to improve administrative management. The IMSS has started operating, despite the fact that legislation has not yet been fully developed, and it has created its own security framework for both patients and doctors. Similarly, the Government Workers' Social Security and Services Institute (ISSSTE) also has information systems designed for administrative management. The case of EMR in ISSSTE is quite specific in that it was generated based on needs detected and coordinated by the technological and financial departments, and not by the medical department.

Despite the fact that comprehensive application of ICTs achieves the best results, this has not been the standard for establishing these technologies in Mexican public medical care. There has not been any prior planning and new applications have been partially implemented from below. The usual practice has been the introduction of computer equipment, followed by the assessment of critical problems and then stressing the need to integrate the scattered processes.

Lastly, the use of EMR in Mexico can be expanded much more than what has been done so far.

⁹⁵ An acronym for the electronic clinical record, which is another name for the electronic health record.

Background information on Mexico Social Development Division, ECLAC, United Nations

Although Mexico is highly urbanized (78.03%), it has not reached the regional average. The country has one metropolis that concentrates 18% of the population and 19% of the country's inhabitants live in 11 large cities.

Mexico's overall fertility and mortality rates are low. The country is currently in an advanced stage of demographic transition, despite the fact that the population's natural growth rate is similar to that of countries completing demographic transition. Among other factors, this is because the country's average life expectancy at birth for both sexes is over 76 years. The country's overall dependency ratio was 56.9 in 2005 (CELADE, 2006).

As regards the epidemiological profile, the principal causes of mortality in Mexico are diabetes mellitus and ischemic heart disease, although perinatal conditions also have a significant effect on the mortality rate.

Within the framework of the Millennium Development Goals, Mexico has advanced 80.2% in terms of its target for reducing the percentage of persons living in extreme poverty. This percentage dropped from 18.7% in 1990 to 11.2% in 2008 (United Nations, 2010).

As regards the Millennium Development Goals relating to health, the under-five mortality rate in Mexico decreased from 44.2 per 1,000 live births in 1991 to 18.9 in 2009 (United Nations, 2010), advancing significantly towards the goal of reducing this rate by two-thirds between 1990 and 2015. The principal causes of death related to certain disorders stemming from the perinatal period and congenital malformations, deformities and chromosomal anomalies (Government of the Republic, 2005).

As for the Millennium Development Goal that refers to maternal health, significant progress has also been made, although maternal mortality has not yet been reduced by three-quarters. This rate dropped from 72.6 per 100,000 live births in 2000 to 57.2 in 2008 (United Nations, 2010). Although there has been progress, additional efforts are still required. According to the figure reported in 1990 (89 per 100,000 live births), the goal of reducing this rate by three-quarters has not yet been reached (Government of the Republic, 2006).

74.4% of all births in 2005 were assisted by specialized personnel. This figure increased to 93.4% in 2006, even though there were still major differences throughout the country's inland regions (Government of the Republic, 2006).

Source:

CELADE, 2006.

Government of the Republic (2005). Millennium Development Goals: Mexico's Progress Report 2005. Ministry of Human and Social Development. ISBN: 968-838-606-5. Mexico Federal District.

Government of the Republic (2006). Millennium Development Goals: Mexico's Progress Report 2006. Ministry of Human and Social Development / Inter-secretarial Commission for Social Development. ISBN: 968-838-636-7. Mexico Federal District

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

IX.

The National Telemedicine and Telehealth Programme in Panama

*Silvio Vega*⁹⁶



Panama is a country of major socioeconomic contrasts and it has a population of 3.49 million inhabitants, 10% of whom are indigenous. Panama City is highly developed, but there are areas of extreme poverty within neighbouring rural areas. The country suffered the effects of a 21-year military dictatorship, which generated poverty, social lags and corruption. With the return of democracy in the 1990s, Panama restarted working towards becoming more developed and it recovered in a relatively short time. Despite this, the country still shows evidence of major inequalities in resources and the quality of urban and rural health services.

Although Panama was one of the last countries in the region to implement the use of information technologies and although cellular telephony was implemented only 15 years ago, mobile telephony⁹⁷ and personal computers are now used and accepted on a massive scale.

Telemedicine was first used in Panama in 1999 when the Faculty of Medicine of the University of Panama created the Medical Documentation and Information Centre (CDIM). The centre used a fibre-optic ring, which

⁹⁶ Silvio Vega was President of the American Telemedicine Association, Latin American and Caribbean Chapter (ATALACC) until 2010.

⁹⁷ At present, the mobile telephony penetration rate in Panama is 165%, with 6 out of every 10 people owning two cellular phones.

Consulted on the 27 May 2010 at http://www.prensa-latina.cu/index.php?option=com_content&task=view&id=188925&Itemid=1

had already been installed in the city by a private company, to conduct a pioneer thesis on teleneurophysiology using an ATM network. The principal objective was to prove the feasibility of telemedicine in Panama.

In 2000, a meeting was held with a group of professionals from the Arizona Telemedicine Program (ATP). The ATP was subsequently awarded as the best telemedicine programme in the United States of America. Later, they held the first National Telemedicine Meeting, an event which led to the National Telemedicine Project, which aimed to develop an inter-agency plan.

Health care in Panama is regulated by the Ministry of Health (MINSA), but Caja de Seguro Social (CSS) is the institution that contributes the most to the social security system. CSS provides health-care coverage for nearly 75% of the country's population. Both of these institutions were involved in the National Telemedicine Project. To start, two local sites were implemented in Panama City, one for teleradiology and another for telepathology. These applications were later installed at three remote sites in the south and northwest of the country.

In 2002, work was started on the legal aspects. Ministerial Decree 472 on telecommunications was adopted on 6 August of the same year. Under this legal framework, CSS and MINSA started to consider in greater depth the development and function of telemedicine in the country. CSS led the actions and started to implement teleradiology and telepathology.

By 2005, the programme had grown and the National Telemedicine and Telehealth Programme (PNIT) was implemented. As a result, a new version of Decree 472 was adopted and the Rural Telemedicine Programme, the Teleradiology Programme and the Telemedicine Programme were created. The latter was aimed at the penitentiary population.

The Rural Telemedicine Programme

The Rural Telemedicine Programme was implemented in a territory lacking health-care services and featuring highly precarious health indicators. The territory's inhabitants are distinctly indigenous. This programme was based on the creation of a local surgery at the San Félix Hospital, which was connected by microwave to six remote sites located near the central range: Hato Juli, Hato Chamí, Llano Ñopo, Cerro Iglesias, Alto Caballero and Altos de Algarrobo.

At present, this hospital has 47 beds, 10 cots, a delivery room, an operating theatre, a digital X-ray machine and a pharmacy. Its medical staff includes a pediatrician, an obstetrician/gynecologist, three general

doctors, three nurses and three auxiliary nurses. Rural telemedicine is used to provide tele-obstetrics services for pregnancy check-ups,⁹⁸ vaccinations and telepediatrics. Telepediatrics is used to provide care and follow-up monitoring for newborns.

One of the six remote sites is the Hato Juli Health Centre located 10 km from the consultation site. Access roads to the centre are in poor condition and the centre provides health care for a population of nearly 1,000 distributed over a large area. The health centre employs one general doctor, one nurse and three auxiliary nurses. It has electric power, but no telephone line.

Secondly, the Cerro Iglesias Health Centre is 16 km from San Félix Hospital and covers a population of 3,300. The centre does not employ a doctor or a nurse, but has health-care assistants who are local to the area. Unfortunately, although these assistants have acquired some medical knowledge, the quality of the service they provide is poor. There are no telephone lines or electric power at Cerro Iglesias and therefore solar panels and storage batteries were installed in order to implement this service.

The third location is Hato Chamí. This health centre is located 43 km from San Félix Hospital, almost at the top of the mountain range that divides Panama, the Pacific Ocean and the Atlantic Ocean. The population in this area is distinctly indigenous.

A very simple system with a video telephone and touch screen was installed at the aforementioned centres, for ease of use by people unfamiliar with this technology. The device is multifunctional and adaptable to medical peripherals, such as an electronic stethoscope. The stethoscope bell is adapted to the video telephone at the remote site and headphones to the local video telephone so that the doctor can turn up the volume and distinguish cardiac and pulmonary sounds.⁹⁹

To establish the communications network, microwave radios with a substantial bandwidth were connected over IP to a video telephone. This system was used to transmit video, voice and sound data without the need of a computer. It is a point-to-point connection and although it could be multipoint, the disadvantage of multipoint connections is that they require a direct line of sight, which limits communication.

⁹⁸ This medical check-up is very important in that it significantly reduces newborn mortality. Under this system, expectant mothers are obliged to have check-ups during pregnancy. However, the first check-up is performed by the health-care assistant and the second by an obstetrician via teleconsultation.

⁹⁹ Pulmonary sounds are one of the many examples of remote stethoscope use and this has enabled studies to be carried out on patients with asthmatic crisis. In the past, patients with this condition had to travel to San Félix Hospital for treatment. At present, the doctor at this hospital centre teaches health-care staff how to perform inhaler therapy and thus the patient does not have to travel. Notably, teleconsultation has reduced visits relating to bronchial asthma, one of the population's most common disorders.

In addition, towers had to be built at each site to ensure that the communication antennas were wind-resistant. The most suitable location also had to be determined before installing solar panels to feed into or to charge storage batteries.

This technology has been well accepted in the sector and physicians are able to use the telemedicine clinic whenever they wish to do so. However, the physician at each clinic works alongside a witch doctor or shaman who uses his or her own health-care resources. The shaman often attends more patients than the physician, which suggests that the adoption of telemedicine does not necessarily imply abandoning local beliefs.

One of the lessons learned from this rural telemedicine project is the need to engage medical, paramedic and administrative personnel, as well as the community leader, whose participation is especially important in order to encourage inhabitants to visit the health centre and make use of telemedicine services.

The Prison Telemedicine Programme

Conditions at prisons throughout the region are generally precarious. The population of prisons often triples or quadruples design capacity and they are not prepared to properly care for prisoners' health needs.

La Joya prison has a clinic with only two part-time physicians. For this reason it is not possible to provide care or specialized treatment for most of the prisoners. This situation laid the foundation for a telemedicine programme in conjunction with the Ministry of Government and Justice. Thus, a communications antenna was installed and La Joya Clinic was fitted with the same equipment used in rural telemedicine programmes. The antenna was used to connect the clinic to the Santo Tomás Hospital, a third level centre under MINSAs.¹⁰⁰ In addition to videoconferencing equipment for real time consultation, equipment for storing¹⁰¹ and sending information was installed.

The Teleradiology Programme

The most recent telemedicine experience in Panama was the National Teleradiology Programme. This Programme aimed to provide countrywide

¹⁰⁰ The station at Santo Tomás Hospital has a computer and a videotelephone.

¹⁰¹ For example, basic medical records are used to standardize the types of medical records. This is done for either otorhinolaryngology or neurology consultations.

radiology services, since Panama has few radiologists and most of them are based in Panama City.

The Programme installed digital X-ray machines that do not use film and which are interconnected by satellite. Areas with no radiologists¹⁰² could thus access these services by means of telemedicine. Plates are taken at any of the 12 posts installed and images are sent to the capital city, where a group of specialists receive the images, formulate reports and then send them back to the points of origin.

Lessons learned

- Education and training are fundamental. The project did not work in areas where the equipment was installed but training was not provided. The Government made an effort to implement other sites like the six mentioned in this publication. Unfortunately, they are no longer operational because nobody knows how to use the equipment. Personnel must be provided with refresher training on an ongoing basis.
- Quality technical assistance is required because faults frequently occur with equipment and its correct use must also be supervised. Accordingly, a regular maintenance schedule must be created and completed; such as changing expired batteries.
- Problem must be solved gradually by means of appropriate diagnosis. Therefore, it is essential to have a clear vision of what needs to be done and what can be done as this creates real expectations.
- Good communication with local and national authorities is essential. Technicians, researchers and policymakers must work together in order for the project to work.

¹⁰² For example, there are only three radiologists in Chiriquí, a province neighbouring Costa Rica.

Background information on Panama Social Development Division, ECLAC, United Nations

Panama has an urbanization rate of 68.7%, 10 percentage points below the regional average. The capital, Panama City, concentrates nearly 40% of the country's population.

In demographic terms, the country has reached the stage of complete transition. Although its natural growth rate is 1.57, it is not among the highest rates for the group of countries classified at this stage (according to ECLAC classification 2008). The overall fertility rate is 2.41 and the overall life expectancy at birth is 75.6. The overall dependency ratio was 56.9 in 2005 (CELADE, 2006).

As for Panama's epidemiological profile, the three main causes of death are ischemic heart disease, cerebrovascular disease and diabetes mellitus, followed by perinatal conditions and lower respiratory tract infections, which are the fourth and fifth leading causes of mortality.

An overview of the country's status with regard to the Millennium Development Goals indicates that limited progress has been made in eradicating extreme poverty. The indicator for the population living in extreme poverty dropped from 16.2% in 1990 to 13.5% in 2008 (United Nations, 2010).

Panama has made significant progress towards the goal of reducing the total number of children under the age of five with malnutrition by 50% between 1990 and 2015. This progress stems from success achieved in rural and indigenous areas, since this indicator has risen in urban areas. This situation is due to migratory dynamics, as well as inadequate food intake by persons who come to the city (Government of the Republic of Panama, 2009).

As regards the Millennium Development Goals relating to the right to health, Panama has reduced the under-five mortality rate from 35.9 for every 1,000 live births in 1991 to 22.9 in 2009 (United Nations, 2010). However, in order to reach the goal of 8 for every 1,000 live births by 2015, the country will have to quicken the pace, since this indicator should have been 7 points lower than what was reported in 2009 (Government of the Republic of Panama, 2009).

In addition, the rate of childbirth assisted by specialized health-care personnel rose from 86.3% in 1990 to 91.5% in 2007 (Government of the Republic of Panama, 2009). Despite this, there are evident disparities between the country's provinces and indigenous districts. According to the 2009 country report, an important challenge is to reduce the spread of HIV/AIDS by 2015, considering that the prevalence rate for the population between the ages of 15 and 49 increased from 0.4% to 1%.

Source:

CELADE, 2006.

Government of the Republic of Panama (2009). Millennium Development Goals, Third Report for Panama 2009. United Nations System in Panama and the President's Social Cabinet of the Republic of Panama. ISBN 978-9962-8967-0-8.

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

X.

e-Health in Peru: an emerging issue

*Walter H. Curioso*¹⁰³



With regard to e-health in Peru, substantial progress has been made over the past 10 years in the fields of research and training (Curioso and others, 2009a). Since its privatization, the telecommunications sector has undergone major development and there is room for continued growth, particularly outside Lima and in rural areas.

The development of mobile technologies applied to the health sector

Mobile telephony is the most dynamic telecommunications sector. In June 2010, there were more than 27 million mobile phones and it is estimated that mobile telephony penetration in Peru will reach 90% by the end of the year (INEI, 2010).

The rapid growth in mobile telephony has created a major opportunity for the development of applications in the health sector (referred to as mobile health or mHealth), not only for health workers but also for the public in general and patients (Aylward and others, 2010). According to the United Nations report entitled “mHealth for Development”, Peru stands out as one of the five countries in the world that excel in the use of mHealth

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technology thanks to the involvement of the Cayetano Heredia Peruvian University (UPCH) in mobile health programmes and projects (Vital Wave Consulting, 2009). A selection of the main mobile health projects developed in collaboration with the UPCH is outlined below:

- Cell-PREVEN is a real-time surveillance system for adverse events using mobile (cellular) phones and the Internet (see <http://www.prevenperu.org>). It forms part of a random trial in Peru entitled PREVEN, a joint effort by UPCH (Lima), Imperial College (London) and the University of Washington (Seattle), in collaboration with the Ministry of Health of Peru. The project was set up to develop an interactive computerized system using mobile phones and the Internet to create a real-time surveillance and data collection system and transmit adverse events related to metronidazole administration as a treatment for bacterial vaginosis among female sex workers in Peru. A mobile team comprising a nurse or obstetrician and a peer educator accessed the system using mobile phones in urban and rural areas in Piura, Huánuco and Chíncha. Then the doctors heading up the project received messages concerning symptoms sent by e-mail and text message (SMS). Cell-PREVEN showed that it is not necessary to have the latest PDA or Tablet PC to develop a real-time surveillance system in Peru's remote communities (Curioso and others, 2005). The interviewees and sex workers were satisfied with the use of the system.
- Colecta-PALM is a Web-based application for personal digital assistants (PDAs) developed by the University of Washington and UPCH, aimed at people living with HIV/AIDS who are undergoing antiretroviral therapy. It includes audio and text files with simple avatar images that add realism and strengthen the user's emotional commitment. All the information gathered is handled in the strictest confidence and data transmissions are encrypted (Curioso and others, 2008b). The application offers personalized messages concerning adherence to antiretrovirals and safe sex (Kurth and others, 2007). An adapted version of the Colecta-PALM application entitled Pambasuko-PALM has been successfully implemented in Kenya (Kurth and others, 2010).
- Cell-POS is a mobile telephone and Internet-based application that sends reminders to take antiretroviral medication and educational messages via SMS to people with HIV/AIDS in Lima. It is a collaborative project financed by the United States National Institutes of Health (NIH) and led by UPCH, but also involves the University of Washington, the non-governmental organization Vía Libre and

Voxiva. The project was created to help tackle the problems arising from patients failing to take the HIV medications prescribed by their doctors, either because they forget or are afraid to do so or because of stigma, side effects or for other reasons. The project comprises three stages. The first was a focus group study of patient perceptions (Curioso and others, 2009b). The second involved the design of the computerized system, which is now operational and enables messages to be sent reminding users to take their medication and attend forthcoming medical appointments, as well as educational messages. The system includes a Web interface so that patients can schedule or change their reminders themselves. The third stage is currently being implemented and involves a random controlled study that will last one year. A pilot study carried out at the start of 2010 found that HIV-positive users who used Cell-POS considered it useful in supporting them with their illness.

- WAWARED, “Getting connected for better maternal and child health in Peru”, is a project led by UPCH and financed by the Mobile Citizen Program of the Science and Technology Division of the Inter-American Development Bank (IDB). The initiative aims to increase access to health systems for low-income pregnant women by using text messages to improve maternal and child health information mechanisms. The project will also include a network of electronic clinical records using this technology. WAWARED is being implemented initially in the district of Ventanilla in Callao. It is intended to solve the maternal mortality problems in Peru by promoting better maternal and child health and contributing to the achievement of Millennium Development Goals 4, 5 and 6. Furthermore, the WAWARED project has established strategic alliances with the Regional Government, through the Callao Health Division, and with Telefónica Movistar of Peru (Curioso and others, 2010b).

Other projects developed by UPCH include:

- CareNet, a monitoring system involving mobile technology and the Internet to support patients with diabetes (Curioso, 2009c, 2009d).
- The “Hispano-American Health Link” (EHAS) telemedicine project, which used mobile technologies and offered distance-learning courses in health (Martínez and others, 2004, 2005, 2007).
- PROMETEO was the first computerized and integrated rural health information system developed in collaboration with UPCH, the Ministry of Health of Peru, the John Hopkins University and the

company International Health Technologies, Inc. The project was implemented in 10 health centres along the Pichis river in the Selva Central region in 1986 (Curioso and others, 2007b).

- PDA-PREVEN, a system for the collection of data on sexual behaviour using low-cost personal computers, was implemented at the national level as part of the PREVEN project (Bernabé-Ortiz and others, 2005).
- Via-Net used the Internet as an alternative means of reaching the community worst affected by the HIV epidemic in Peru, namely men who engage in sexual relations with other men (Blas and others, 2007).

Other projects developed in Peru involving the use of mobile technologies include: Alerta DISAMAR (Lescano and others, 2003); mobile systems for HIV/AIDS education (Zolfo and others, 2010); mobile systems for the compilation of information on tuberculosis (Blaya, Fraser and Holt, 2010); and systems for the transmission of tuberculosis-related images over mobile phones (Zimic and others, 2009).

Most information and communication technology (ICT) health projects have been developed by universities and non-governmental organizations (Curioso and others, 2007b). Although a National Telehealth Plan has been drawn up (INICTEL, 2004), Peru's Ministry of Health does not at present use ICTs systematically.

However, several promising initiatives have been deployed by the government. Since July 2007, Peru's National Institute of Health has been using NETLAB, an information system providing HIV patients with access to their CD4 and viral load results. NETLAB is the first example of "e-Government" in Peru and it is the first time that patients and health workers in the public service have been able to retrieve test results via the Internet (García and others, 2009).

Until now, mobile health technology applications have largely been limited to pilot projects and have focused on the sending of text messages (Curioso and others, 2009a, 2009b). However, as a result of their popularity and low cost, Internet cafés are becoming a useful tool for developing e-health projects and several schemes have been rolled out using this means (Blas and others, 2007; Blaya, Fraser and Holt, 2010; Curioso and others, 2007a), including the use of online video (Blas and others, 2010).

Interoperability in the health sector

Interoperability among the different health information systems in Peru is still at the early stages. There is consensus on the need to exchange information but many challenges remain to be overcome. These include, first, the haphazard way in which health information systems have evolved: in isolation, fragmentedly and using obsolete technology. Second, the work culture and political changes within the various health-provider institutions are reflected in a lack of coordination, which has resulted in the duplication of efforts, the failure of promising projects and wastage of time and human resources, all of which is due to the lack of a long-term vision for a national e-health initiative. Finally, standards, legislation and enforcement are all lacking, even in fundamental areas such as security, confidentiality and privacy of health information (Curioso and others, 2008a).

Electronic clinical records in Peru

Electronic clinical records are not widely used in Peru. The reasons for this include, first, the lack of legislation regulating and promoting their use, content and/or the method of exchanging electronic health information, since it is still not a priority. Second, the relative isolation and parallel development of various computerized health management systems in the public and private sectors. Third, the continued use of paper formats, not only in rural areas, where there are few or no technological resources, but even in large cities and in the major hospitals and clinics and finally, the lack of planning and systematic evaluation of these systems (Curioso and others, 2008a). However, some systems have been evaluated or are under development (Curioso, Saldías, Zambrano, 2002; Curioso and others, 2010b), such as the WAWARED system involving the application of electronic files to gather data on maternal health and a system to support decision-making among health workers (Curioso and others, 2010b).

Education and training in health informatics

While training and education in e-health is definitely required, it has also been noted that there is a lack of education in biomedical informatics among medical students, doctors, nurses and many other health professionals. The Medical Association of Peru does not recognize medical informatics or health informatics as a specialization. Although several biomedical information databases are available in Peru (e.g. HINARI, SciELO Peru, LIPECS), due to the rapid development of biomedical knowledge and information resources,

particularly as a result of the Internet, students, doctors and other health professionals often find it difficult to locate quality information when they need it (Villafuerte-Gálvez and Curioso, 2007).

One notable biomedical informatics training programme in Peru is AMAUTA, which was developed to train health professionals in the application of health informatics (Curioso and others, 2010d). The participants in this collaborative programme were UPCH, the National University of San Marcos and the University of Washington (UW) in Seattle, with the support of the John E. Fogarty International Center and the United States National Institutes of Health. The AMAUTA programme helped to develop the UPCH Health Informatics Unit as a multidisciplinary team of professionals engaged in the research and development of ICTs applied to health. Between 1999 and 2009 four short courses were organized in Lima, in which more than 200 health professionals received training (Curioso and others, 2010d). The first two courses (2000-2001) covered issues relating to medical informatics and public health informatics. The last two (2005-2008) covered medical informatics, public health informatics and bioinformatics. In response to the growing demand for bioinformatics training in Peru, topics in this area have been added since 2005 (Curioso and others, 2010d). In addition, Peruvian professionals have been trained at the master's and doctorate levels at the University of Washington (Curioso, Kurth and Nodell, 2006).

In 2009, the network of collaborators was expanded into the QUIPU¹⁰⁴ project for the promotion of research and the training of professionals in biomedical informatics and global health, with the intention of forming a centre of excellence of the highest quality in the Andean region. The project is led by UPCH in collaboration with the United States Naval Medical Research Center Detachment (NMRCDD) in Lima, the University of Cauca in Colombia and the University of Washington in Seattle and is funded by the Fogarty Center (Curioso and others, 2010c). It aims to:

- develop and implement short- and long-term training opportunities in biomedical informatics and global health throughout the Andean region
- engage new researchers in the Andean region in research into health informatics and bioinformatics
- expand and strengthen a research network in the Andean region while promoting South-South cooperation as well as cooperation with partner universities in the United States and other institutions.

¹⁰⁴ The word "quipu" means "knot" in Quechua and was an ancient system used by the Incas in the Andes to record and pass on information. For further information on the QUIPU project, see <http://www.andeanquipu.org>.

UPCH promotes effective South-South cooperation in training and research in biomedical informatics. A strategy currently being developed is the creation of a centre of excellence for training and research in biomedical informatics for the Andean region and Latin America. UPCH is the first and only Peruvian university to offer a master's programme and diploma in this field.

The QUIPU network:¹⁰⁵ This group has grown up as part of the effort to broaden and strengthen a network that brings together researchers in the Andean and Latin American region, as well as universities and institutions in the United States and abroad. It includes representatives of the Fogarty Informatics Training for Global Health programme. It is hoped that the QUIPU network will be consolidated and expanded and will attract new members while promoting South-South cooperation among universities and institutions worldwide. The QUIPU network aims to broaden the multidisciplinary view of global health and biomedical informatics research in Latin America.

E-health policies in Peru

The recent implementation of the Universal Health Insurance Act in Peru opens up numerous opportunities to achieve an integrated health information system and generate specific policies on e-health in the country.

At present, very few policies specifically target e-health issues. Most policies concern general-purpose ICT and were devised outside the health sector. In any case, they generate very little adherence and have not been fully implemented. In order to progress, the e-health sector needs leadership to develop national policies, protocols and standards.

Collaboration should be promoted among institutions in both developed and developing countries, as well as within individual countries, along the lines of projects such as AMAUTA. In Latin America, this type of collaboration can be promoted through the Regional Federation of Health Informatics for Latin America and the Caribbean (IMIA-LAC), the Economic Commission for Latin America and the Caribbean (ECLAC) and/or the Pan American Health Organization.

Both North-South and South-South cooperation should be promoted, as has been done, for example, in the field of mobile technologies applied to health or mHealth (Curioso and Mechael, 2010a).

¹⁰⁵ The QUIPU network web page is available at <http://red.andeanquipu.org>. The website includes information on the activities of the QUIPU network and its partner institutions.

Conclusion

In short, Peru is at an early stage of e-health development. Its health information systems are fragmented and not integrated. ICTs can play a key role in tackling many of the e-health challenges. Careful planning is required to develop, implement and evaluate ICTs applied to health, together with e-health policies, properly trained human resources, physical infrastructure (hardware and networks), health authority leadership, the support of all stakeholders, international collaboration (especially South-South collaboration) and sources of funding to support research and training.

Background information for Peru Social Development Division, ECLAC, United Nations

In 2010, 73.3% of Peru's inhabitants were living in urban areas, but that figure is still below the regional average of 79.5%. Furthermore, 29% of the total population lives in Lima, the country's only metropolis.

Peru is in full demographic transition. Its natural growth rate stands at 1.47 persons for every 100 inhabitants (2005-2010 period) and it has a total fertility rate of 2.6 children per woman and an average life expectancy of 73 years for both sexes. The total dependency ratio was 59.8 in 2005 (Latin American and Caribbean Demographic Centre (CELADE), 2006).

In epidemiological terms, acute respiratory infections constitute the primary cause of death in Peru, followed by ischemic heart disease and cerebrovascular disease in second and third place respectively.

In the context of the Millennium Development Goals, Peru has made substantial progress in terms of the extreme poverty indicator, with 25% of the population living in extreme poverty in 1990 compared with only 12.6% in 2008 (United Nations, 2010). This marked progress stands the country in good stead to achieve the goal of reducing by half the proportion of people living in extreme poverty.

With regard to the health-related Millennium Development Goals, Peru is making significant progress towards reducing mortality among children under five years of age. In 1990, mortality in this age group stood at 85.1 for every 1,000 live births, whereas in 2009 the rate had fallen to 30.7 for every 1,000 live births. With regard to the maternal mortality rate, the latest data available for Peru indicate that in 2008, 98 deaths were recorded for every 100,000 live births, which represents marked progress towards achieving the Goal given that the same source indicates that in 1990 the rate was 250 deaths for every 100,000 live births (CEPALSTAT).

Source:

CEPALSTAT. Date of reference: 2010.

United Nations (2010). Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coords.), Santiago de Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

XI.

e-Health in Uruguay: development and challenges¹⁰⁶

*Álvaro Margolis, Alicia Ferreira, José Clastornik,
Jorge Forcella and Álvaro Vero*¹⁰⁷



Uruguay has a population of 3.3 million, almost half of whom live in the capital city, Montevideo. Health indicators (for example, average life expectancy of 76.6 years) are close to those of developed countries. The health system in Uruguay is made up of public or private providers of comprehensive services, the majority of which are non-profit organizations, as well as other institutions (partial insurance, police health, military health, etc.). Private institutions of comprehensive care cover approximately 60% of the population and are financed through social security, collective agreements or contributions from individual members. They are organizations that provide both health care and health insurance, and their services are regulated by the National Health Board by means of legislation and contracts.

¹⁰⁶ The project described in this chapter has been partially funded by the Inter-American Development Bank by means of FOMIN, project UR-M1021. <http://www.iadb.org/projects/project.cfm?project=ur-m1021&language=spanish>.

¹⁰⁷ Álvaro Margolis is outgoing President of IMIA-LA, member of IMIA (International Medical Informatics Association) Steering Committee and medical informatics consultant for FEMI Digital Health Project. Alicia Ferreira was Director of the Ministry of Public Health Information Systems Division and is currently Assistant Manager. José Clastornik is Executive Director of the Agency for Governmental Development of Electronic Management and the Information and Knowledge Society (AGESIC). Jorge Forcella is Informatics Director for State Health Services Administration (ASSE) and a consultant for AGESIC. Álvaro Vero is Director of FEMI Digital Health project.

A health-care system reform was carried out in 2005 to increase coverage and access to the system, while improving patient management at first level care. During the first year of this reform (2008), the number of citizens under the Medical Federation of the Interior (FEMI) increased by 40%. This is just one example of how coverage changed for institutions. Other institutions experienced similar changes, particularly as a result of the increase in the pediatric population that was covered by the main public provider of comprehensive care, the State Health Services Administration (ASSE).

The reform, which will be described in further detail later, has had a large impact in terms of requiring comprehensive providers to meet objectives relating to services, among others, contractually agreed to with the National Health Board (JUNASA). They must have information systems to record and report quality indicators of chronic pathologies and use information systems in order to prevent errors. Likewise, the authorities have encouraged the use of technological tools for continuing training on the use of health-care equipment, another of the goals set for services. This chapter will also look at the Agency for Development of Electronic Government and the Information and Knowledge Society (AGESIC) and two examples of comprehensive health-care providers, one public and one private, and their e-Health actions. There are other health-care providers not mentioned in this chapter, but their actions are also within the framework of the new regulations in force.

e-Health and telemedicine in the context of the Integrated National Health System (SNIS)

The Integrated National Health System (SNIS) is one of the main reforms promoted by the administration that came into power in 2005. It is intended to provide universal access to health care for the entire population with uniform levels of coverage and quality, and to distribute more fairly the economic burden of health care among citizens. The Ministry of Public Health (MSP) took responsibility for implementing SNIS in 2007, which coordinates public and private health-care providers and proposes changes in the care, management and financing model.

In 2007, SNIS was created by Law 18,211,¹⁰⁸ which establishes the main guiding principles for the system including the promotion of health care and prevention, comprehensive and humanistic guidance; intersectorial health-care policies; universal coverage, accessibility and sustainability of health-care services; equity, continuity and access to services; respect for users' rights

¹⁰⁸ Consulted at <http://www.parlamento.gub.uy/leyes/AccesoTextoLey.asp?Ley=18211&Anchor=>.

to make well-informed decisions regarding their health (which includes choosing a service provider) and the participation of workers and users. As regards funding, this is guided by the principles of solidarity, efficiency and effectiveness in economic and social terms, and sustainability in the allocation of resources for comprehensive health care.

Article 23 of the aforementioned law created the National Health Board (JUNASA) as a decentralized organization under MSP, responsible for managing the National Health System (SNS) and ensuring that providers observe SNIS guiding principles and objectives.

SNS operates under a social security model designed to combine contribution equity with health-care and economic efficiency. Individuals' contributions are measured by what they pay and they receive care depending on their health needs. In addition, the National Health Fund (FONASA) redistributes financial resources from population groups that use lower cost (and lower risk) health services to other groups which need to make more intensive use of health-care services (higher risk). This design also incorporates an economic incentives system to encourage changes in the health-care model on the basis of health-care quality and efficiency shown, as well as greater social justice.

Payment of the National Health Fund (FONASA) includes a bonus that is paid for meeting service delivery goals set by the health authority. These goals are associated with promoting first level care.¹⁰⁹

JUNASA and providers which form part of SNIS signed a management agreement outlining, for example, the method and frequency for sending health-care and economic/financial information.

By late 2008, the results of SNIS revealed that over 200,000 people who had no comprehensive health-care coverage up until 2007 (130,000 of whom are minors) had been included in the system. It had also included 100% coverage of children under the age of 18 and the disabled of all ages. According to a report compiled by the National Statistics Institute, almost half of the net poverty reduction observed in the first half of 2008 (4.7 percentage points) compared to the year-earlier period is due to the incorporation of children under the age of 18 into SNS. FONASA pays for 70.7% of all health service users.

Applying ICTs in health care in the context of SNIS entails major challenges and encompasses different areas. The following strategic guidelines were prioritized in the 2005-2009 MSP Informatics Master Plan:

¹⁰⁹ Consulted at http://www.msp.gub.uy/ucsnis_3153_1.html.

- Create health information systems to support the main functions of MSP and ASSE, integrating informatics to medical care processes, as well as for health promotion and disease prevention.
- Use management systems with emphasis on ASSE authorities' management needs to facilitate competitive insertion in SNIS and MSP ability to conduct health checks of the population.
- Promote the use of electronic medical records (EMR) for each person in accordance with Decree 396/03, with emphasis on first level care.
- Progress in the definition of contents and interoperability standards.
- Optimize and make MSP communication with the population more transparent by means of efficient use of the Portal.
- Participate in projects for development and implementation of information systems with other state agencies by means of ongoing coordination systems.

The objective relating to the definition of contents and interoperability standards involves all informatics projects applied to health care as they are essential for the development and the smooth running of systems, primarily EMRs.

Creation of the Uruguayan Society for Standardization, Interchange and Integration of Health Service Data (SUEIIDISS), incorporated as a Chapter of HL7 Uruguay¹¹⁰ in 2005, was accordingly an important milestone. MSP is an institutional member of this society and has worked on several Technical Subcommittees (ST) to date. Special emphasis is placed on the publication of the First Report on the Agreement of the Personal Identification Standard (SUEIIDISS-UY-ESP-001:STID) and the work by the Subcommittee on CDA (Clinical Document Architecture, HL7v3).

As regards the undertakings of the Master Plan over this five-year period, the project which stands out is on the Vital Statistics, Birth and Child Monitoring System (SEVEN) which features the electronic certificate of live birth (CNV-e), the electronic death certificate (CD-e), the Perinatal Information System (SIP) and the Aduana Programme (child growth and development follow-up monitoring until the age of two). Perhaps this is the most important project with the largest scope that is being implemented by MSP, since it brings together several aspects included in the strategic guidelines.

¹¹⁰ www.sueiidiss.org.

Indeed, this is a cross-sectional project involving state organizations and health services as it entails coordination between the Planning and Budget Office, the Ministry of Public Health, the Ministry of the Interior (National Directorate for Civil Identification), the Ministry of Education and Culture (General Directorate of Civil Registration) and the Social Security Bank (BPS) and requires participation in the remote processing of data for all public and private maternity hospitals in the country. This takes place in the first part of the project: CNV-e civil registration of birth. Once the other components are implemented and working (electronic death certificate, perinatal information system and the Aduana Programme), other areas including pediatrics and funeral services will be incorporated throughout the country.

Moreover, it aims to improve both the quality and timing of vital statistics by integrating and validating information, as well as single registration of birth of a child and his or her mother and follow-up monitoring and control of the child's growth and development.

In addition to this project, information systems have been implemented which prioritize the quality and timely supply of data required to meet MSP key functions and for supporting SNIS implementation. All of these systems use web-based technology such as the Epidemiological Surveillance System, the Single Registry of Formal Health-Care Coverage and the Health-Care Goal System.

As for EMRs, one MSP objective is that each citizen has a single medical record in SNIS, regardless of where they receive care. In accordance with SNIS, each institute is responsible for providing comprehensive care for the person affiliated to the health service (and for which FONASA pays a monthly premium) and medical records are mostly paper-based and are circulated between different care levels within the same health-care provider. In addition, some providers have already implemented EMRs for their users, which have different technological features, as well as proprietary formats and developments.¹¹¹

As regards the rights of citizens, the challenge is to advance interoperability of existing and future applications. To do so, standards must be outlined and met by all stakeholders.

As for the legal status, according to Decree 396/03 of September 2003 which outlines EMR specifications, EMRs are valid under medical law. Article 1 of this Decree states "that the establishment of a single electronic medical record for each person, from perinatal to death registration, is hereby declared to be of public interest. For the purposes of this Decree, electronic

¹¹¹ Not covered by open-source licenses.

medical record is understood as the set of clinical, social and financial data relating to a person's health, processed by computers or telematics". Ministerial Order 598/008 of September 2008 launched a comprehensive health information system based on the digital health record.

A national workshop known as "Towards the design and development of a single electronic medical record for the public health subsystem in Uruguay" financed by the European Union was held from 23 to 26 March 2009. Different stakeholders from the health sector, academics and foreign consultants attended the workshop. A strategy was established to start implementation in first care level and in the public health subsystem, thus prioritizing the issue on the political agenda.

Agency for Development of Electronic Government and the Information and the Knowledge Society (AGESIC)

The Agency for Development of Electronic Government and the Information and Knowledge Society (AGESIC) was established in Uruguay in December 2005 under Article 72 of Law 17,930. It operates within the framework of Decree 205/006 of June 2006 and its functions include:

- Giving legal advice to the executive power pertaining to the formulation of policies for the information and knowledge society and to state informatics development, contributing to the formulation, monitoring and evaluation of results obtained in areas within its competence.
- Promoting better use of ICT by the State.
- Issuing and drafting informatics regulations, standards and technical procedures for the State.
- Generating, planning and executing electronic government projects with emphasis on improving services provided for all Uruguayans.

AGESIC focused primarily on two lines of action during this first stage: the generation of skills at knowledge and infrastructure level and the strengthening of the regulatory framework and institutional development, on the basis that e-government cannot be deployed until the macroconditions to ensure the success and future sustainability of projects are in place.

Strengthening the legal framework

The information society is a society in which information and communications technologies reach people, companies and the State. It creates new ways of

communicating and a new model of development. However, with these significant changes comes the need for new regulations.

A new legal framework must therefore be outlined in order to provide safeguards and protect the citizens' rights in the Republic of Uruguay, while establishing clear rules for relations between the different social stakeholders. Since August 2008, Uruguay has adopted a series of standards that will underpin advances in the application of ICTs in different areas such as government, health care, education and trade.

As regards policy, for the first time there is a definition of principles and strategic guidelines for the online Electronic Government (Executive Power Decree 450/2009 of 28 September 2009) where seven fundamental principles are laid out for the establishment of projects: equality, transparency, accessibility, efficiency and effectiveness, cooperation and integrity, reliability and security, and technological neutrality.

As for the protection of human rights, the following laws and regulations have been incorporated into the existing legal framework:

- Law 18,331 on the Protection of Personal Data and “Habeas Data” Action recognizes the right to the protection of personal data and it created the Unit for the Regulation and Control of Personal Data (URCDP).
- Law 18,381 on Access to Public Information promotes transparency of all non-State government organizations administrative functions, guaranteeing citizens the right to access public information.
- Article 72 of Law 18,362 on Accountability and Balance of Budget Execution for the 2007 Fiscal Year created AGESIC Directorate for Citizens' Rights. Its functions include carrying out consultations and giving advice on the protection of personal data and access to public information.

Information security:

- The National Response Centre for Computer Security Incidents (CERTuy) was created.
- Public agencies adopted an informatics security policy which was regulated by a decree.
- Law 18,600 was adopted on 21 September 2009. It recognizes the legal admissibility, validity and effectiveness of electronic documents and electronic signatures and the Electronic Certification Unit was established as a control body.

Developing skills

Human resources and technological training to create new projects are required for a state to provide services online. In addition to encouraging development of the legal framework, AGESIC has developed projects that strengthen technical and infrastructure skills.

Development of infrastructure

To promote the development of electronic services and procedures, infrastructure was developed that facilitates the implementation of various electronic government projects and interconnects all State Execution Units (UEs). Units will therefore be able to exchange information and execute processes and joint activities, as well as foster mutual collaboration services. The principal components developed to date are:

- REDuy, a high-speed network that connects the entire Uruguayan State. This network aims to improve services for citizens by connecting all UEs with the right bandwidth and appropriate levels of service, security, scalability and availability. Network connectivity infrastructure enables agencies to work in an integrated manner under a safe technical framework for the exchange of information. In addition, this enables rational use of human and economic resources.
- An Electronic Government Platform that provides the technological context for developing cross-sectional state projects, facilitating the installation and deployment of components, services and applications, guaranteeing availability, security control and access.
- The Electronic Record is a tool that helps to transform paper-based procedures and process management into electronic format.

The development of technical regulations and standards

Technical standards and good practices must be standardized and adopted for the development of online services. This enables interoperability and exchange of information; data assimilation and universal access to information and services; and technical compatibility and maximum use of ICT.

Several tools have been developed for this purpose, including the maturity model, security guidelines, guidelines for the development of state portals, ICT master plan models, a specification of an electronic file exchange format and methodological guidelines for project development. In addition,

AGESIC is a member of W3C, an international consortium which aims to promote standards for web development and has operated since 5 June 2009 as the National Object Identifier Unit (UNAOID). This unit operates under an agreement signed by Uruguay's national ISO agency (the Uruguayan Institute of Technical Standards, UNIT), the Communications Services Regulatory Unit (URSEC), and a member of the International Telecommunications Union (ITU).

All of these features make up the Government's strategy for improving services and information offered, increasing management efficiency and effectiveness, and encouraging increased transparency and citizen participation.

AGESIC and health care

Observing examples of how technology is applied to health care reveals how each of the elements developed by AGESIC will be used:

- Citizens can access accurate, easy to understand and up-to-date health information by using portals. These portals must meet development, usability, accessibility and quality standards.
- Development of knowledge bases which facilitate communication and the exchange of information between professionals. These bases should include, for example, security measures, exchange mechanisms and the protection of sensitive data.
- Use of electronic medical records (EMRs) which include all the health information about a citizen irrespective of where and when it was compiled. This medical system must form part of its own health-care service information system, connecting to economic and financial management systems, and strategic planning and management control systems. Standards, infrastructure for interoperation, regulations guaranteeing the protection of citizens' rights, security assurances using electronic signatures ensuring non-repudiation of actions and mechanisms for citizen access to information must be used in order to meet these objectives.
- Provision of online health-care services that enable citizens to carry out basic procedures and integrate information from health-care centres. Services lacking the necessary infrastructure could use the electronic government platform and high-speed network.
- Use of intangible resources such as information, research, knowledge and lessons learned as a new way to manage health-care services for

promoting sustainable development in Uruguay. Training, standards and good practices are needed for knowledge management.

- Use of techniques and medical appliances to make diagnoses and issue treatment based on the analysis of images, symptoms and information. Technical standards, object identifiers (OIDs) and infrastructure are therefore needed to analyse the information irrespective of the location.

Each point is just a brief example of how ICT complements medical technology in order to ensure optimal diagnosis and therapy and increase citizens' quality of life and well-being. Further examples of how these concepts were implemented at public and private institutions in Uruguay are described below.

State Health Services Administration (ASSE)

The State Health Services Administration (ASSE) is part of the Integrated National Health System (SNIS) in Uruguay. It is a decentralized public agency responsible for providing comprehensive health care for approximately 1,200,000 Uruguayans (36% of the country's population).

To fulfil its mission, ASSE has a national health-care network consisting of health-care units of different complexity. This organization has the widest coverage network in the country and its presence is strong in both cities and small towns. ASSE operates 63 hospitals and 360 health-care units throughout the country that provide first level care (health-care centres and general hospitals).

Hospitals are classified as follows:

- 18 departmental centres located in the capital cities of the departments of Uruguay.
- 33 health centres.
- 5 national reference hospitals and 7 specialized institutes located in the country's capital city.

One of the obvious problems of a decentralized model and the uneven distribution of different medical specialists is that decision-making is more difficult in different regions of the country. Montevideo attracts most of the health-care professionals, followed by the country's main cities, leading to scarcity of professionals in rural areas throughout the country.

Telemedicine is one way to reduce this problem and it enables different localities to combine their services to make them better. Telemedicine provides

examples of imaging and interconsultation studies, as well as the coordination, sending and reception of laboratory tests.

ASSE is expanding and restructuring its communications network in an attempt to provide all of the aforementioned health institutions with the right bandwidth for image transmission and thus significantly increase the use of telemedicine. At the same time, as part of a strategy to increase the decision-making capacity of its health-care network, it is acquiring new imaging equipment in order to strengthen this area.

In addition, an agenda system supported by the new communications infrastructure was designed to manage medical consultations and is being deployed at national level and it can be accessed from different locations throughout the country. Its objectives are to ensure convenience for its subscribers, to improve access to services, to avoid patient transfer for merely administrative reasons and to improve the quality of information for first level care and relating to the system. This project aims to extend the system operating in Montevideo, which has been adapted for use in different scenarios at health-care units throughout the entire country.

The FEMI Digital Health Project¹¹²

The Medical Federation of the Interior (FEMI) is made up of 23 private providers of comprehensive care that are non-profit organizations in all the departments of Uruguay. At present, FEMI provides health care for approximately 700,000 subscribers. It operates the Americano Hospital in Montevideo, which was purchased in 1993 and has been gradually re-equipped with state-of-the-art technology.

A computerization project aimed at clinical management was developed to meet the needs of the institutions comprising FEMI, which stem from insufficient integration of information about them, as well as epidemiological changes of the population and requirements of the Integrated National Health System. It was supported by Uruguay's health-care professionals and was presented to the Inter-American Development Bank (IDB) for partial financing. An agreement between IDB and FEMI was signed in late March 2008 when the four-year project was formally launched.

This project will provide FEMI institutions with a federal electronic medical record integrated into the informatics systems of each institution, with an information management system enabling clinical, epidemiological

¹¹² Details regarding this project have already been published, as indicated in the references of this document.

and accounting analysis. The project considered the different levels of existing informatics development at each of these institutions. While all of these institutions have the necessary management systems for their daily operation (subscribers, copayment, accounting etc.) and most have departmental systems (pharmacy and provisions department, laboratory, etc.), almost none of these institutions have complete EMRs. In addition, although each institution has chosen its informatics system providers and considering that a wide variety of systems are currently being used, there are two which cover half of all these institutions. The project aims to provide federal functions and also accept each institution's autonomy. It has four principal lines of action as outlined below.

System development and specification

The first line of action includes the specification itself and the creation and implementation of electronic medical records (EMRs). During the first stage, EMRs will be applied at emergency wards and at outpatient services in five pilot institutions and at the rest of the institutions during the second phase. There are other components that involve all FEMI institutions from the start. This line of action also includes the design and construction of a strategic planning management tool (balanced scorecard).

Alignment and standards for interoperability

The second line of action includes standards for exchanging information and how it is represented (for example, messaging, standard terminology, federal identification services) and the coordination with other interested parties in Uruguay (Ministry of Health, Social Security, HL7 Uruguay and other health-care organizations).

Cultural change management

The third line of action includes training and prototypes of federal functions, such as federal authorization and telemedicine services.

Infrastructure

The fourth line of action includes videoconferencing equipment, hardware, software and networks.

Advances

System development and specification

A federal balanced scorecard is currently being implemented as part of this line of action. Each institution will thus have access to national health-care system indicators and other clinical performance data, which can be used to compare their performance and to the rest of FEMI institutions. As for Federal EMR System specifications, the professional services company KPMG completed the specification and is expected to continue with the next steps (construction/adaptation and implementation of EMR system) during the first half of 2010. At the same time, the Buenos Aires Italian Hospital is helping to redesign processes in clinical areas where EMRs will be implemented (specifically for emergency wards and outpatients).

Alignment and standards for interoperability

Alignment of the members of the Federation is essential so that they can exchange information. It also ensures that the company that provides EMR systems implements them on the basis of consensus. In particular, progress has been made in terms of personal identification services and medical terminology.

Person identification services are the foundation of a federal EMR system in that they ensure each patient's medical information is incorporated as accurately as possible. The principal personal identification processes must be reviewed in order to implement this type of service, in particular, records, accreditation and subsequent auditing. This work is currently being implemented and developed in stages, with the objective of not only identifying persons, but also providing related services, such as health-care coverage for each patient, as well as georeferencing of households and physicians' medical centres.

Terminology services enable health-care professionals to write in their native languages with automatic coding into international classifications (SNOMED, CIE 10, etc.). The service used by the Buenos Aires Italian Hospital is currently being adapted for use in Uruguay.

There is also consensus on the use of HL7 CDA as a messaging standard, recommended by SUEIDISS, a representative of HL7 Uruguay. These issues are presently being discussed at regular meetings with the main stakeholders in Uruguay (Ministry of Health, Social Security, HL7 Uruguay and other health-care organizations), since this alignment includes organizations that are not members of FEMI.

Cultural change management

Cultural change is one of the project's lines of action and a key to its success. At management level there are hundreds of professionals in executive committees and local coordination units of the 23 FEMI institutions and eventually it will incorporate 2,800 physicians and over 10,000 health-care and administrative employees. One of the noteworthy strategies of cultural change management is the training of project leaders and end-users of the systems will be trained in 2010.

At present, a strategy developed by experts in communication and organizational change is being implemented. In the meantime, training activities and system prototypes are being implemented, for example, the authorization system for institutions and telemedicine applications.

As for training, thus far emphasis has been placed on the creation of Multidisciplinary Coordination Units at each institution. First, training was provided for 72 professionals who took part in the 2008 and 2009 editions of the online course known as 10x10 Introduction to Biomedical Informatics which involved 150 hours of study. Second, 85 professionals attended an introductory training course. Third, an HL7 online course was provided for 40 professionals in the area of informatics. Lastly, 67 registered nurses with coordination duties participated in an informatics and health-care quality activity in 2009. A strategy is currently under way to prepare trainers to conduct capacity-building in end-users of the informatics system.

Infrastructure

FEMI has a national Intranet that has been expanded in order to meet new requirements. Videoconferencing equipment which is needed for telemedicine applications is being purchased.

Lastly, the importance of work coordinated at a federal level can be seen at country level, as has national and international coordination with countries in the region. The first stages of cultural change and alignment have been successful, but there is still a long way to go before achieving the project's main objectives.

Background information on Uruguay **Social Development Division, ECLAC, United Nations**

Uruguay is a highly urbanized country. Its urban population is 13% above the average for Latin America and the Caribbean. In addition, 45% of the total population lives in the capital city and 13% live in Uruguay's six intermediate cities.

At present, Uruguay is at an advanced stage of demographic transition. Its natural growth rate is lower than that of countries classified in the same stage by ECLAC (2008) and its overall fertility rate of 2.12 is higher than countries like Cuba and Barbados, which are ranked highly on the demographic transition scale and have an average 1.5 children per woman. The country's overall dependency ratio was 59.6 in 2005 (CELADE, 2006).

In epidemiological terms, chronic illnesses are the leading causes of death in Uruguay. In fact, the first five causes of death fall into this category of illnesses.

As regards the Millennium Development Goals, data from the 2010 United Nations report shows that Uruguay has fallen behind the target for the population living in extreme poverty indicator, even though this refers to the population living in urban areas. This percentage increased from 3.4% in 1990 to 3.5% in 2008 (United Nations, 2010). However, the 2009 country report showed that this indicator had improved for the entire population, decreasing from 3% in 1990 to 1.5% in 2008. Between 2002 and 2004, this indicator increased significantly, registering 3.9% in 2004 due to one of the worst economic crises ever reported by the country (National Council for Social Policy, 2009).

The status of the Millennium Development Goals relating to health varies. Progress has been made towards reducing the under-five mortality rate, which dropped from 24.3 for every 1,000 live births in 1991 to 15.8 in 2009 (United Nations, 2010). However, the pace must be quicker to reach the target of 8 for every 1,000 live births by 2015. In addition, as regards maternal health, significant progress has been made. The average rate calculated for the 2002-2005 period was 2.2 for every 100,000 live births, the lowest maternal mortality rate in the region (National Council for Social Policy, 2009).

Despite this, maternal mortality is a worrying issue for health-care institutions in Uruguay, particularly because death could have been prevented in most cases. Indeed, half of the deaths which happened throughout the period of analysis were due to unsafe, induced abortion or deficiencies in the health-care process (National Council for Social Policy, 2009).

Source:

CELADE, 2006.

National Social Policies Council (2009). Millennium Development Goals. Uruguay 2009. Country Report. ISBN: 978-9974-8196-2-7. Montevideo.

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

XII.

Technological projects for e-Health in the Bolivarian Republic of Venezuela

*Ricardo Silva*¹¹³



The Venezuelan public health system is made up of several subsystems including the Ministry of People's Power for Health Care (MPPS), the Venezuelan Institute of Social Security (IVSS), the Ministry of Education's Social Welfare Institute (IPASME), the Social Welfare Institute of the Armed Forces (IPSA) and the Barrio Adentro Programme.

Public health subsystems compete for the same patients and are not coordinated with each other. The Ministry of Health and the SINAPSIS system are being used to link MPPS, IVSS and the Barrio Adentro Programme. The latter has been used to create a matrix-based model for the development of telehealth in the country by means of the National Comprehensive Health System which has a series of cross-sectoral layers where training, education, standardization and connectivity are fundamental.

At present, there are numerous public, private or hybrid projects that provide health-care services in the Bolivarian Republic of Venezuela. One of the most notable is the Medicarro Project coordinated by the author of this publication; followed by the Society for Telehealth and e-Health in Venezuela, which has promoted a number of national and international conventions.

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The Telehealth System is another project and it is a very attractive private initiative since it uses funds that private companies allocate to social projects to finance rural telemedicine projects. The last project noteworthy of mention is SOS Telemedicina de Venezuela which is a Central University of Venezuela initiative financed by Hewlett Packard International (HP) and it is aimed at developing technology.

This chapter reports on the progress made in terms of electronic health records and technological developments for telemedicine and networks.

Electronic health records

Prior to the Telehealth Programme, each health-care institution managed its own health records. The first standardized medical record in the Bolivarian Republic of Venezuela was created under the Telehealth Programme. First, the Ministry of Health standardized paper-based health records which would be converted into electronic records at a later stage. The electronic health record was created entirely under free software platforms and was named SINAPSIS, which is an acronym for the National Public Health System for Social Inclusion.¹¹⁴

SINAPSIS can be accessed by anyone via its web page.¹¹⁵ Its system administrator is the National Centre for Information Technology. The system includes predetermined ethnic groups in all states, municipalities and districts of the Bolivarian Republic of Venezuela.

Having a standardized health record has given rise to a number of private initiatives for the development of electronic health record, and some public institutions have also adopted private models. For example, the military hospitals used the system name SANOS and adapted it, converting it into the health system for the national armed forces.¹¹⁶

¹¹⁴ The code is open, the software and the source are available to all countries for modification or for attempting a similar initiative. The idea of working on the development of a Latin American common standard has been proposed and this would mean significant progress.

¹¹⁵ www.softwarelibre.com.ve.

¹¹⁶ Technology transfer from private companies to the national armed forces is one advantage of standardizing electronic health records.

Technological development and telemedicine in the Bolivarian Republic of Venezuela

National Centre for Technological Innovation (CENIT)

Although the Bolivarian Republic of Venezuela has been working on telehealth projects since the 1980s, most of the initiatives were executed using international technology. In 2005, an institute known as CENIT was created to transfer technology from academic and research sectors to communities. The objective of CENIT was to bridge the technology transfer gap and it has become a facilitator for the needs of communities and the potential developments at research centres.

Digital Hospital

According to official figures, there is a high level of Internet¹¹⁷ access in the Bolivarian Republic of Venezuela, but hospitals are not connected and therefore there is not a good intrahospital information exchange system. Working with a fourth level hospital, such as Carlos Arvelo de Caracas Military Hospital,¹¹⁸ has been very complicated and expensive. The hospital digitization project has been running for three years and has not yet concluded.

Medicarro

All equipment developed by the author and his collaborators, such as Medicarro and the Negatoscope, provides wireless access. A wireless bearer in a Wi-Fi network can be connected to a Wi-Max network or use cellular telephony communication featuring Ev-Do technology to access system servers. Communication is then sent to command and control rooms where complex tasks can be carried out, such as epidemiology, predictions and pandemic control. The idea is to replace the wired system with a wireless communication system which will speed up and cut the costs of implementing solutions.

In 2006, Medicarro was created as a mechanism for transferring health information through a joint technological development project between the Simón Bolívar University and CENIT. Its objective was to provide a device that uses long life batteries; connects to any wireless network; uses electronic health records software; and is able to manage and monitor vital signs.

¹¹⁷ According to official figures, penetration is higher than 30% of the country's population. <http://www.psu.org.ve/?q=node/7618>.

¹¹⁸ This is a hospital with 1,200 beds.

The first general prototype was created in 2007 and another was created for rural areas. Development has continued since and there is currently a third version of Medicarro that uses videoconferences in real and deferred time and is also able to operate remote medical equipment. In addition, Medicarro acts as a point-to-point connection between health-care institutions. Medicarro version 3.0 is particularly attractive since not only does it use SINAPSIS system for electronic health records, but it also operates using a unique version of LINUX software known as CANAIMA on computers manufactured by a Venezuelan company. Medicarro is product of the partnership between different public and private stakeholders to create a technological solution to meet these needs.

Negatoscope

The team at Simón Bolívar University created a device specifically for the area of teleradiology. Even though it is designed for remote procedures, the device can be used for intrahospital radiology and is known as a digital negatoscope. This is a device that is installed on the wall of a medical clinic or operating room, just like a conventional negatoscope. Images can be transferred by means of a local area network, a USB key or DVD, to an area where digital information is needed. In addition, if there is no digital image, acetates can be viewed using analogue images. Acetates can also be compared with an electronic image recently taken using a double negatoscope. One advantage of this device is that it does not change the physician's work routine. It can also be used as a blackboard for meetings with other colleagues or for explaining medical cases to patients.

Intelligent operating rooms

A version of these devices, known as intelligent operating rooms, was developed by Simón Bolívar University. They are operating rooms equipped with devices for capturing videos and vital signs, which can be used to provide remote medical advice during an operation. In addition, they can be used as distance health-care learning centres when installed in fourth level hospitals. High complexity and major surgical operations in intelligent operating rooms can be narrated in real time to medical students, or they can be saved and documented for later reference by medical students specializing in this area.

The Carlos Arvelo Military Hospital electronic operating room has a camera on the surgery light featuring a 30x zoom lens for distance operations and is connected by means of images and sounds. Surgical X-ray machines

(C-arm) can be connected to the video capturing system or the anesthesia machine can be used to monitor a patient's vital signs.

Surgical robots

A number of Da Vinci surgical robots have been purchased in the Bolivarian Republic of Venezuela. A console links the surgeon and robot in the same room, but they are remotely connected. The country hopes to develop a prototype based on the Da Vinci robot so that the remote consoles can be implemented. This means that the robot can be located in one place and the expert surgeon in another. There could even be several surgeons working closely together to control an operation carried out by the robot.

The neurosurgical navigation system

The 1988 Telemedicine Project in the State of Carabobo was the first of a number of projects being implemented (since there has been a health network as such). It was the first example of how useful telemedicine could be for the country. The project involved a number of institutions and established a structured wire and fibre-optic network between different health-care centres in the State of Carabobo. It also connected several research centres and five universities, as well as a number of government institutions.

The University of Carabobo is creating a neurosurgical navigation system known as Neuropanacea, which enables a neurosurgeon to view where in the brain a surgical instrument is being placed in real time by means of slides and image merging. This can be used to execute cerebral ablation or to install a neurosurgical oscillator assistance device. In addition, this university is working on integrating Neuropanacea into a surgical planning system and a distance learning system.

Networks

There is also a REACCIUN network in the Bolivarian Republic of Venezuela, which is a very attractive Internet2 network that belongs to the CLARA network. REACCIUN links all public universities in the country, including university hospitals. Teleradiology and broadband communication projects have already been implemented at these hospitals. The Simón Bolívar satellite covers most of the region and is responsible for providing the transport and connectivity network for the development of the National Tele-Education and Tele-Health System.

A prospective outlook

The Bolivarian Republic of Venezuela aims to integrate health information by means of a multi-server/multi-customer system that enables the use of any means of communication to access the Internet. The Internet is therefore used to access a national network of servers so that health records can be used anywhere. For this reason, the Simón Bolívar satellite should be used for this purpose, together with computer-based satellite telecommunication devices that connect telephony, voice, data and video, and for example, Medicarro and/or computers to connect telephones.

The scenario described does not yet exist in the country, but it is being developed. There are currently two pilot projects that use the Simón Bolívar satellite for connection: one located at Delta del Río Orinoco and another at the Guajira Peninsula, two extremes of the country.

These projects have already been launched. The Bolivarian Republic of Venezuela is now working on an expanded model, which means that new technology would be installed over former technology. The idea is to achieve a layered model, which ideally encourages technological independence and could be implemented by other countries in the region.

Background information on the Bolivarian Republic of Venezuela Social Development Division, ECLAC, United Nations

The Bolivarian Republic of Venezuela has one of the highest urbanization rates in Latin America. Although the country does not have a metropolis, it has five large cities where 33% of the total population resides, as well as 50 intermediate cities where 32% of the inhabitants live.

At present, the country is completing demographic transition. This is evident from its natural growth rate of 1.63, the total fertility rate of 2.55 children per women and average life expectancy at birth of 73.8 years. According to CELADE, the overall dependency ratio for 2005 was 56.8. As regards its epidemiological profile, the main causes of death in the Bolivarian Republic of Venezuela are chronic illnesses, violence and accidents.

As for the first Millennium Development Goal, the percentage of the population living in extreme poverty dropped from 14.4% in 1990 to 9.9% in 2008, which represents significant progress towards the goal of reducing the percentage of people living in this situation by 50% (United Nations, 2010).

The under-five mortality rate has improved considerably, decreasing from 31.6 for every 1,000 live births in 1991 to 21.1 in 2008 (United Nations, 2010). However, CEPALSTAT 2010 reported that the country will have to work harder if it is to reach the target for 2015 (10.4 for every 1,000 live births).

As for maternal health improvement, the goal of 14.7 maternal deaths for every 100,000 live births by 2015 is still far from achieving, since this rate was 60.1 in 2001 and dropped slightly to 56.8 in 2008 (United Nations, 2010).

Source:

CELADE, 2006.

CEPALSTAT, 2010.

United Nations (2010), *Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges*, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

The SOS Telemedicina para Venezuela Programme

The Bolivarian Republic of Venezuela is characterized by marked inequality in the availability of specialist medical care in rural populations. The *SOS Telemedicina para Venezuela* programme at the Faculty of Medicine of the Central University of Venezuela (UCV) has set up a telemedicine network that makes use of ICT, equipping and connecting remote centres for primary care with medical specialists from UCV to improve their capacity to deal with clinical problems, to provide distance education, to support technology transfer to these regions, to develop skills and to evaluate the benefits of telemedicine.

SOS methodology includes research in telehealth, distance education, software engineering, telecommunications engineering, the processes of teleconsultation and tediagnosis, technological platforms, management indicators, user requirements, integration with social networks and relations with academic, governmental and private organizations.

The following has been achieved after two years of implementation: a clearly conceptualized programme, financing, a committed multidisciplinary team, 16 health centres equipped and connected to the Faculty of Medicine at the Central University of Venezuela, a technological platform for telemedicine and distance education, support from the university and regional health authorities, as well as a strong alliance with private technology companies (HP, CISCO, Microsoft, Digitel).

SOS Telemedicina para Venezuela has succeeded in demonstrating that, with the commitment of the different stakeholders and the appropriate use of ICT, it offers support for physicians, residents and health-care personnel, uses the network to provide continuing medical education, and benefits patients by providing specialist medical care as a contribution to human development.

Source: Héctor Arrechdera. Faculty of Medicine, Central University of Venezuela, 2010.

XIII.

Public health information systems in the Caribbean

*Tomás Sandor*¹¹⁹



Trinidad and Tobago

ICT developments in health care

Trinidad and Tobago has 1.3 million inhabitants and is a major exporter of oil and natural gas. In regional terms, it has a high per capita income but the lowest health-care spending. In 2005 this spending item was equivalent to 3.75% of GDP, as against the regional average which, according to PAHO, exceeded 5% of GDP.

Lack of investment in the health sector in Trinidad and Tobago reflects the lack of an adequate institutional structure owing, in turn, to operative decentralization. The country is divided into five health-care regions that are 30 km apart. Due to the lack of management capacity, the Central Ministry (CM) opted to outsource health-care provisions in 1998. Since the Ministry failed to provide clear operating rules, however, the regions considered themselves autonomous even through their funding came from CM.

Against this background, the current management of the Ministry of Health found itself obliged to implement the National Health Insurance

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System and stipulate a package of health services that would be covered by the State. This was intended to make public health centres form contracts with insurance companies for service provision. Public health centres thus came back under the control of the State, which increased their budget to 6% of the country's GDP.¹²⁰

In August 2009, the Prime Minister of Trinidad and Tobago stated that health care is a priority sector for development. In this context, ambitious plans have been designed to provide computer equipment and connectivity for the 187 existing public health centres. The country's present Minister of Health is assessing the conditions put forward by the former administration relating to contracting application services for health insurance, hospital administration and health centres.

Projects implemented

• *The AIDS Programme*

An information system project for the HIV/AIDS Programme was successfully launched in November 2009. This project was financed by the Office of the Prime Minister (OPM) and partially by a loan from the World Bank. The OPM managed a tender under which a United States company (Terida) was contracted to implement a system in a web-based technology platform.

This project was used to implement the following improvements: the MLab system for laboratory management at Trinidad Public Health Laboratory (TPHL); the e-Progressa system at the National Blood Bank; the Cellma clinical administration system operated by the RioMed company at six pilot sites for attending patients with AIDS; the Business Intelligence Health Metrics 3D package at the National Epidemiological Surveillance Unit and National AIDS Coordinating Committee. Finally, a series of blade servers, a communications hub (Health Exchange Integration Platform) with an HL7 interface, the Forsys database on an Oracle platform and the X4H expert system were implemented at the Ministry of Health.

The applications implemented at the aforementioned facilities were interconnected by means of the GovNeTT national communications network, with the correct bandwidth for web platform operations.

To date, the Ministry of Health in Trinidad and Tobago has one of the most modern AIDS information systems in the world. However, time

¹²⁰ According to statements made by the Honorable Minister of Health, Jerry Narace, at the Summit of the Americas in November 2009.

is needed for the project to develop properly.¹²¹ There are also a number of barriers that must be overcome, particularly the need for support from the Ministry of Health. In addition, the clinical management system that currently covers six health centres is expected to include an additional six or eight and it is hoped that patient information will be shared between all AIDS Programme stakeholders. The principal AIDS care centre (Medical Research Foundation) does not share information about its 12,000 patients undergoing treatment. The Epidemiology Unit of the Ministry of Health still receives paper-based information which is incomplete and substantially backlogged.

• *The Chronic Disease Assistance Program (CDAP)*

The Ministry of Health of Trinidad and Tobago provides free medication to 40,000 patients with chronic illnesses. Each patient registered on CDAP receives a smart card which can be used to access a network of 115 pharmacies that provide medication. Pharmacies process prescriptions, record the prescribed dosage and issue medication to patient. The number of prescription drugs dispensed is checked online, as well as the total amount of authorized medication during that period, among other aspects. Once the transaction has been completed, information is transferred to a central database (NIPDEC-Infotech). Drug stock is then checked by batches at each pharmacy and at the headquarters. The National Insurance Property Development Company (NIPDEC) purchases medication centrally and distributes it to all the pharmacies within the network.

• *e-Health card*

An e-Health card system was implemented as a pilot project in early 2010 using a web-based patient management system. It was launched at a group of health centres and the objective was to implement it throughout the country. The project was designed to (a) provide beneficiaries of the public system with an identification card that will eventually become single patient identification;¹²² (b) record each patient who uses the system for the first time in a centralized database with all the necessary demographic information; and (c) capture the basic information about the transaction including the patient ID, the provider ID (the physician who treated the patient) and service area, the code for the service provided (procedures), the principal diagnosis code, data or vital signs measured (blood pressure, temperature, etc.) and in the case of emergencies, the triage level, data from rapid tests requested, as well as the date and time of patient state changes (registered-treated by

¹²¹ For example, the system provider operated without a maintenance contract for over one year and independently managed continuity of its operations. The aforementioned contract was signed recently.

¹²² There is no single patient identification document in Trinidad and Tobago.

physician-discharged from institution). The e-Health card system is supported by a basic medical shift module.

• *The National Health Insurance System*

The Ministry of Health has plans to implement a health insurance system which is similar to the National Health Service (NHS) in England. It is therefore evaluating the process of contracting a management system¹²³ with the specifications of a modern e-Health system, which were approved by the former administration of the Ministry and National Cabinet.

The application software to be contracted includes hospital and medical centre management and will thus provide these health institutions with the computer equipment and the connectivity required. The continuity of the project depends on the new government administration.

• *Health dictionary*

In March 2010, the Ministry of Health commissioned a PAHO consultant to create a health dictionary which included information such as the definition of the main indicators to be met and information sources. The process started with two workshops for all the agencies which process data in the health sector and a progress report for health information systems. The Ministry of Health expects this dictionary to provide support for the computer project relating to the strategic health information plan and the standardization of forms and processes.

Dominican Republic

ICT developments in health care

The Dominican Republic has 9.5 million inhabitants and it occupies two-thirds of the Island of Hispaniola or Santo Domingo. The public health-care sector is divided into nine health regions which govern the 32 provinces in the country.

At present, the Ministry of Health is reorganizing the structure of public health-care, as well as its reporting and information system. It will essentially examine the interrelationship between different programmes, regional and provincial hospitals, as well as health centres or primary health-care units (UNAP).

¹²³ They are health-care management or application software systems.

The National Health Insurance Board is a new institution that will be incorporated into the restructured system. It offers the population a single plan that partially covers medical costs by means of a co-payment system. There is comprehensive coverage for some critical health services, in particular those connected with national programmes such as AIDS. However, they do not always meet the objective of covering the whole population affected. In fact, there are primary health-care and public awareness campaigns in the Dominican Republic designed to encourage people to go to health-care centres or UNAPs.

ICT in health care is a priority in the Dominican Republic. However, the various public presentations on projects carried out at different organizations do not accurately represent what was really done, since these projects were abandoned shortly after they were launched. The present supply of equipment in the public health sector is adequate for the limited scope of ICT plans and the connections between health agencies are appropriate. The Ministry of Health has a national ICT strategy but has yet to implement it.

Despite this, there are some public organizations that use ICTs in health care, such as the Presidential Council on AIDS (COPRESIDA) and the Directorate for the Control of Sexually Transmitted Diseases and AIDS (DIGECITSS). Both organizations receive funding and technical support from the Clinton Foundation, which is an NGO. COPRESIDA has implemented an initiative that has the technology required for health application software. It has developed an informatics tool for monitoring and evaluation that the Ministry of Health has decided to implement throughout the entire health sector. There is a group of qualified technicians assigned to this task. In addition, there are plans to develop a national ICT platform for the National Health Insurance System.

Projects implemented

• *The AIDS Programme*

The AIDS programme is the project which receives the best funding in the field of ICT and health. DIGECITSS is operating a management information system based on SIAI software at a number of health-care centres for treating AIDS patients. This tool is used to monitor processes which affect indicators of the Provincial Epidemiological Surveillance Directorate, regional health-care services and specialist centres (CEAS). The platform was designed using Net and SQL Server 2008 tools as the database and its results have been very successful.

At present, a new version of SIAI (SIAI+) is being developed. According to the latest update, it will not be implemented until an evaluation of clinical application software available on the market has been completed. This new platform will give the Ministry of Health access to a very important operating tool. A pilot plan was launched to test connectivity between participating sites. Other countries have shown interest in developing SIAI+, such as Honduras and Panama, and this evidences the possibilities for regional integration.

The clinical information system implemented with the support of the Clinton Foundation includes: clinical management systems with detailed patient health records; a laboratory management system with automatic reporting to the database; an appointment/medical shift system and other modules for collecting data and generating reports at regional and national levels.

The AIDS programme has its goals clearly outlined, as well as technically competent human resources and acceptable financing in all areas. Based on this scenario, the country has got the capacities to manually process information for all national indicators.

In addition to the SIAI+ programme, DIGECITSS developed a georeferencing system for the AIDS programme, also funded by the Clinton Foundation. These georeferencing management programmes were used successfully in 2008 in other areas of the Ministry of Health, such as the medication supply chain management.

Grenada

ICT developments in health care

Grenada is a country made up of several islands and it has a population of 110,000. The Ministry of Health has a national ICT strategy for the health-care sector based on recommendations made by the ICT consultant at the Office of the Prime Minister. The strategy considers the possibility of using technology and communication developments implemented by the Ministry of Health in Belize¹²⁴ and Saint Lucia. The Ministry of Health ICT platform will be provided by the Ministry of Economy's information technology department.¹²⁵

¹²⁴ In Grenada, there is great interest in finding out more about the Belize health sector development project. Therefore, there is willingness to learn from other experiences.

¹²⁵ Most of the Government Institutions in Grenada are located in the same building as the Ministerial Complex.

ICT Strategy

The Ministry of Health is divided into six districts. Each district has a family health centre and a general hospital, for example, in the capital of Grenada, it is the Saint George National Hospital. According to a 2006 Ministry of Health report, the paper-based information system is not very useful at hospitals and health-care centres in Grenada, meaning that there are areas where a basic ICT system could be of use. However, this publication does not include any specific information technologies plans. Suggestions were generally aimed at the hospital information system rather than management of national health care.

Given that Grenada has urgent information needs, the Ministry of Health considers that the strategy should focus on generating a basic information system on e-Health from the Social Security Administration¹²⁶ and work towards the National Health Insurance System.

Connectivity

The computer equipment used by the Ministry of Health is very limited, quite outdated and it is not adequate to meet the development requirements of the sector. As for software, there are no management systems in operation within the health sector, with the exception of a laboratory system. As regards the present state of connectivity, it is almost non-existent¹²⁷ in the Ministry of Health, its central office and the primary health centres.

The State communications provider is a private monopoly that is very expensive to use. The Government of Grenada is therefore launching a project to connect all government offices, including primary health services (using a network exclusively for the sector). This strategy is designed to connect Grenada's Government Building to all the health centres and it aims to put it into effect using a new public tender in order to obtain better prices.

Belize

ICT developments in health care

Belize is located in Central America and it stands out for being an English-speaking country and belonging to the Caribbean Community. It has a

¹²⁶ Grenada has a social security system for retired persons and pensioners. However, it is being reviewed to improve the way health care is financed. Interdependence between the public and private health sectors is also being analysed, among other aspects.

¹²⁷ They were difficult to use on the few occasions they were available.

population of 320,000 and its health system is divided into four management regions: north, central, west and south. The country successfully implemented a Health Sector Reform Project (HSRP) using loans provided by multilateral institutions such as the Inter-American Development Bank (IDB) and the Caribbean Development Bank (CDB). This project has been used to support ICT in the health care sector.

ICT strategy

Belize requested and received support from PAHO to strengthen its health information systems. It became the first country in the Americas to be granted technical support priority after being chosen in 2008 for the Assessment of the Health Information System led by the Health Metrics Network (HMN). The country completed the assessment and received the first draft of the Strategic Plan jointly developed by HMN and PAHO in October 2009. There were three priority objectives in this plan including (1) the revision of the legal framework in order to provide support for the Belize Health Information System (BHIS); (2) the improvement of data management in order to support evidence-based decision-making; and (3) the improvement of dissemination and use of information.

Connectivity

The present state of connectivity in the Ministry of Health is acceptable, even though costs are high. The computer equipment is adequate to meet the plans for development.

BHIS was launched in September 2008 and it is a comprehensive national system with computerized and centralized health records. The system was developed by the Canadian consulting firm, Accesstec Inc., and it integrated its own modules using systems already operating in the country, thus achieving high degrees of security and reliability.

The modules currently operating are (1) processing of inpatient admissions/discharges/transfers; (2) processing of clinical orders at health centres or hospitals; and (3) laboratory management of clinical analysis.¹²⁸ At present, pharmacy and supply chain management modules are being

¹²⁸ These modules were implemented at the following health centres: Corozal Community Hospital; Northern Regional Hospital; Cleopatra White Polyclinic; Matron Roberts Polyclinic; San Pedro Polyclinic; Port Loyola Health Centre; Central Laboratory; Central Supply Warehouse; Western Regional Hospital; San Ignacio Community Hospital; Southern Regional Hospital; KHMHA (Karl Heusner Memorial Hospital Authority); Punta Gorda Community Hospital; Central Regional Administration and Ministry of Health Central Administration.

implemented. Implementation of HIV/AIDS, public health and human resources modules is expected in the future.

Social security system

The social security system, in collaboration with the private sector, has successfully developed an ambitious information system. The system operates through the National Health Insurance Fund as an independent company that provides health services in the public sector. The private sector provides services through the Innovation Fund.

According to an announcement made by the Secretariat for Social Security at a congress held in Saint Lucia in 2009, this system has improved health sector economy and provided services to the most deprived sectors.

British Virgin Islands

ICT developments in health care

The British Virgin Islands is comprised of a group of islands, the largest of which is Tortola, with a population of 20,000. It is a tax-free territory which has banks and over 200,000 companies, and its inhabitants have high per-capita income.

The Ministry of Health and Welfare is responsible for providing public health services, as well as regulating and monitoring the private health sector. The public health sector has three clinics, two of which are satellites and one at Peebles Hospital, the country's only central hospital. In turn, the private sector has three clinics offering some specialized services. Patients requiring treatment that cannot be provided in the country are referred to Puerto Rico, Jamaica, the United States Virgin Islands or the United Kingdom.

ICT strategy

The Ministry of Finance manages the only central government data centre, including the Social Security Board (SSB). The possibility of providing Peebles Hospital with a comprehensive health management system which includes health centres is currently being discussed. There are also plans to provide the connectivity needed for the health sector.

Health insurance

The compulsory social security scheme, which includes public or private providers, covers all citizens free of charge. All employees, employers and self-employed workers who form part of the system make contributions to the scheme.

The Ministry of Health plans to implement a comprehensive health insurance management system at national level, in which external providers (in other countries) will be required to validate their transactions online in order to send an invoice.

Saint Lucia

ICT developments in health care

Saint Lucia is a mountainous English-speaking island of the Caribbean with a population of 150,000. Unfortunately, the Ministry of Health initiatives to implement a national health system have not been successful to date.

Primary health care is provided at several public health centres where medical and pharmaceutical services are only available on certain days of the week. There are two general hospitals (Victoria and Saint Jude) and two community hospitals (Soufriere and Dennery) that provide emergency services.

There are also private clinics which offer specialized medical services. Patients who cannot receive care locally are referred to neighbouring countries.

ICT strategy

A Canadian group has been developing a system based on Unix technology (open architecture) since 2008. Work with open systems has prevented the delays associated with tender processes and financing was provided for the system over the last two years. Despite the fact that several countries in the Caribbean had expectations of this strategy, the project was not implemented due to lack of funding. To summarize, the existing communication development plans for the health sector are making very slow progress.

Jamaica

ICT developments in health care

Jamaica is the largest English-speaking island in the Caribbean and it has a population of 2.6 million. Health care is free for all legal residents at the country's 23 hospitals and 350 public health centres, and medication is free. Health management is divided into four health-care regions, south-east, north-east, west and south.

Although the quality of medical care is acceptable, public services are inadequate and long waiting times for care and medication are common. The private sector provides cover for the citizens who can afford to pay for care. There is an agreement with Cuba under which a contingent of Cuban physicians can work on the island.

ICT strategy

The Ministry of Health does not have a clearly defined ICT strategy. Manual information systems are able to generate basic indicators requested by international organizations such as PAHO, but they are stagnant and no information has been processed in recent years.¹²⁹

Despite this, some programmes have implemented information systems independently. This is the case of injury surveillance at general hospitals where very basic information systems have been installed. In addition, an information system was installed in two public hospitals in 2010 through an agreement signed together with the Republic of South Korea. In spite of this, a national health information system has yet to be implemented.

Health insurance

Jamaica's public health system is free. It is financed by taxes and covers 80% of the population. The private subsystem also includes a company that provides health insurance (Sagicor Life) and several life insurance companies that also offer health insurance plans with traditional actuarial systems (NCB Insurance, Guardian Life, Scotia Life, etc.).

¹²⁹ According to an unofficial report from the local PAHO office, the health statistics available relate to the previous decade, which is a major cause of concern for PAHO technicians.

Telemedicine initiatives in Jamaica

The National Telemedicine Project is a comprehensive and ambitious plan, which has been promoted at length in the subregion and has just been implemented. It combines all of the features included in the technological initiatives planned in the Caribbean.

The objectives are to:

- Establish a national information technology network, dedicated to delivering affordable health services to Jamaicans at home and abroad. The network can later be expanded to the rest of the Caribbean and West Africa territories.
- Provide an affordable telemedicine information technology platform including digital television content, for the delivery and export of health services from Jamaica reaching customers including tourists wherever they are, at home or abroad.
- Facilitate the development of a Caribbean health tourism market as part of the process of diversification and expansion of tourism in the Caribbean.
- Enable the active participation of health professionals from Jamaica, the Caribbean and Africa in the global ICT market so that these professionals may export their services to facilitate national and regional development of the health sector.

Telemedicine projects have been executed in Jamaica since 1997. In that same year the National Commission of Science and Technology (NCST) was founded and it later became the body that implemented the National Telemedicine Project. According to the Development and Research Unit of the University of the West Indies (UWI), there is an increasing number of medical specialities using telemedicine, such as dermatology, oncology, psychiatry and home care services.

According to UWI, NCST is the latest telemedicine solution for health-care needs in Jamaica. It recognizes how NCST uses ICT for different applications by means of telephone lines, fibre optics and satellite links. In addition, UWI emphasizes how the telemedicine project is helping medical staff to provide health-care services efficiently and at lower costs. The university also states that this technology overcomes distance barrier while ensuring better diagnosis and patient management.

Since 1997, the National Telemedicine Project has been developing UNIMEDICS, which is an electronic health records (EHR) system based on a web platform. This system facilitates online management of patient

health records. The system is extensively scalable and meets the information security requirements and standards of the Health Insurance Portability & Accountability Act (HIPAA) of the United States of America.

Plans for continuing medical education have benefited from the existing link between several community hospitals and medical institutions that support them, all within the framework of the National Telemedicine Project.

The Cayman Islands

ICT developments in health care

The Cayman Islands is a British Overseas Territory comprising three islands (Grand Cayman, Cayman Brac and Little Cayman) and it has a surface area of 216 km² and a total 56,000 inhabitants. It is the main financial centre in the Caribbean and has the highest per capita income in the region.

Health provision system

The health services authority manages health centres in the Cayman Islands, in particular, the principal hospitals, such as the Cayman Island Hospital which has 124 beds and is located on the main island; the Faith Hospital in Cayman Brac; and the Little Cayman Clinic. There are also clinics in several districts. In the event that a particular service is not available, patients are referred to international medical centres, mostly in the United States of America.

ICT strategy

The health sector is one of the main priorities for the Cayman Islands Government and for this reason it has contracted a large United States hospital systems provider (Cernes) for its most important health centre. A budget has already been assigned for this strategy and implementation started in 2009.

Health insurance

Health care is public and free of charge in the Cayman Islands, and it is financed by taxes and contributions paid by employers and employees. The country has a Health Insurance Commission whose members are appointed by the State. The commission is responsible for authorizing expensive operations, particularly those carried out abroad.

Conclusions for the Caribbean subregion

Present state of health information systems in the public health sector of the Caribbean

In the countries of the Caribbean, the population is distributed over islands with different population densities and in many cases specialized services are offered to the local residents only one day per week. Health services are provided by the public sector and the private sector intervenes in certain areas where the State is unable to provide care.

A number of different informatics developments have been made in the public health sector. Based on the analysis of ICT projects in the Caribbean, the conclusion is that only well-managed health institutions which plan medium- and long-term projects are able to implement successful initiatives.¹³⁰

ICT projects in the region are usually short-term and not sustainable in the long term. The reason for this is that instant results are expected and the political authorities do not provide the support needed to manage these new projects, primarily due to lack of knowledge. In addition, standardization processes are still required for sharing information between countries and health centres.

Despite this, one positive aspect is that acquisition of technology is centralized in most Caribbean countries, while it is decentralized or individually purchased by health centres, hospitals and regions in industrialized countries. This is of the region's strengths because it facilitates the integration of health centre information systems with health information systems or health insurance systems at a central level.

ICT in health care should ideally connect health agents and prompt the right flow of information to support those making decisions relating to rationalizing expenditure and epidemiological surveillance.

Proposals

An understanding and analysis of the obstacles and the favourable conditions in each country are needed in order to implement successful ICT health

¹³⁰ The experience at the University of West Indies (UWI) is noteworthy in this regard. Among other initiatives, the university signed an agreement with Canadian health centres to implement specialized pediatric cancer telemedicine services. A telemedicine strategy was designed by the Eric Williams Medical Complex in Trinidad and Tobago and the SickKids Hospital in Toronto. Another example is teleconference centres which link several hospitals in Trinidad and Tobago. Third sector participation has also been important in this area, since it has financed patient transfer.

projects. Process redesign must also be considered and planned to incorporate informatics tools, adapt personal abilities and skills, and optimize management of economic/financial and medical/clinical aspects relating to health care. Economic results in terms of financing health care and other social factors should help to evaluate the project. In addition, the high level of bureaucracy in public health services must also be reduced (for example, to contract services).

As regards the structure of the organization, the ICT Division of the Ministry of Health is planned to hold a top hierarchical position and the authorities must commit to implementing technology projects. In addition, the Division must incorporate and accept the support of organizations with experience in public health-care management. Health authorities at central level and at health centres should receive training on project management of this nature. The latter could be funded by loans from multilateral organization in the health sector.

As for operating issues, it is important to have single patient identification, as well as ICT standards that have been adopted and implemented for providing services and supplying medication, among others. In this respect, the adoption of clinical terminology standards in the region could be a flagship project and integrate operating standards to health centres throughout the countries and subregion.

In terms of ICT infrastructure, web-based solutions are the most suitable for the subregion since they require centralized infrastructure that, in many Caribbean countries, could be outsourced in order to use this tool more efficiently and effectively in the health sector. Likewise, a processing centre could be built for health systems managed by a subregional agency as a feasible solution.

As regards the scope, ICT projects should engage most of the public health areas, including institutional order and its jurisdictions, standards and regulations, laws in force, political organization and the Ministry of Health organizational structure, among others.

Improved health management should incorporate a system which is able to process contacts between beneficiaries of the public system and service providers in real time. In particular, this system should incorporate information on (1) the health service requested; (2) the provider identification; (3) the beneficiary identification; and (4) the diagnosis. This data makes it easy to validate health coverage plans and contracts with public and private health-care providers online.

Background information on the Caribbean subregion Social Development Division, ECLAC, United Nations

In the Caribbean, 67% of all inhabitants live in urban areas. However, this percentage varies throughout the subregion. Countries with different levels of urbanization evidence high concentration in their main cities (more than 30% of the total). For example, in Haiti and Cuba 32% and 19% of the total population lives in their largest cities, while levels of urbanization are 45% and 77% respectively.

In other countries, such as Jamaica and Belize, the population is divided among the intermediate cities and their level of urbanization is approximately 50%. The population of Trinidad and Tobago is also distributed among medium-sized cities, but only 14% of the inhabitants reside in urban localities.

The regional averages for some demographic indicators in the Caribbean show that the average life expectancy at birth (LEAB) is 72 years and the total fertility rate (TFR) is 2.37 children per woman. Population distribution by age groups shows that a one to one ratio will be reached by the 2040-2045 period between the 0-14 age group and the over 65 age group.

As regards demographic heterogeneity in the Caribbean, it is noteworthy that Jamaica is currently in full demographic transition. Likewise, its demographic characteristics are similar to those of the subregional averages (TFR of 2.4 and LEAB of 72 years). This group includes Guyana, Suriname, Jamaica, French Guyana and Belize. Guyana and Suriname have the lowest fertility rates in the group but also the highest mortality rates, higher than the aforementioned average. In contrast, fertility rates in French Guyana and Belize are the highest, but these countries' average life expectancy surpasses all other countries in the region (ECLAC, 2008). Although the average in Trinidad and Tobago is similar to the subregional average, the country is at an advanced stage of demographic transition (TFR is 1.64 children per woman and LEAB of 66 years for men and 73 years for women). Guadalupe, Martinique and Puerto Rico are also included in this group and they stand out from the other countries in Latin America and the Caribbean for their significant increase in the average life expectancy of their inhabitants (ECLAC, 2008). Finally, Barbados is currently at a highly advanced stage of demographic transition given its high life expectancy at birth for men and women, as well as its low fertility rates.

The 2005 overall dependency ratio for countries in this subregion (according to CELADE data, 2006) was 57.7 for the Dominican Republic; 69.6 for Belize; 63.3 for Jamaica; 56.3 for Saint Lucia and 40.6 for Trinidad and Tobago.

Although chronic illnesses are the principal causes of mortality in the Caribbean, transmissible diseases are also significant, in particular HIV/AIDS in some countries. In fact, HIV/AIDS figures prominently among the principal causes of death in Guyana (19%), the Bahamas (17%) and Trinidad and Tobago (16%). The two principal causes of death in Barbados and Suriname are ischemic heart disease and cerebrovascular disorders, while in the case of Belize they are ischemic heart disease (10%), perinatal conditions (8%) and cerebrovascular disorders (8%).

According to the Millennium Development Goal for reducing the percentage of the population whose daily income is less than US\$ 1, extreme poverty estimates, which form part of the CEPALSTAT official database, include

a limited number of countries (Guyana, Jamaica, Saint Lucia, Suriname and Trinidad and Tobago). However, slightly more than 75% of the regional population and a large percentage of the population living in extreme poverty in the Caribbean reside in these countries (United Nations, 2010). For example, development in Jamaica was unstable over the period analysed; it was 0.2% in 1990 and rose to 3.8% in 1993 and then dropped to 0.2% in 2004. Despite this, the household surveys for Jamaica show that it has made sustainable progress in terms of the percentage of the population under the poverty line since the level dropped from 28.4% in 1990 to 9.9% in 2007 (Planning Institute of Jamaica, 2009). In addition, according to the Belize Millennium Development Goal report for 2005, the country is behind with regard to its first goal. The percentage of the population under the poverty line was 33.5% in 2003 and must drop to 16.8% by 2015. Poverty reduction in Trinidad and Tobago was lower since it decreased by more than four percentage points between 1992 and 2005; dropping from 21% to 16.7% (United Nations, 2010).

As for health, the Millennium Development Goal on improving maternal health showed significant variations between the countries in the subregion. Jamaica and Guyana reported a rising maternal mortality rate between 1990 and 2005. In Jamaica, this rate increased from 120 maternal deaths for every 100,000 live births to 170. In Belize, conversely, it fell from 140 in the year 2000 to 52 in 2005, and the country is therefore approaching its target of 35 by 2015. Trinidad and Tobago also reported progress between 2000 and 2005. The country was able to reduce the mortality rate to 45 for every 100,000 live births. The Bahamas is another country which stands out for its decreasing maternal mortality rate which was 100 in 1990 and dropped to 16 in 2005.

The Millennium Development Goal to combat HIV/AIDS, malaria and other diseases is important in the Caribbean, particularly relating to the human immunodeficiency virus, since this rate is 0.4% higher than the average for Latin America (CEPALSTAT). Although the average HIV prevalence rate among the population between 15 and 49 years old in the subregion has remained stable at 1% between 2000 and 2008, growth starting in 1990 must be taken into consideration. In Jamaica, this rate increased from 0.3% in 1990 to 1.5% in 2005 and in Belize it rose from less than 0.1% in 1990 to 2.1% in 2005.

Lastly, in general the mortality rate linked to tuberculosis has made progress in the subregion, except in the case of Guyana and Suriname, where the mortality rates increased by 18 and 15 points (per 100,000 inhabitants).

Source:

CELADE, 2006.

ECLAC (2008). Demographic transformations and their influence on development in Latin America and the Caribbean, Thirty-second session of ECLAC, Santo Domingo, Dominican Republic.

United Nations (2010), Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges, (LC/G.2460), Alicia Bárcena, Antonio Prado and Arturo León (coordinators), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

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XIV.

The e-Health experience in Spain: lessons for Latin America and the Caribbean

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The population of Spain stands at approximately 46 million, including over 5 million foreigners. Average life expectancy at birth is 81 years; 77.8 for men and 84.1 for women.¹³²

Although Spain's health indicators are very good, there is uncertainty as to which of these results are due to the health system and which are due to Mediterranean conditions that are synonymous with a healthy lifestyle. Approximately 80% of all deaths in the country fall into five major groups of causes: circulatory system diseases, cancer, respiratory tract diseases, digestive system diseases and external causes of traumatism and poisoning.

The e-Health strategy must be the result and form part of the health strategy. For this reason, it is essential to consider the health indicators and the principal causes of death. Another factor which requires significant consideration is the ageing population. Given that the birth rate has decreased significantly in recent years and life expectancy is high, Spain is in an advanced stage of demographic transition. Therefore, chronic diseases and an aged population determine the health strategy and the e-Health strategy.

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¹³² More exhaustive information about the Spanish National Health System can be found in the Annual Report, available at: <http://www.msc.es/organizacion/sns/planCalidadSNS/pdf/equidad/informeAnual2008/informeAnualSNS2008.pdf>.

Spain is almost a federal state since it has 17 autonomous communities which have absolute or nearly absolute jurisdiction over the management and provision of health services and systems. State jurisdiction is limited to foreign health and the general coordination of health through the National Health System Interterritorial Council, made up of health councillors (regional ministers) and senior representatives of the Ministry of Health. Other State responsibilities are public financing of medication and the National Health System service portfolio.

The National Health System in Spain receives public financing and guarantees universal coverage provided mostly by public services. Each autonomous community manages its health services. They are organized into health-care areas within territorial limits that have at least one reference hospital and provide health care for between 100,000 and 500,000 inhabitants.

Health-care areas are divided into basic health-care zones for primary health care. Each basic health zone should have at least one health centre for populations of over 1,000. These health centres have nurses, pediatricians, family doctors and administrative assistants. In some cases, they also have social workers.

There are local clinics which provide health care for smaller population nuclei (less than 1,000 persons). However, health personnel are only available on certain days of the week at some of them.

■ Table 1 ■

Distribution of structural resources by autonomous community (2008)

Autonomous community	Structural resources			
	Health-care areas	Basic health zones	Health centres	Local clinics
Andalusia	33	216	390	1 112
Aragon	8	125	116	915
Asturias (Principality of)	8	84	68	150
Balearic Islands	3	55	55	104
Canary Islands	7	109	109	160
Cantabria	4	40	38	134
Castille and Leon	11	248	240	3 647
Castille and La Mancha	8	197	196	1 115
Catalonia	7	358	407	827
Community of Valencia	22	240	252	580
Extremadura	8	113	106	417
Galicia	7	315	389	96
Madrid (Community of)	11	307	257	158
Murcia (Region of)	6	85	76	189
Navarra (Autonomous Community of)	3	54	54	244
Basque Country	7	116	135	183
Rioja (La)	1	19	19	171
Ceuta and Melilla	2	7	7	0
National Health System	156	2 688	2 914	10 202

Source: Spanish Ministry of Health and Social Policy. SIAP-SNS 2008. National Health System of Spain Annual Report 2008.

Spain has a total 156 health-care areas, 2,688 basic health zones, 2,914 health centres and 10,202 local clinics. On average, there is one family doctor for every 1,410 adults, one pediatrician for every 1,029 children, one nurse for every 1,663 inhabitants and one administrative assistant for every 3,102 inhabitants.

■ Table 2 ■

Distribution of the IHC* population/existing professionals ratios

Autonomous community	Family medicine	Pediatrics	Nursing	Administrative assistant
Andalusia	1 442	1 069	1 890	2 838
Aragon	1 229	997	1 458	4 078
Asturias (Principality of)	1 481	779	1 516	3 219
Balearic Islands	1 685	1 059	1 894	3 691
Canary Islands	1 519	974	1 723	3 568
Cantabria	1 361	1 035	1 522	3 407
Castille and Leon	939	901	1 165	3 326
Castille and La Mancha	1 276	1 041	1 376	3 379
Catalonia	1 474	1 180	1 572	2 575
Community of Valencia	1 555	994	1 936	3 080
Extremadura	1 199	969	1 218	3 954
Galicia	1 347	900	1 574	2 880
Madrid (Community of)	1 541	1 044	1 948	4 006
Murcia (Region of)	1 470	972	1 814	3 633
Navarra (Autonomous Community of)	1 418	977	1 413	2 470
Basque Country	1 563	905	1 709	2 573
Rioja (La)	1 251	950	1 535	4 674
Ceuta and Melilla	1 550	1 068	1 632	3 957
National Health System	1 410	1 029	1 663	3 102

Source: Spanish Ministry of Health and Social Policy. SIAP-SNS 2008. National Health System of Spain Annual Report 2008. IHC*: Individual health card.

According to the National Catalogue of Hospitals, the total number of working hospitals in Spain was 800 at the start of 2008. More than 40% of them belong to the National Health System and thus depend on different public administrations. Among the remaining hospitals, several form part of the network of hospitals for public use and hospitals that have signed substitution agreements with SNS, or which receive public funding for their activity. As a result, up to 40% of the hospitalizations in private hospitals in Spain are financed by SNS. The network associated with the public system had 71.2% of the total of 158,306 hospital beds, the ratio being 3.53 beds for every 1,000 inhabitants for the sector as a whole. The evolution in the number of beds in recent years continues to follow the downward trend that began in the 1980s, although the decrease is not generalized if the use of beds and the system they depend on are analysed. The decline in the number of beds is more pronounced in public hospitals, mainly due to the reduced number of beds in psychiatric hospitals. In the private sector, while acute hospitals

have also seen a decline in the number of beds (almost 4% between 2000 and 2007), the number of beds in geriatric and long-term care hospitals has increased over the same period.

In contrast, the number of places in day hospitals has increased very significantly in recent years, in a trend opposite to the one shown by the number of beds. This is a reflection of the progressive shift towards ambulatory specialized care, which is resulting in procedures that previously required admission to the hospital being performed in activity areas without overnight stay. This increase is found in both absolute numbers and in rates per 1,000 inhabitants.

■ Figure 1 ■

Evolution in number of beds and day hospital places in SNS hospitals 2000 and 2007



Source: Spanish Ministry of Health and Social Policy. Statistics on inpatient medical facilities 2007 National Health System of Spain Annual Report 2008.

In Spain, public health expenditure¹³³ is approximately 6% of the gross domestic product (GDP). Private expenditure is 2% and overall health expenditure is 8% of GDP.

■ Table 3 ■

Evolution of health expenditure and GDP
(Figures in millions of Euros)

	2003	2004	2005	2006	2007
Public expenditure on health	44 938	48 581	53 127	58 466	63 768
Private expenditure on health	18 853	20 287	22 144	23 598	25 060
Total expenditure	63 791	68 869	75 271	82 064	88 828
GDP	782 929	841 042	908 792	982 303	1 050 595

Source: Subdirectorato General of Economic Analysis and the Cohesion Fund of the Ministry of Health and Social Policy (MSPS). National Statistics Institute. National Health System of Spain Annual Report.

¹³³ The figures relate to 2007 because they are the last to be consolidated in the National Health System Report 2008. Economic figures analysed therein date from one year before the report was drawn up.

Electronic health records (EHRs)

Spain has invested a lot of money in electronic health record projects in recent years. Investments over the last three years amount to 300 million euros, approximately half of which has been financed by the State, while the other half was provided by the autonomous communities.

Primary health-care institutions have implemented electronic health records with advanced functions on a widespread scale. In fact, almost 90% of all primary care doctors use EHRs. In primary health care EHR functions include the prescription of medicines and supplementary exams, and the initial appointments with the specialist, among others. In addition, some communities have implemented electronic prescription systems. Establishment and use of electronic health records in primary health care in Spain has been a success.

In Spain, the electronic prescription system has been widely introduced in some communities, such as Andalusia and the Balearic Islands, thus creating a link between the doctor issuing the prescription, the pharmacist who accesses the prescription repository and dispenses the medication and the health service that pays for the benefit.¹³⁴ Other communities are currently implementing or in a pilot test phase of the electronic prescription system.

The central role of primary care doctors in the first electronic health records developments in the mid-1990s was key to their success. Despite their heavy workloads and at times insufficient support from the health system, they dedicated a lot of time and effort to developing these electronic health records.

In hospitals, the situation is heterogeneous. All hospitals built over the past five years feature a EHR system and are therefore known as 'paperless hospitals', even though there is no such institution that does not use paper at all. In older hospitals, the situation is quite different. They all have hospital information and patient management systems, etc. Of these hospitals, 70% have a medical station for the doctor and health personnel, although there is no information relating to their real use. In older hospitals, implementation of electronic health records has been far more difficult in view of the complexity relating to change management.

¹³⁴ A pharmacy can access electronic prescriptions directly and so the patient does not need to provide a written order.

Other e-Health applications

Over the past 5 to 10 years, Spain has made substantial progress in the field of medical imaging in the use of RIS (Radiology Information System) and PACS (Picture Archiving and Communications Systems). There is also widespread use of laboratory systems, primarily due to the fact that firms selling autoanalysers and reagents offer computer systems. This is undoubtedly a success factor. However, the only drawback is that these firms own the systems.

All of the autonomous communities have developed systems to guarantee the correct identification of patients, which is a requirement for medical record systems. For this reason, the health card system has been used to guarantee the correct identification of patients. A national database of health cards has been created, linked to the National Health System Quality Plan,¹³⁵ which receives information from the databases of the 17 health-care services.

The autonomous communities are working on other e-Health projects involving the introduction of management of laboratory requests and results. Interesting developments have also been made in prescription assistance systems, which have focused more on efficiency (costs) than on clinical aspects to date.

Another relatively successful area is large-scale appointment system supported by a call centre. This has been particularly successful in primary care and appointments are now made online.

Telemedicine

In Spain, telemedicine projects are mostly at a pilot stage and have not been disseminated on a massive scale. There are teledermatology projects in the Balearic and Canary Islands, where telepathology projects (pathologic anatomy), image transfer, Teliectus projects, etc. have also been developed. Other experiences that are beginning to expand in some communities (for example, Madrid and Catalonia) are networks of image-based diagnosis services. Radiologists have reported on studies of these services that have been carried out at other hospitals.

During the last National Health System Quality Awards ceremony, special recognition was made of the Remote Surveillance System for Heart Patients

¹³⁵ <http://www.msc.es/organizacion/sns/planCalidadSNS/home.htm>. For details regarding the statement of activities and scheduled actions, see <http://www.msps.es/organizacion/sns/planCalidadSNS/informe0610/Index.html>.

at the Madrid Clinical Hospital. However, as stated beforehand, there has been no massive telemedicine project dissemination as yet.

Given that Spain is not as vast as the countries in the Americas, it does not have as many communication problems. By analysing the cost-effectiveness ratio, it would be difficult to justify development and implementation of telemedicine projects in Spain.

Difficulties: standardization and interoperability

There have been both successful and unsuccessful experiences in Spain. Although the system provides public services and the primary health care centres and their reference hospitals belong to the same organization, there are two health record systems (primary and specialized health care) for historical reasons.

However, in recent years, these systems have been linked to create single databases. For example, the autonomous communities of Valencia and Andalusia are working to establish communication and integration procedures for both systems, thus enabling the consultation of data or the development of single systems which link the information. In some cases, such as Madrid, the Basque Country and Navarra, which is a community with 100% primary health coverage and almost full hospital care coverage, the solution was based on communication mechanisms rather than integration. When a specialist doctor wants to consult primary care health records, he or she can access the primary database; if a primary health-care doctor wishes to find out information on a specialist, he or she can access the hospital record.

Given that the 17 autonomous communities in Spain have developed their own systems and all of these have different technological and functional solutions, there are significant interoperability challenges. For this reason, it is almost impossible for one autonomous community to gain electronic access to information on another. However, there are some advantages of a decentralized health system, since the autonomous communities can emulate each other. For example, if a project is successful in one autonomous community, other regions will be encouraged to implement it in their territories. Some examples of successful projects include electronic prescriptions in Andalusia¹³⁶ and the Balearic Islands, the digital medical imaging project in Castille and La Mancha and telemedicine in Extremadura.

¹³⁶ One positive effect is that there is substantial knowledge flow between autonomous communities at both political and technical levels. In general, there is a lot of collaboration and willingness to teach and provide assistance throughout processes.

Balance

In 2006, Spain adopted the Cohesion and Quality Law that created the National Health System Quality Plan that includes the electronic health strategy. This is a success as the Technology Strategy is therefore part of the National Health System General Quality Strategy.

The Quality Plan includes the Online Health strategy and its first objective is to achieve interoperability between the autonomous communities. A number of phases have been set to achieve this, which include (1) setting up a reliable and accurate identification system: the health card was implemented; (2) creating an electronic medical record project; and (3) encouraging actions such as electronic prescriptions, tele-appointments, telemedicine. This is all interconnected and forms part of AVANZA Plan.¹³⁷

The single identification system for Spanish citizens

First of all, a single citizen identification system exclusive to the health system has been implemented over the past three years. This has consolidated the health card database.

Basic information to National Health System clinical reports

Second, the Interterritorial Council of the National Health System¹³⁸ adopted the basic information common to National Health System clinical reports, as well as the agreement regarding technical requirements, functionality and conditions of access of this information. A secure and certified health Intranet for clinical information exchange between autonomous communities has been established under this framework. A pilot phase has already begun in two autonomous communities (the Balearic Islands and Valencia) to test access to patient clinical information between communities. The first phase of interoperability has therefore been achieved with the National Health System Digital Clinical Record (HCDSNS) project.

¹³⁷ An electronic government plan that develops the information society and that has received funding from the country and from the European Regional Development Fund (ERDF).

¹³⁸ It is noteworthy that 32 scientific societies and patients associations reached an agreement, including the Spanish Society of Internal Medicine, Pediatrics, Pathological Anatomy and Biopathology, as well as the Association of Diabetic Patients. The minimum information for each of the reports (clinical documentation) was specified, and its form was established so that this information would be accessible within the communities. Following the agreement reached between scientific societies and groups of experts from the autonomous communities, an institutional agreement was reached at the Interterritorial Council (between all the autonomous communities and the State).

In the future, all the autonomous communities are expected to be incorporated into this health data access system, which is secure and respects the European Union Data Protection Directive (a European Union regulation which is in force in all the member countries). There are currently three groups of autonomous communities working with the Ministry of Health and Social Policy: standards and technical requirements, semantic interoperability and communities. The latter is made up of the 10 autonomous communities participating in HCDSNS pilot project.

As previously indicated, part of HCDSNS project includes semantic interoperability and therefore Spain has incorporated it into the Systematized Nomenclature of Medicine-Clinical Terms (SNOMED) technical platform.

The second Online Health Plan is scheduled for the next three years. Its objectives are to guarantee accurate identification of each person and to finish evaluating HCDSNS pilot project, extending it to the entire National Health System. This plan's budget is 200 million euros, half of which will be provided by the State, partly from the European Regional Development Fund (ERDF), while the other half will be provided by the autonomous communities.

Smart Open Services for European Patients

Spain is actively participating in the Smart Open Services for European Patients (EPSOS). This project is highly complex in that it involves 12 member States of the European Union, all of which operate different languages and technology for accessing summarized health records and electronic prescriptions. The project aims to provide the 12 countries involved with access to summarized medical records on any of their inhabitants when they require medical care in their country of residence or in any of the other 11 countries. In addition, it aims to make an electronic prescription issued in any of the 12 countries valid for medication dispensed in the other countries.

EPSOS is based on national initiatives. It is an interoperability project that does not attempt to build a new system, but rather to build on existing systems. Each member State has a national contact point (NCP), which is a node for managing requests from the country to another member State and vice versa. In other words, a member State does not connect with all the hospitals in other member States, but only with the contact points.

The project is currently in a development phase. In recognition of its experience, Spain led three working groups on electronic prescriptions, summarized clinical records and implementation of pilot projects.

Another group, not led by Spain but in which the author participates, addresses legal aspects and reports on a number of delicate issues which are difficult to resolve, for example, data protection and security. There are difficulties in this area despite the fact that all European Union countries share a Data Protection Directive and therefore are within the umbrella legislation. However, the problem arises when this Directive is applied in the countries as it is not the same as the various national legislations. For example, the requirements for guaranteeing patient consent entail more formalities in some countries than others.

In turn, this working group acts as the National Contact Point on issues such as authentication, data integrity and non-repudiation, among others.

The working group is also addressing a number of interesting issues, such as the different professional roles in different European Union countries. For example, nurses in the United Kingdom can prescribe certain medication, while nurses in Spain are not permitted to issue medication at present. What happens when a Spanish pharmacy wishes to dispense medication using an electronic prescription issued by a British nurse? Another example is that in some countries in Eastern Europe, a psychologist is not considered to be a doctor and therefore cannot access health records. However, in other European countries it is normal that psychologists access health records on a regular basis. These are examples of the issues that are currently being discussed in order to find solutions. There is obvious complexity involved.

Lastly, EPSOS is contemplating carrying out a pilot project prior to mass dissemination. This will identify any legal problems and their respective solutions.

XV.

Discussion and proposals



The experiences described in this publication show the efforts that different countries in the region are making to incorporate ICTs into the health sector. However, they also reveal the relative lack of institutional mechanisms, at national and regional level, to articulate these efforts in a public policy designed to bridge health access gaps, address epidemiological changes and overcome increasing pressure on health expenditure.

The present difficulty does not reside in deciding whether to incorporate ICTs or not, but rather in finding the best options and formulating the right strategies to realize their potential in a cost-effective manner. ICTs must be incorporated into public health policies in each of these countries in order to improve health care, optimize processes and cut costs.

Indeed, ICT are a means to an end. For this reason it is not advisable to create a public policy on electronic health, but rather to specify the use of information technologies in health policies and the way that they can contribute towards solving problems and challenges in each of the health systems in the region. In other words, the strategy on ICT incorporation is subordinate to the health-care strategy.

The development of trust among health professionals, as well as patients and citizens is equally important. The European experience shows that the success of implementing ICT in health care depends on this.

It is of utmost importance that progress be made in the implementation of e-Health projects in Latin America and the Caribbean. To do this, the

countries must formulate a strategy to guide decision-making and it is for this reason that the Working Group on Health of Latin America and the Caribbean suggests four areas where strategic alignments should be formulated: (1) facilitators, (2) information management, (3) health care, and (4) education.

1. Facilitators

The concept of “facilitators” refers to the elements that constitute the basic platform on which the initiatives associated with the other three areas are set up. Sustainability of these areas would be difficult without this platform. However, progress can still be made without these facilitators. All of the areas should be promoted while ensuring the right priority is placed on resource allocation.

The first requirement identified is to create a government office which is responsible for leading the e-Health strategy and is duly financed and equipped with qualified human resources. This body is in charge of resource allocation and monitoring of programmes and projects. It has been suggested that it is managed by a health professional, ideally someone with training in ICT.

Progress has been made at different levels and to different degrees. In some countries of the region, having these types of entities has been essential not only for implementing networks, but also for encouraging the use of electronic health records and telemedicine applications, and promoting ad hoc legislation. However, care must be taken to avoid the mistake of creating institutions within institutions.

The second requirement suggested is for a legal framework to support the use of ICT in health, as well as to validate telemedicine actions and guarantee the protection of personal data.

Experience shows that the implementation of any technological project will come up against opposition, which is usually protected due to unclear legislation. For example, this has happened in projects on electronic health record. Lack of legal support creates legitimate concerns for health professionals. In this context, the concept of “legal framework” refers to generic guidelines stating that the electronic health record is valid, telemedicine actions are legally valid and data are legally protected. This facilitates the management of change.

Notwithstanding, experience also shows that in order to formulate a legal framework which favours e-Health development and does not prevent it, health professionals must have the chance to practise using ICT beforehand

by means of pilot projects. Jurists and legislators can thus be informed of the exact requirements relating to real needs and problems.

The last suggestion regarding the second requirement is to validate electronic signatures, without which it will not be possible to plan anything other than sporadic or ephemeral projects. Electronic signatures are essential for telemedicine and they are also needed for health administration and management.

The third factor relates to providing the conditions so that health-care units can implement networking, for example, they should have access to telecommunications, infrastructure and equipment, without which it will be impossible to achieve the targets set for e-Health.

In this respect, there has been a tendency for e-Health projects to focus on providing access to vulnerable, geographically isolated populations where little or no infrastructure previously existed. It makes sense to tap the existing telecommunications and infrastructure, including that set up by such projects but not currently being used for any sort of health or education services. This strategy does not mean neglecting rural areas; on the contrary, it is a realistic means of ensuring greater chances of at least some success, especially in pilot schemes or ventures aimed at developing special applications.

The fourth element is single patient identification, a requirement for unequivocal management of clinical and administrative information associated with health care. However, this is also required for appropriate monitoring of patients at different care levels and their link with tools, as will be established hereinafter.

Last but not least, the fifth facilitator is relating to the training of human resources, professionals and technicians, who are qualified to support ICT projects and strategies in the field of health care.

It is a well-known fact that if a person's type of work is altered as a result of new projects, he or she should be trained, especially if it requires the incorporation of new technologies. In addition, this poses an important challenge for higher education institutions. Medical informatics and telemedicine must be incorporated into the plans and programmes of different faculties and institutes in the area of health, as well as engineering and technologies.

2. Information management

ICTs have made significant contributions, primarily to production and decision-making processes. For the health sector, this involves designing systems for integrating administrative information with clinical information.

Logistics management (infrastructure, equipment, supplies) should be prioritized in the area of administration, as well as invoicing and expenditure monitoring. Moreover, one priority for all health systems in the region is to introduce improvements to clinical information management, identifying the electronic health record (EHR) as the key to improving effectiveness and efficiency.

The evaluation of experiences of ICT in health care reveals three problems or mistakes which have contributed to its failure or significantly delayed its development, and which therefore merit particular attention when designing strategies. First, the fact that the incorporation of ICT requires more time, particularly in electronic government, than in other sectors is not considered. Fragmentation and segmentation of a system featuring multiple stakeholders and interests does not enable linear extrapolation of experiences observed in other areas of the public apparatus. Second, it is often forgotten that changes must be made to the structure and care processes in order to improve effectiveness and efficiency. The poor results obtained are mainly due to the fact that the necessary organizational redesign for the incorporation of ICT was not carried out. Third, in a significant number of cases, the solutions adopted are less cost effective than normal procedures and this has discouraged necessary investment.

3. Integration of ICT in health care

Effective e-Health development requires gradual but systematic implementation of tools in care processes. For this purpose, decisions regarding implementation must be made in two particular areas: electronic health records (EHRs) and telemedicine applications.

The adoption of EHR involves making certain decisions such as determining the minimum set of data¹³⁹ it should contain in order to support the work of health professionals, as well as decision-making management and epidemiological surveillance, among others. EHR design should integrate professionals from first, second and third health levels in order to identify the information flow model, the scope of EHR and how patients or other external stakeholders will participate in the system.

The adoption of EHR is not an easy process, because, in addition to technical difficulties linked to the design and application, such as the definition and adoption of standards for interoperability (technical, semantic and

¹³⁹ Minimum patient data, discharge report, outpatient consultation report, health record summary, complementary test results.

operative), it is important to consider how to overcome hurdles stemming from the parties affected. For example, EHR can affect stakeholders of the health system by transferring greater power to the patient and gaining more control of the pharmacy system.

In turn, telemedicine services must answer to the needs of each country and must be integrated into care processes.

The countries in the region must make the transition from using telemedicine as an isolated experience or experiment to using it regularly as part of the health care for treating specific illnesses or in particular territories.

According to regional experience, the integration of telemedicine into health systems involves rethinking the processes used to provide health care to the population. Many telemedicine projects in Latin America and the Caribbean have failed because they attempted to support a former health process using a new telemedicine device. Telemedicine requires change to support new ideas and processes designed to solve former health problems.

Secondly, telemedicine services in each country must be aligned with priorities established in national health plans. In some countries, telemedicine will be important in the area of mother-and-child health, while in other countries it will be important for radiology. In some cases, telemedicine will be used for general communication and accessibility problems associated with health services.

Thirdly, telemedicine must always be considered as a means to an end. In many cases, different ICT solutions must be considered to address similar problems as they depend on the sociocultural, geographical and technology assimilation characteristics of countries in Latin America and the Caribbean. For example, in some cases the support technology used to provide care in remote areas could be based on the Internet, while in others it may be cellular telephony.

4. Education

It is important to differentiate between two different areas. The first relates to health informatics education and training programmes and the second is the use of ICT in education. The first area was already discussed under facilitators and has been formulated as a requirement for project sustainability.

As for the second area, it has been suggested that educational strategies be formulated for two types of recipients: (1) health professionals, and (2) patients and the general community.

To improve the quality of health care, the refresher courses offered on the use of health equipment must include new methodologies for using ICT to facilitate access to continuing education. The role of higher education institutions is essential for this and given the experience, it is recommended that special attention be paid to accreditation systems for this type of education.

At the same time, it has also been advised that health portals be certified to ensure the dissemination of quality information. This becomes especially important with regard to the increasing assignment of health-care responsibilities to the community and for home care provided to chronic patients by family members.

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