

Information and Communications Technologies Health Projects in Panama: A Systematic Review and their Relation with Public Policies

Gema Anabel Castillo Sánchez^{1,2} · Aranzazu Berbey¹ · Isabel de la Torre-Díez²  · Miguel López-Coronado²

Received: 26 March 2017 / Accepted: 25 May 2017
© Springer Science+Business Media New York 2017

Abstract This paper presents a review about Information and Communications Technologies (ICTs) health projects in Panama. The main contribution is to provide a vision of the situation in Panama, allowing an understanding of the dynamics of health policies and how they have affected the implementation of ICT's Projects to improve the health of Panamanians. We analyze the projects found with ICT's in health of Panama, which allow us to see a perspective of projects information is obtained from 2000 to 2016, however it is important to highlight that there may be other projects that we do not know because we did not find enough information or evidence of the same. That is why this review has interviews with key personnel, who have guided us with the search for information. 56% of technology projects are concentrated in the capital city and only 16% in the province of Chiriquí. 64% of these projects are focused on the development of information systems, mainly focused on electronic patient

registration. And 60% refers to projects related to primary health care. The MINSA and CSS both with a 20% participation in ICT project, in addition we can notice the dispersion of projects for hospitals, where each one is developing programs per their needs or priorities. The national information about ICT projects of Health, it has been notorious the state of dispersion and segmented of public health information. We consider that it is a natural consequence of Policy in Panamanian Health System. This situation limits the information retrieval and knowledge of ICT in Health of Panama. To stakeholders, this information is directed so that health policies are designed towards a more effective and integral management, administering the ICT's as tools for the well-being of most the Panamanian population, including indigenous group.

Keywords Health technologies · ICT's project · Information · Panama · Review

This article is part of the Topical Collection on *Systems-Level Quality Improvement*

✉ Isabel de la Torre-Díez
isator@tel.uva.es

Gema Anabel Castillo Sánchez
Gema.castillo@utp.ac.pa

Aranzazu Berbey
Aranzazu.berbey@utp.ac.pa

Miguel López-Coronado
miglop@tel.uva.es

¹ Technological University of Panama, Vía Centenario, Ancón, Panama

² Department of Signal Theory and Communications, and Telematics Engineering, University of Valladolid, Paseo de Belén, 15, 47011 Valladolid, Spain

Background

In the Panamanian context, the Republic of Panama has a public health system that is organized and coordinated between two government agencies: The Ministry of Health (MINSA) and the Social Security Fund (CSS) [1]. Currently, both Health's institutions provide health services to Panama's population at a national level and their offices are found throughout all provinces across the country including indigenous regions.

The MINSA provides leadership in the coordination of inter-sectorial health topics, based on national political health information. Health policies according to the World Health Organization (WHO) refer to “decisions, plans, and actions that are undertaken to achieve specific health care goals within a society” [2].

It is very interesting to mention that during the development of this research work it was obvious the lack or availability of the information necessary to measure the impact of the applied health policy, in direct correlation with Health Technologies Assessment (HTA). Due to this local fact, it is important to highlight the problematic existence of the fragmented or segmented health Panamanian system managed by both MINSA and the CSS. On one hand, this fragmentation causes "health gaps" because of the inability to establish the vulnerability vs capable resolution of all the public Panamanian health system. This fact is evident at the time data is needed for analysis [1].

According to the Health Situation Analysis [1], national coverage is allocated as 60% of the population to CSS and 40% to MINSA. The Panamanian population is composed of 3,913,275 people according to 2014 data from MINSA. About 5.5% of the Panamanian population corresponds to indigenous groups. In addition, MINSA is a major public service provider, the principal authority of the National Health System and, as such, formulates policies, regulates activities and exercises the role of health authority.

There is scattered information in the two institutions coordinating the health issues in Panama, MINSA and CSS [3], each institution handles its information independently. In some cases, the information is not available to serve the citizenry as a means of oversight of transparency, thus being able to exercise the right to access information.

In addition, the citizen is expected to use Information and Communication Technologies (ICT) to find out where the health teams are available to obtain the diagnosis that their doctors request, without waiting a long time to get appointments because the equipment in operation is highly in demand especially in areas with vulnerable populations, for example.

On the other hand, the public health sector does not cover all the demand of the Panamanian population, that is, the private sector offers an option to people who can afford private health insurance. According to the article Medical Tourism: Global Competition in Health Care [4], Costa Rica and Panama are popular destinations for medical travel in Latin America. Medical tourism is due to the efficiency of the medical services offered by private medical services.

Accordingly [5], the authors did a research related to HTA in Latin America and the Caribbean. Banta states that in the late 1990's, there was a strong movement for health reform in Latin America, and HTA became part of that movement. Countries that now are actively institutionalizing HTA include Brazil, Mexico, Chile, and Argentina. Other countries, such as Costa Rica, Colombia, Cuba, Peru, Panama, Paraguay, Trinidad and Tobago, and Uruguay, were following these trends in this direction.

Related to this point is important to mention the definition of Health Technology (HT). It refers to the "application of organized knowledge and skills in the form of devices,

medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of lives" [6]. Another definition of Health technology is "any Intervention that can be used in the promotion of health, prevention, Diagnosis or treatment of a Disease, or in rehabilitation or in Long-term care" [6]. Examples of health technologies are diagnostic and treatment methods, medical equipment, pharmaceuticals, rehabilitation and prevention methods, and support systems in which health care is provided.

In [7] was a systematic review that identified national health research policies and priority agendas through a search of ministry and government databases related to health care institutions in Latin-American and Caribbean Countries. PubMed, LILACS, the Health Research Web, and others were searched for the period from January 2002–February 2012. The results presented in [7] showed that of the 18 Latin American countries assessed, 13 had documents that established national health research priorities; plus the Caribbean Health Research Council had a research agenda for its 19 constituents. These 14 reports varied widely in terms of objectives, content, dissemination, and implementation; most provided a list of strategic areas, suggestions, and/or sub-priorities for each country; however, few proposed specific research topics and questions. In this study, Panama was one of the countries that can show documents explicitly including health research priorities. Panama used research documents to compare to the checklist for health research priority setting; [7] indicated that Panama used the Hanlon method and the meeting/ consensus approach. The main features of national health research systems are discussed (SNIS) of Argentina, Bolivia, Brazil, Chile, Costa Rica, Cuba, Ecuador, El Salvador, Honduras, Panamá, Paraguay, Perú, Uruguay and Venezuela based on documents prepared by experts from those countries who participated in the First Latin American Conference on Research and Innovation for Health, held in April 2008 in Rio de Janeiro, Brazil [8].

In [9] a Web-based survey was sent to 11,792 HTA researchers and users in Latin-American to explore the perceived relevance of each Key Principles in HTA, its current level of application and the gap between these two. These authors received 1142 responses from nineteen Latin-American countries (9.7% response rate). The subgroup of KP related to Methods and to the Use of HTA received the higher mean scores in the relevance scale (9.00 and 8.94). Level of current application scored low in all KP (3.2 to 4.9). Higher gaps were observed in principles related to the use of HTA in decision making and to the processes for conducting HTA. We consider that it is a natural consequence of the fragmented Panamanian Health System. This situation limits the rapid knowledge of the national state of the art in related to HTA due to the dispersion of information.

In [10] a mechanism to increase the influence of Health Technology Assessments (HTAs) on hospital policy decisions

was developed. The [11] presented an overview of processes and practices of horizon scanning systems (HSS) based on a literature review (Medline and Embase) and on unpublished information gathered from HSS-agencies. According to [12] presents an interesting review about the history of HTA and International Collaboration with examples like: ISTAHC and HTAi, INAHTA, EuroScan, the Cochrane Collaboration, The European Commission, The World Bank, The World Health Organization and PAHO. In [13] presented a study about bridging Health Technology Assessment (HTA) and Efficient Health Care Decision Making with Multicriteria Decision Analysis (MCDA): Applying the EVIDEM Framework to Medicines Appraisal. The implications of the studies related to public policies based on evidence, allow us to assess and visualize the situations that interest us, as presented in [14] the study on Effect of pay for performance in health care, where he points out the importance of evaluating “real- word”.

Due to this scenario, we have considered that the role of ICTs allows us to get closer to achieving a better health for the Panamanians. It is very interesting to indicate that all these previous research experiences could contribute to state a comparative framework between these studies and Panama. The main contribution is to provide a vision of the situation in Panama, allowing an understanding of the dynamics of health policies and how they have affected the implementation of ICT's Projects to improve the health of Panamanians.

Our review has an objective response to the following question: How can Health policy influences of ICTs in the Panama Health Systems? Coming up next, we present the method of the review, the result of the same, and we also present the discussion and main conclusions.

Methods

Search strategy

To develop this review, we have searched for sources of information about public institutions that coordinate Panama's health policies. Articles written in English and Spanish published between January 1999 and February 2017 were eligible for inclusion. Information was then sought from the public institutions that coordinate health care in Panama. We also researched the internet via Google Scholar, contacted experts, and interviews.

Reviewed information about Work Bank [15–17], Cepal [18], WHO [6], MINSA [1, 14, 17, 19], CSS [3], PAHO [20] (some stakeholder) Organizations that provide official information. The methodology scheme is shown in the scheme of the Fig. 1. Moreover, the selection of scientific literature found and selected by this method is shown in this figure. After selected, we can observe the little scientific

information about health ICT's related to Panama. We analyze the projects found with ICT's in health of Panama, which allow us to see a perspective of what is registered in PAHO [20], however it is important to highlight that there may be other projects that we do not know because we did not find enough information or evidence of the same.

That is why this review has interviews with key personnel, who have guided us with the search for information. During the search of information on projects in health ICT in Panama, information is obtained from 2000 to 2016. The projects are related in ICT's of Panamanian health with the information found in scientific articles on the subject.

Indicators about health policy in Panama

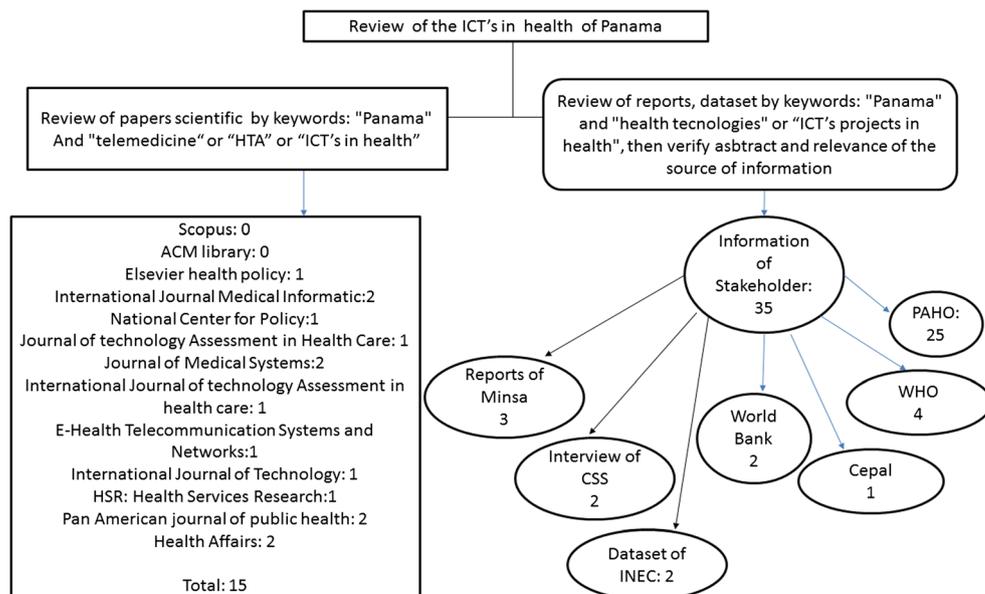
According to [1], national coverage is allocated as 60% of the population to CSS and 40% to the MINSA. The Panamanian population consist of 3,913,275 people and 5.5% of the Panamanian population consists of indigenous groups. The Panamanian population consists of 3,913,275 peoples and 5.5% of the Panamanian population consists of indigenous groups.

Panama is a country of transit, recognized for its geographical position, where cultures, languages, ethnicities and creeds converge from many parts of the world. Its strategic geographical location allowed the construction of the Panama Canal, which reduced distances and communication between the coasts of the Atlantic and Pacific Ocean. This has worked in favor of the positive economic impact and commercial advances that Panama has experienced for more than a century [17].

Since the creation of MINSA in 1969 [1], its vision was “Health equal for all” and it created facilities across the country called “Health Centers” however only their names show that the responsibility of the health of the population was prioritized [1]. Since then the Panamanian model of care establishes that the system must respond to the need of the individual, the family and the community. This system must guarantee the access of the individual from birth, ascribing to the system and guaranteeing coverage with public health and care programs regardless of whether it is in the public or private sector. The first level has the responsibility to know its population and verify that it has access and coverage. It is for this reason that the first level of care in the public subsystem is considered as the gateway to the health system, understood as the site where health checks are carried out and less complicated episodes of illness are treated during the period of life. However, in the cases where the patient does not go to his/her controls, the Health system should search for those non-existent patients. Currently, this search process of non-existent patients has been very weak in the last 15 years [17].

In Panama, there is the legal framework across the Law No. 66 of November 10, 1947. This National Law regulates, in its

Fig. 1 Flow diagram of the information selection process



entirety, those topics related to national health, public health, health policy, prevention and curative medicine [4]. Also, it is necessary to mention other important National Laws. This is the General Law No.1 of Medicines from January 10, 2001. The topics correspond to medicines and other products for the human health [1]. This law N°1 regulates everything related to medical equipment in Panama.

Regarding Health Expenditure, Panama invests millions of dollars annually in operating expenses and investments. In Fig. 2, they are observed investing between 6 and 8.5% of GDP in US dollars approximately per year.

Per the World Bank metadata presented in Fig. 2, total expenditure on health is the sum of public and private expenditure on health. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities and emergency assistance designated for health; however it does not include water supply and health services.

About the expenditure reported by MINSA [22], during 2016 the Modified Investment Budget for the year 2016 is in the order of \$ 305.2 million; against which total commitments have been

recorded for \$ 248.8 million of an allocation of \$ 303.2 million; meaning a budget execution of 82.0% in the operative period.

Among the projects underway, we are struck by the project “Equipment of Health Facilities” with a budget commitment of \$ 9.1 million, equivalent to an execution of 44.5% [19].

Results and discussion

One of the more complex aspects of the National Health Management system in Panama is the ability to measure the impact of the assignment of the financial resources in Health-related projects and programs and how efficiently these are distributed. The fragmented approach towards health care delivery in Panama, combined with inequalities in access to care that reflect geographic, socioeconomic, and cultural disparities can create a care gap for Panamanian citizens. A range of ICTs can help to bridge this gap by providing a cost-effective means to deliver quality of care to the population.

Due to the complexity of this situation, this review will be concentrated on the transference of information related to ICT’s in health. Despite its health policy objectives, the evaluation of health technologies (HT) must always be firmly rooted in research and the scientific method. Panama has invested in the health sector, making great progress according to Table 1, but at the same time, there are major challenges facing the sector, such as the existing inequality in terms of access and quality of health care for not only the indigenous population [17]. Although health outcomes are improving in many key areas, people from poor rural households and indigenous people experience health outcomes when compared to other parts of the country. In addition, segmentation in health administration on the one hand, MINSA and other CSS allow

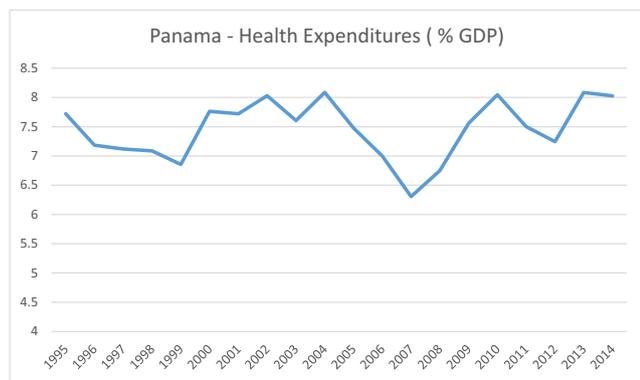


Fig. 2 Health expenditures of panama according world bank [21]

Table 1 ICT's medical projects in panama in the period 2000–2016

Name of the initiative	Institution /organization executing the initiative	Sector	Category	Health Topic	Level of Application	Province	Brief Description	Year	Reference
Online Courses ULATINA	Universidad Latina de Panamá	Academic	Education using ICT's	Primary health care	provincial	Panamá	Environment LMS (Learning Management System) facilitates academic collaboration, is within the multimedia didactic material environments of medical courses. Improve teacher-student communication. Save time.	2000	[23]
Digital electronic record based on standards ICD-10 and HL7	Universidad Tecnológica de Panamá	Academic	Information Systems	Primary health care	provincial	Panamá	The project develops a platform in Cloud Computing - The information system has an important set of software tools that facilitate the management of primary care of patients. Similarly, a set of standards for interoperability such as HL7 and ICD-10 are used.	2013	[24]
Statistical generator of NEOnatos	Universidad Tecnológica de Panamá/ Hospital José Domingo de Obaldía	Public-private partnership	Information Systems	Maternal, child, neonatal and child health	provincial	Chiriquí	To carry out analytical statistical studies on the pathologies of the neonates, using algorithms of data mining.	2013	[25]
History - Electronic Clinic	Hospital Materno Infantil José Domingo de Obaldía	Public-private partnership	Information Systems	Primary health care	provincial	Chiriquí	Generate the clinical history of the patients who enter the Hospital Materno Infantil José Domingo de Obaldía.	2015	[26]
Telemedicine	Hospital Materno Infantil José Domingo de Obaldía	Public-private partnership	Telemedicine	Maternal, child, neonatal and child health	provincial	Chiriquí	Study exams and consultations remotely. Provide information of exams and consultations in a virtual way.	2012	[21]
Clinic history	Hospital Santo Tomás	Public-private partnership	Information Systems	Primary health care	provincial	Panamá	Registering patients' medical records has more than 12 years of use and is currently in operation. Support the management of information generated by the doctors of the Hospital Santo Tomás, through an electronic file.	2003	[22]
SILAB Laboratory System	Instituto Conmemorativo Gorgas	Public-private partnership	Information Systems	laboratory technician	provincial	Panamá	Provide a software tool for researchers at the Gorgas Memorial Institute to store and share information about their laboratory research.	2011	[27]
Electronic Medical Record	Instituto Oncologico Nacional	Public-private partnership	Information Systems	chronic diseases	provincial	Panamá	A system has been developed for the management of the outpatient care per patient. We are currently in the implementation phase of hospital records.	2013	[28]
Sume 911	sume 911	Public-private partnership	Information Systems	Emergencies, injuries	National	the whole country	El SUME 911 es el Sistema Único de Manejo de Emergencias de la República de Panamá.	2007	[29, 30]

Table 1 (continued)

Name of the initiative	Institution /organization executing the initiative	Sector	Category	Health Topic	Level of Application	Province	Brief Description	Year	Reference
Fact sheets - Minsa	MINSA	Governmental	Information Systems	Primary health care	National	the whole country	The Law states that the elaboration of the Technical Sheets will be by medicines, medical – surgical equipment, supplies, laboratory reagents and any other product that is necessary.	2011	[31]
Professional Risk - CSS	CSS	Governmental	Education using ICT's	Environmental health	National	the whole country	Self-management of professional risks by the employer from your company with direct link with the Social Security Fund. It is a tool to train the worker in the field of professional risk prevention "in Company".	2013	[3, 32]
CSS Contact Center	CSS	Governmental	Access to information and services	Primary health care	National	the whole country	The Social Security Fund's Contact Center allows you to communicate with qualified professionals to obtain health services, make inquiries about their procedures or attend to their concerns and suggestions.	2011	[3, 33]
Perinatal information system SIP WEB	MINSA	Governmental	Information Systems	Maternal, child, neonatal and child health	National	the whole country	Project The Perinatal Clinical Record is the most valuable data source available to the health team. Pre-established indicators are included in programs of selection, description and distribution of variables that allow to perform more specific and complex analyzes.	2012	[34]
My Social Security APPs	CSS	Governmental	mHealth	Primary health care	National	the whole country	It allows the insured to request or cancel their appointment, in addition request information or guidance on procedures. Give provided by the institution the social insurance fund. Offer services for the management of appointments, request of ambulances through Smartphone and tablets	2013	[3, 35]
Monitoring of ART clinics (MONITOR)	MINSA	Governmental	Information Systems	Primary health care	National	the whole country	Expansion of care coverage for people affected by HIV / AIDS by opening 16 CTARVs in different Health Regions: 14 of the MINSA and 2 of the CSS. Distribution of antiretroviral drugs and reagents for HIV testing to all Health regions.	2014	[36]

Table 1 (continued)

Name of the initiative	Institution /organization executing the initiative	Sector	Category	Health Topic	Level of Application	Province	Brief Description	Year	Reference
Government cloud	AIG	Governmental	Storage and Information Management	Primary health care	National	the whole country	The Cloud Computing Government project has a platform capable of hosting a considerable number of software applications of various characteristics (Electronic Medical Record, Telehealth, Health, eLearning).	2011	[37]
Electronic Health Record or the Clinical Health Record	MINSA	Governmental	Information Systems	Primary health care	National	the whole country	It is a set of processes that are integrated within a Health Information System, which allows us to interconnect with the different areas of Health Facilities, Hospitals, Health Center, Polyclinic to generate a unique Clinical Record of the patient.	2013–2014	[38]
Electronic Health Record or the Clinical Health Record	CSS	Governmental	Information Systems	Primary health care	National	the whole country	The SIS (Health Information System) is the technological platform that is interconnected with the different areas of a Hospital, Polyclinic, ULAPS and / or CAPPs to generate a unique Medical Record of the patient, which can be consulted from any Executing Unit of the Social Security Box at national level.	2012	[3, 39]
Panama's National Registry of Cancer Information System - RNCP	MINSA	Governmental	Information Systems	Primary health care	National	the whole country	It contains all cancer cases diagnosed in the country, institution and other means. It is a population-based registry and national coverage that aims to provide useful information to know the cancer problem in the country.	2011	[40]
Telesalud (telemedicine) Teleradiology.	CSS	Governmental	Telemedicine	Primary health care	National	the whole country	The digital teleradiology system consists of capturing and reproducing images of radiological studies, which are connected to a communications network. With this system the images obtained from patients in different hospitals, polyclinics and other primary care units will be sent through the network to the Teleradiology Center, where a team of qualified and trained professionals will issue the diagnosis that will be directly incorporated To the electronic clinical record of the patient.	2014	[3, 41]

Table 1 (continued)

Name of the initiative	Institution /organization executing the initiative	Sector	Category	Health Topic	Level of Application	Province	Brief Description	Year	Reference
Laboratory Mobile Unit	Instituto Comemorativo Gorgas	Governmental	mHealth	Patient safety	National	the whole country	Mobile laboratory unit to facilitate the analysis of Chagas, HIV, dengue, deamainases, hanta. Facilitate timely diagnosis at the site of transmission through a mobile Rapid Response Unit for diseases infections.	2016	[42]
(Mobile Devices) Medication Management Using HandHeld (Bracelet)	Hospital San Fernando	Private	mHealth	Primary health care	provincial	Panamá	Use Handheld to read a Patient Armband Bar Code, which will display patient information and your active drug medical orders. To facilitate the control and clinical monitoring of patients.	2007	[43]
Emergency Room Clinical History	Hospital de Chiriquí	Private	Information Systems	Emergencies, injuries	provincial	Chiriquí	Medical information is recorded and stored for the patient who enters the emergency room, and is managed by the doctor for his/her care.	2014	[44]
Medical Clinic	Hospital San Fernando	Private	Information Systems	Primary health care	provincial	Panamá	Transactional System, collector of data and evidences medical, clinical, administrative and financial attention.	2007	[45, 46]
Mi clinica WEB	Mi clinica WEB	Private	Information Systems	Primary health care	National	the whole country	The company develops software products to: Access your patient information from anywhere in the world, at any time, when you need it most through the mobile device.	2006	[47]

inefficient efforts to duplicate efforts to meet the same needs [15].

In the Table 1, the MINSA and CSS are developing in parallel their information systems of the patients' clinical history, it would be interesting to know if at the time of starting these projects, open considering the possibility of interacting and exchange information between both institutions. Simply continue to develop projects by pieces, that is, without taking into account the sustainability of providing health to all as a universal right. With the information and systematic review of some projects we can note that a comprehensive and continuous policy on ICT projects is not applied, which only facilitates the registration, organization and distribution of health information to patients, doctors and all staff Technician who is involved in the flow of information. The projects in ICT's are tools that facilitate the decision making and allow for following up the real health needs that Panama must attend.

Reducing inequalities in health and administrative inefficiencies, as well as migration and epidemiological situations, is essential for Panama to strengthen its digital strategies, including those based on the Internet and mobile technologies, and align them with national health policies, to provide services that improve the quality of life of its inhabitants. Panama has all the potential to make it possible. The policy makers can evaluate better the hospital's management. For example in Table 2, in the areas of supply of medicines or medical supplies, training, as well as the human resource interactions provided by health services, government, citizens or patients can find in ICTs the opportunity to interact and innovate in the health sector [48]. Within the strategic lines, it is pointed out the strategic priority 2, where it is desired to strengthen the leadership or rectory of MINSA in the construction of participatory and management of public health policies. Within this aspect, the need to manage health information and its research capacity is recognized. Developed an integrated health information system for decision making [1, 17].

Analyzing the results obtained on the selected sample of 25 projects (Table 2), which include some projects ICT's Health in Panama, of the public and private sector, we can indicate the following information.

56% of technology projects are concentrated in the capital city and only 16% in the province of Chiriquí. The high concentration of projects in the capital reflects that rural areas remain entrenched and ICT projects could be the bridge between areas of difficult access and provide the option of medical attention at a distance, this is known as telemedicine [49]. Of the projects, we can only mention two projects categorized as telemedicine, with a presence of 8%. In [50], it present the important of considering that in this region offers an opportunity to experiment with telemedicine, and that is why it is indispensable and necessary that this discussion begins, both among political representatives and among the community in general on the real impact or utility of telemedicine [50].

Table 2 Top features of ICT's project in health of panama

Level of application usage	Amount	Percentage
National	14	56%
Provincial	11	44%
Total	25	100%
Province where the project is implemented		
Panama	7	28%
Chiriquí	4	16%
The whole country	14	56%
Categories		
Information systems	16	64%
M-health	3	12%
Education using ICT's	2	8%
Telemedicine	2	8%
Storage and management of information	1	4%
Access to information and services	1	4%
Total	25	100%
Sector		
Governmental	12	48%
Public - Private Partnership	7	28%
Private	4	16%
Academic	2	8%
Total	25	52%
Health issue addressed:		
Primary health care	15	60%
Maternal, child, neonatal and child health	3	12%
Injuries, trafficking	2	8%
Chronic diseases	1	4%
Specialized care	1	4%
Environmental health	1	4%
Patient Safety	1	4%
Laboratory technician	1	4%
Total	25	100%

The 28% realizes ICT projects of way public and private association. What it indicates to us, the opening and at the same time the little coordination between the sectors, on the one hand the private sector has more economic incentives to be more efficient. It is for this reason, that projects such as the bracelet for the collection of their services are implanted, while the public sector continues establishing its technological base, as the projects of clinical history.

In addition, it is noted that only 8% of these projects are managed by the academic sector, which motivates us to carry out this review and show the research opportunities.

The public sector has 48% of the projects. The leading role of public institutions is reflected in this percentage of participation, which should promote policies to manage and manage the health sector more efficiently, which is why there is much to be done in health-related ICT projects.

It is important to provide immediate information using ICTs, due to an increasingly connected world, people need to learn more about the situations that affect their health. This is why health policymakers should promote access to information and ICT projects, especially on the Internet, to provide information that helps prevent disease [51].

We share the opinion of Panamanian researchers [52] that there is a lot of health information in Panama that is not administered electronically. ICTs are one of the powerful tools. These are not only an effective and necessary condition to advance in a consistent way for the development of infrastructure, implementation of applications, validation, inter-operability, but also promote the prevention of diseases, medical care and the management of services. Such coherence and sustainability require the determined leadership of the main health authorities and the concurrence of the different actors involved in a National Health Policy.

The private sector accounts for 16%, but we assume that they handle a lot of electronic information that has not been reported in this list of initiatives. Panama has high quality health care, concentrated primarily in the metropolitan areas. Medical standards at Panama's top hospitals are comparable to those in the United States. Indeed, many Panamanian physicians were trained in the United States. Hospital Punta Pacifica in Panama City, Panama, is an affiliate of U.S.-based Johns Hopkins International [4].

It is therefore important to mention the private sector in health care services, which have given Panama a competitive position, which is even considered a destination or medical tourism.

64% of these projects are focused on the development of information systems, mainly focused on electronic patient registration. ICTs can contribute to the reduction of operating costs in the clinical services thanks to time savings provided with data processing, and reduction of multiple handling of impress documents. For example, the experience of Spain shows that these functional improvements have had a positive effect on health staff productivity. The evidence in the health sector is, however, generally mixed depending on the context and the technology used. We can mention the article *The Lack of Interoperability between Primary and Specialty Care* [53], as an interstate experience to apply in Panama.

We note that only 8% of the projects refer to distance education. In the health sector, there are many applications of ICTs, for example the education or training of clinical staff is necessary for the use of health equipment and that way, a better trained staff will minimize the level of errors in the use. As well as in the reports of failures when in fact a percentage is due to untrained personnel, in addition to the high rotation of personnel in the shifts that attend the hospitals.

It is also possible to educate communities by electronic means, to disseminate information and messages of preventive nature related to diseases and these can be established as priorities in distance education, focusing on the vulnerable or indigenous sectors.

60% refers to projects related to primary health care. This division between public health systems, CSS and MINSA, plus the inequalities in access to care that reflects geographic, socioeconomic, and cultural situation have produced a health gap for the Panamanian citizens. A range of ICTs can help to bridge this gap by providing a cost-effective means to deliver quality of integral health care to all the Panamanian population.

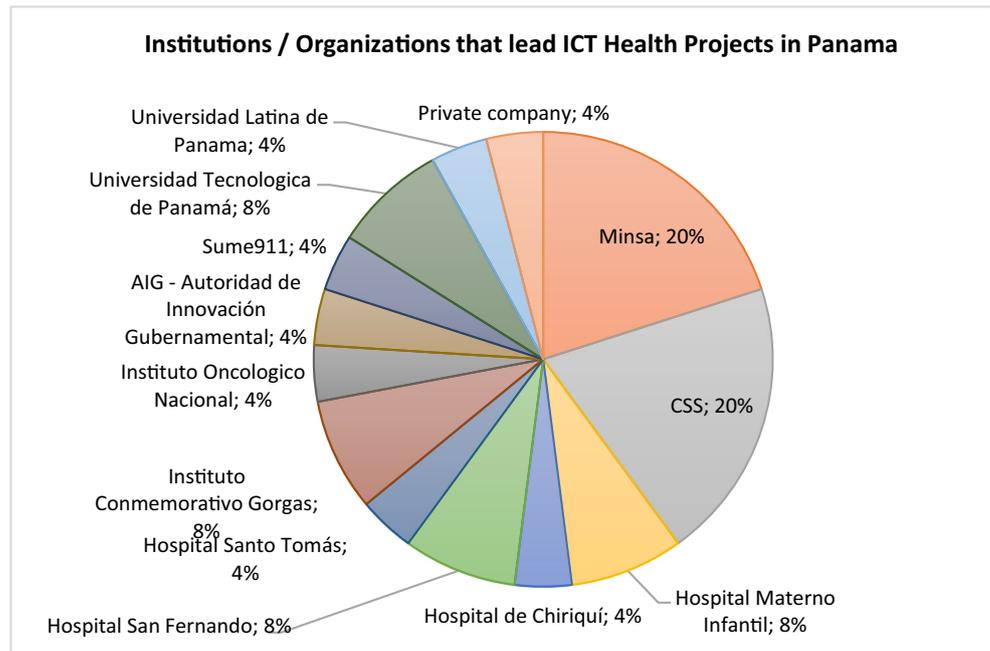
ICTs are one of the powerful tools. These are not only an effective [54] and necessary condition to advance in a consistent way for the development of infrastructure, implementation of applications, validation, inter-operability, but also to promote the prevention of diseases, medical care and the management of services. Such coherence and sustainability require the determined leadership of the main health authorities and the concurrence of the different actors involved in a National Health Policy.

In Panama, there are research professionals in ICTs who have contributed to scientific knowledge their work in this area, which is why it is necessary to recognize the national talent to exert social change and promote high-level collaboration. In other words, Panama has certain local research experiences about e-health topics. In [52] presented a research work about eHealth Management Platform for Screening and Prediction of Down's Syndrome in the Republic of Panama.

This research [52] presented an interesting study of case about a Ubiquitous and Ambient Assisted Living eHealth Platforms for the Republic of Panama. In [55] presented a Model Of Knowledge Extraction Of Text Mining For Palliative Care Patients In Panama. We can see in Fig. 3, that the institutions that lead these initiatives are the MINSA and CSS both with a 20% participation, in addition we can notice the dispersion of projects for hospitals, where each one is developing programs per their needs or priorities.

In Fig. 3 shows the context of heterogeneity in health policies, there is a relative lag of the effective incorporation of ICTs in Panama Health System. There are public initiatives; both new and expanding however, there is no total evidence of a systematic reliable record. Despite the variety of projects, there is an absence of specific policies, so general or articulated with any national strategy, mainly by the differences of management of the MINSA and CSS. Among other consequences, there is little progress in the definition of standards and therefore difficulties for interoperability, as well as a misalignment with public health policies that guide investment decisions objectively.

Fig. 3 Institutions/organizations that lead ICT health project in panama



Conclusion

In a process of review, the national information about ICT projects of Health, it has been notorious the state of dispersion and segmented of public health information. We consider that it is a natural consequence of Policy in Panamanian Health System. This situation limits the information retrieval and knowledge of ICT in Health of Panama.

The little information published about Panama in scientific articles of impact, calls us the attention and the interest to understand the situation of the ICTs in the health, reason for which, motivates to initiate this investigation. That is why, when doing a review on this topic gives us the opportunity to show a little what exists in Panama and how the scientific community can collaborate generating information that allows us to study the impact of projects in the field of ICT's have affected or Not the health of the Panamanian people. All these decisions by which it is implemented or not, telemedicine projects are influenced by health policies.

In view of the need expressed on the effective exchange of information; content development that are accessible by various platforms such as browsers and devices can be achieved through more inclusive health policies that from central government institutions can coordinate all technological initiatives to benefit the health sector of Panama.

The high concentration of projects in the capital city is 56%, reflects that rural areas remain entrenched and ICT projects could be the bridge between areas of difficult access and provide the option of medical attention at a distance, this is known as telemedicine [49]. In this sense, it is important to consider that in this region offers an opportunity to experiment

with telemedicine, and that is why it is indispensable and necessary that this discussion begins, both among political representatives and among the community in general on the real impact or utility of telemedicine [50]; Of the projects, we can only mention two projects categorized as telemedicine, with a presence of 8%, and only 16% in the province of Chiriquí.

The 28% realizes ICT projects of way public and private association. What it indicates to us, the opening and at the same time the little coordination between the sectors, on the one hand the private sector has more economic incentives to be more efficient. It is for this reason, that projects such as the bracelet for the collection of their services are implanted, while the public sector continues establishing its technological base, as the projects of clinical history.

In addition, it is noted that only 8% of these projects are managed by the academic sector, which motivates us to carry out this review and show the research opportunities.

To stakeholders, this information is directed so that the health policies are designed towards a more effective and integral management, administering the ICT's as tools for the well-being of most the Panamanian population, and mainly our indigenous group. In such a way, as to design policies that use the various programs in a more collaborative manner and effectively follow up on projects that improve the quality of life of Panamanians.

The Panamanian health policy influences the implementation of ICT's, which is why we recommend applying more inclusive health policies using ICT's and systematically initiate steps toward state policies and not to periods of governments of every 4 years.

This division between public health systems, CSS and MINSA, plus the inequalities in access to care that reflects geographic, socioeconomic, and cultural situation have produced a health gap for the Panamanian citizens. A range of ICTs can help to bridge this gap by providing a cost-effective means to deliver quality of integral health care to all the Panamanian population.

There are great opportunities to reduce inequalities and overcome poverty, health is a key sector to measure the coverage and quality of health services. It is therefore, fundamental the application of ICTs in the health sector, since it can be used in various ways, it can focus on activities related to prevention, diagnosis, treatment and monitoring, as well as the administration of health management systems [56]. It is necessary, to highlight the applications and Spanish experience that have had in a satisfactory way with the handling of electronic medical records, the great challenges in telemedicine services that in other developed countries have been implemented. It is also possible to design applications to epidemiologically monitor the country situation, the most accessible health portals, and health information systems to control costs, maintain timely supply of medicines, and make decisions about programs to prioritize efforts. In addition, distance education programs can be established, health professionals such as patients; authorities can appreciate the benefits of such applications that are available to meet e-Health needs [57].

As future work, in view of the need to investigate the realities in Latin America regarding the use of ICT in Health, we intend to carry out a comparative study between Colombia, Costa Rica and Panama to see in which aspects of health have documented their experience in the scientific literature.

Acknowledgments This research has been partially supported by the European Commission under the project ICT-24-2016-732375 named “FocusLocus: ADHD management Gaming System for educational achievement and social inclusion”.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Ministry of Health - Panama, Panama Health Profile, Panamá, 2015. http://www.minsa.gob.pa/sites/default/files/publicaciones/asis_2015.pdf.
2. WHO: World Health Organization, WHO | Health policy, WHO. 2013. http://www.who.int/topics/health_policy/en/. Accessed 20 Nov 2016.
3. S.S.F. of Panama, Projects of Social Security Fund of Panama, Proj. Soc. Secur. Fund Panama. n.d., 2017. <http://www.css.gob.pa/nuestrosproyectos.html>. Accessed 7 Jan 2017.
4. Herrick, D.M., Medical tourism: Global competition in health care. *Natl Cent Policy Anal.* 304:6, 2007.
5. Banta, D., Health technology assessment in Latin America and the Caribbean. *Int J Technol Assess Health Care.* 25:253–254, 2009. doi:10.1017/S0266462309090710.
6. WHO: World Health Organization, WHO | Technology, Health, WHO. 2016. http://www.who.int/topics/technology_medical/en/. Accessed 4 Dec 2016.
7. Reveiz, L., Elias, V., Terry, R.F., Alger, J., and Becerra-Posada, F., Comparison of national health research priority-setting methods and characteristics in Latin America and the Caribbean, 2002–2012. *Rev Panam Salud Publica.* 34:1–13, 2013 <http://www.ncbi.nlm.nih.gov/pubmed/24006014>. Accessed 7 Feb 2017.
8. Alger, J., Becerra-Posada, F., Kennedy, A., Martinelli, E., and Cuervo, L.G., Grupo Colaborativo de la Primera Conferencia Latinoamericana de Investigación e Innovación para la Salud, [National health research systems in Latin America: a 14-country review]. *Rev Panam Salud Publica.* 26:447–457, 2009 <http://www.ncbi.nlm.nih.gov/pubmed/20107697>. Accessed 15 Mar 2017.
9. Pichon-Riviere, A., Augustovski, F., Rubinstein, A., Martí, S.G., Sullivan, S.D., and Drummond, M.F., Health technology assessment for resource allocation decisions: Are key principles relevant for Latin America? *Int J Technol Assess Health Care.* 26:421–427, 2010. doi:10.1017/S0266462310001042.
10. McGregor, M., and Brophy, J.M., End-user involvement in health technology assessment (HTA) development: A way to increase impact. *Int J Technol Assess Health Care.* 21:263–267, 2005 <http://www.ncbi.nlm.nih.gov/pubmed/15921068>. Accessed 8 Feb 2017.
11. Wild, C., and Langer, T., Emerging health technologies: Informing and supporting health policy early. *Health Policy (New York).* 87: 160–171, 2008. doi:10.1016/j.healthpol.2008.01.002.
12. Banta, D., and Jonsson, E., History of HTA: Introduction. *Int J Technol Assess Health Care.* 25:1–6, 2017. doi:10.1017/S0266462309090321.
13. Goetghebeur, M.M., Wagner, M., Khoury, H., Levitt, R.J., Erickson, L.J., and Rindress, D., *Bridging health technology assessment (HTA) and efficient health care decision making with Multicriteria decision analysis (MCDA): Applying the EVIDEM framework to medicines appraisal*, n.d., 2011. doi:10.1177/0272989X11416870.
14. M. of H. Panama, Ministry of Health Panama Experience in Telemedicine, Panama, 2012.
15. World Bank, Study of public expenditure and social institutions, DC 20433, USA, 2015.
16. Data Base of World Bank, Dataset, 2014. <http://databank.bancomundial.org/data/reports.aspx?source=2&series=SH.XPD.TOTL.ZS&country=PAN>.
17. I.T.C. of Panama, PAHO - WHO, HMN - Health Metrics Network: “Diagnosis of the health information system,” Panama, 2007.
18. CEPAL, The role of information and communication technologies in reducing inequities in health, Colombia. 2012.
19. Ministry of Health - Panama, 2016 Budget, Budget, 2016, pp. 2. http://www.minsa.gob.pa/sites/default/files/transparencia/finanzas_web_mes_diciembre_2016.pdf. Accessed 7 Feb 2017.
20. P.A.H.O. (PAHO), Lista de iniciativas | Portal de Iniciativas de eSalud, List. Iniciativas E-Salud. n.d. Panama. http://www.paho.org/ict4health/projects/?page_id=239&ps=Panama. Accessed 10 Feb 2017.
21. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Telemedicina – Chiriquí, 2012. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=403&lang=es. Accessed 18 Mar 2017.

22. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Hosp. St. Tomas – Hist, 2003. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=405&lang=es. Accessed 18 Mar 2017.
23. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Curso Online Ulatina, 2000. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=396&lang=es. Accessed Mar 18 2017.
24. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Ficha Electrónica Digit. Basada En Estándares CIE-10 Y HL7, 2013. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=392&lang=es. Accessed 18 Mar 2017.
25. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Gener. Estadístico Neonatos. 2013. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=402&lang=es. Accessed 18 Mar 2017.
26. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Hosp. Matern. Infant. JOSÉ DOMINGO OBALDÍA, (Historia Clínica Electrónica), 2015. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=400&lang=es. Accessed 18 Mar 2017.
27. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Inst. Conmem. GORGAS (Sistema Lab. Silab, 2011. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=406&lang=es. Accessed 18 Mar 2017.
28. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Inst. ONCOLÓGICO Nac. (Registro Médico Electrónico), 2003. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=404&lang=es. Accessed 18 March 2017.
29. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Sume 911, 2007. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=394&lang=es. Accessed 18 Mar 2017.
30. Sume 911- Panama, ¿Quiénes Somos? – Salvar vidas depende de ti., ¿Quiénes Somos?. 2017. <http://www.sume911.pa/quienes-somos/>. Accessed 18 Mar 2017.
31. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Fichas Técnicas – MINSA. 2011. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=416&lang=es. Accessed 18 Mar 2017.
32. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, CSS-Riesgo Prof. 2013. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=412&lang=es. Accessed 18 Mar 2017.
33. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Cent. Contacto- CSS. 2011. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=409&lang=es. Accessed 18 Mar 2017.
34. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Perinat. - MINSA. 2012. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=414&lang=es. Accessed 18 Mar 2017.
35. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, CSS APP. 2013. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=411&lang=es. Accessed 18 Mar 2017.
36. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, VIH -MINSA. 2014. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=415&lang=es. Accessed 18 Mar 2017.
37. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, The Cloud -Panama. 2011. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=393&lang=es. Accessed 18 Mar 2017.
38. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Exped. Clin. - MINSA. 2013. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=413&lang=es. Accessed 18 Mar 2017.
39. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Regist. Med. Electron. - CSS. 2012. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=408&lang=es. Accessed 18 Mar 2017.
40. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Regist. Cancer Panama- MINSA. 2011. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=417&lang=es. Accessed 18 Mar 2017.
41. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Teleradiología- CSS. 2014. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=410&lang=es. Accessed 18 Mar 2017.
42. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Unidad Movil LAB. 2016. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=407&lang=es. Accessed 18 Mar 2017.
43. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Brazalete- Hosp. San Fernando. 2007. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=398&lang=es. Accessed 18 Mar 2017.
44. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Hosp. Chiriquí. 2014. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=399&lang=es. Accessed 20 Mar 2017.
45. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Hist. Clin. Hosp. San Fernando. 2007. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=397&lang=es. Accessed 18 Mar 2017.
46. Hospital San Fernando, Información del Paciente | Clínica Hospital San Fernando en Panamá, Inf. Paciente. n.d., 2017. <http://www.hospitalsanfernando.com/www/es/informacion-del-paciente>. Accessed 18 Mar 2017.
47. PAHO, Detalles de la iniciativa | Portal de Iniciativas de eSalud, Clin. Web. 2006. http://www.paho.org/ict4health/projects/?page_id=190&ps=Panama&id=395&lang=es. Accessed 18 Mar 2017.
48. Perry, L., and Malkin, R., Effectiveness of medical equipment donations to improve health systems: How much medical equipment is broken in the developing world? *Med Biol Eng Comput.* 49:719–722, 2011. doi:10.1007/s11517-011-0786-3.
49. Vega, S., National Telemedicine and Telehealth Program in Panama, *EconPapers*. 2010. <http://econpapers.repec.org/paper/eccol093/35248.htm>. Accessed 20 Mar 2017.
50. Litewka, S., Telemedicina: Un desafío para América Latina. *Acta Bioeth.* 11:127–132, 2005. doi:10.4067/S1726-569X2005000200003.
51. Novillo-Ortiz, D., Hernández-Pérez, T., and Saigí-Rubió, F., Availability of information in public health on the internet: An analysis of national health authorities in the Spanish-speaking Latin American and Caribbean countries. *Int J Med Inform.* 100:46–55, 2017. doi:10.1016/j.ijmedinf.2017.01.013.
52. Saldaña, J., and Vargas-Lombardo, M., eHealth management platform for screening and prediction of Down's syndrome in the Republic of Panama. *E-Health Telecommun Syst Networks.* 3:33–42, 2014. doi:10.4236/etsn.2014.33005.
53. de la Torre-Díez, I., González, S., and López-Coronado, M., EHR Systems in the Spanish Public Health National System: The lack of interoperability between primary and specialty care. *J Med Syst.* 37: 9914, 2013. doi:10.1007/s10916-012-9914-3.
54. Rozenblum, R., Donzé, J., Hockey, P.M., Guzdar, E., Labuzetta, M.A., Zimlichman, E., and Bates, D.W., The impact of medical informatics on patient satisfaction: A USA-based literature review. *Int J Med Inform.* 82:141–158, 2013. doi:10.1016/j.ijmedinf.2012.12.008.
55. Moreno, D., and Vargas-Lombardo, M., Towards a model of knowledge extraction of text mining for palliative care patients in

- Panama. *Int. J. Technol.* 5. 2016. <http://www.ijstr.org/final-print/july2016/Towards-A-Model-Of-Knowledge-Extraction-Of-Text-Mining-For-Palliative-Care-Patients-In-Panama.pdf>.
56. CEPAL, *Telemedicine presents itself as a health solution in rural areas of Latin America and the Caribbean*. Santiago, Chile, 2010
- <http://www.cepal.org/socinfo/noticias/paginas/3/44733/newsletter12.pdf>.
57. American Telemedicine Association. 2017. <http://www.americantelemed.org/main/membership/ata-members/regional-chapters/latin-american-caribbean-chapter>.