Computing and Informatics, Vol. 41, 2022, 309–329, doi: 10.31577/cai_2022_1_309

PROPOSAL OF CRITICAL SUCCESS FACTORS FOR EHEALTH SERVICES DEPLOYMENT

Luis E. Mendoza

ESPOL Polytechnic University
Escuela Superior Politécnica del Litoral
ESPOL, Facultad de Ingeniería en Electricidad y Computación
Campus Gustavo Galindo Km. 30.5 Vía Perimetral
P.O. Box 09-01-5863, Guayaquil, Ecuador
e-mail: lemendoza@espol.edu.ec

Lornel Rivas, Cristhian Ganvini

Cusco Andean University
Universidad Andina del Cusco
Facultad de Ingeniería y Arquitectura
Departamento de Ingeniería de Sistemas
Urbanización Ingeniería Larapa Grande, A-7, San Jerónimo, Cusco, Perú
e-mail: {lrivas, cganvini}@uandina.edu.pe

Abstract. eHealth is widely recognized as the application of information and communication technologies (ICT) in health. However, eHealth initiatives are still incipient in Latin America and the Caribbean, and, in many cases, restrictions in terms of access have been reported, also the necessary infrastructure, interoperability and scalability of these. This work proposes a set of critical success factors (CSFs) for the implementation of eHealth, which allow the identification of gaps, and the proposal of alternatives for the optimization of eHealth. It starts with the establishment of an eHealth domain, its scope and contributions, prior to the identification of key topics, and the establishment of every CSF, with support in guiding questions and metrics. The CSFs can facilitate the planning of projects or activities in eHealth, promoting strengths, either in ICT, management, or another of the involved topics. The CSFs must be employed with a criterion of flexibility and adequacy regarding the case in which they are applied. Finally, opportunities to evaluate and apply the CSFs in a specific context are set out.

Keywords: eHealth, critical success factors, services deployment

1 INTRODUCTION

Access to comprehensive and quality health services constitutes a core line for the universalization of health and its services. However, in Latin America and the Caribbean (LAC) there are causes that can mean the exclusion of social sectors from the exercise of the right to health; among them [1]: the deficit of adequate infrastructure, necessities of modernization in management and its technologies, demographic changes, insufficient health workers, and geographic barriers.

Health care involves the interaction and the exchange of information between the different involved actors [2]. In order to facilitate the access to health services, the use of Information and communication technologies (ICT) has been proposed in LAC, together with the implementation of digital literacy programs and access to quality information, that allows progress towards more informed, equitable, competitive and democratic societies [3, 4]. In this context, the application of ICT in health, which is known as Electronic Health, or eHealth, has demonstrated significant opportunities for the improvement of these services.

eHealth is an emerging field at the intersection of medical informatics, public health and business [2], and involves improving health services at local, regional and global levels through ICT [5]. About the term eHealth, there are different conceptions and little consensus on a definitive taxonomy [5]. eHealth is widely recognized as the application of ICT in health. The term ICT for health is also used to describe eHealth. This includes the electronic health records (EHR) and electronic medical records [6], as well as being part of eHealth, Telehealth [7], mobile health or mHealth [8], tHealth [9], Teleconsultant, health portals and hospital management systems [10].

Recognizing the breadth of the topic, the following stand out among the main contributions of eHealth:

1. improvements in access to health services,
2. minimization of geographic and social barriers,
3. improvements in efficiency, by using fewer resources in the care of equal or greater number of patients,
4. reduction of the unnecessary contact of patients with the health system, and
5. remote access, through consultations and facilities for the formulation of medical diagnoses, treatments and alerts [4, 11].

However, eHealth initiatives are still incipient in LAC and, in many cases, problems in terms of access have been reported, also the necessary infrastructure, interoperability and scalability. The implementation of eHealth requires a framework of policies, resources, infrastructure, and the joint work of ICT specialists and health workers. In countries like Ecuador and Peru, there are aspects such as the centralization of health services, geographic dispersion, and social conditions, that con-

templates attention needs and priorities when identifying intervention strategies, in which eHealth represents an important opportunity.

The current work has the objective of establishing the critical success factors (CSFs) for the implementation of eHealth services, which will allow the identification of gaps and the approach of alternatives for optimizing eHealth. These CSFs can serve as a basis for decision making in the planning and management of eHealth initiatives in healthcare institutions. After exposing the methodological approach that leads to the proposed CSFs, this work starts from the establishment of eHealth, its scope and contributions, prior to the identification of key topics and the establishment of every CSF, with support in guiding questions and metrics. On this basis, opportunities to evaluate and apply the CSFs in a particular context or instance, are set out.

2 METHODOLOGICAL APPROACH

The research process started with a systematic literature review to explore the CSFs, which was carried out at three levels: global, national and regional. This review was guided by the question: What are the CSFs for the implementation of eHealth? Academic repositories were used in order to identify scientific publications on the topic, as well as other sources through which reports, and publications of an institutional nature, were identified.

For the search, keywords such as: eHealth, health informatics, digital health, critical success factor, implementation, strategy, Latin America, and low and medium incomes were used, supported by their respective logical operators. Mainly, literature sources that highlighted possible factors that influenced on the success of eHealth strategies (and related terms) were selected; also, works focused on eHealth in the context of LAC.

The review of literature allowed establishing baseline inputs for the definition of the CSFs, which are identified under names such as *Factors*, *Topics* or *Questions*, aimed at the implementation of eHealth, which are expressed in different degrees of granularity. From these inputs, the following were established thematic areas with influence on eHealth initiatives, in order to establish the factors on this basis. Subsequently, it proceeded with the operationalization of the CSFs using guiding questions, which are also subject to measurement.

As a previous activity to the formulation of the CSFs, a consultation applied to 20 medical specialists, who work in the surroundings of Region of Cusco, Peru, and Guayas Region, Ecuador, revealed that 20 % of the consulted specialists *Totally agree* on the use of eHealth applications to replace some medical procedures, while a 30 % *Slightly agree*. Likewise, a 15 % of the specialists stated that they *Fully agree* that patient care will be increased through eHealth applications and, therefore, care services will be improved by reaching more people, while a 45 % of the specialists *Agreed* with this statement and a 30 % *Slightly agreed*. This consultation confirms, on a regional scale, the relevance of the topic.

3 KEY TOPICS FOR THE SUCCESS OF EHEALTH

In any of its conceptions, eHealth is characterized by its potential to complement the efforts of workers in health institutions, providing support for the provision of services, in response to the needs of inhabitants in urban and rural population centers. Such benefits are achieved in various aspects that are part of the domain of eHealth, such as:

1. Monitoring, search and dissemination of information about health and its services;
2. Support to the communication between the individuals, in a synchronous and asynchronous way;
3. Collection, management and use of health data sources;
4. Patient-centered design, for self-care and prevention;
5. Access and registration of personal data and monitoring of health values;
6. Influence on the creation and application of policies;
7. Development of information dissemination services; and
8. Development of data-centered services, and others.

However, significant restrictions for access to health services are determined by the characteristics of each territory. Particularly, in the Andean and Amazon Region, factors coexist that are significant challenges for planning and monitoring health services. A territorial reality characterized by situations such as the dispersed location of population settlements, the barriers of geography, the communications and telecommunications infrastructure, and the restrictions of the neediest sectors, constitutes a context that makes access to health services more complex.

In this way, there are various topics that are especially significant for *evaluating eHealth interventions*, with different degrees of influence according to the context. On the basis of the review carried out, the topics of singular importance are:

- About health systems. A health system includes the organizations, people and actions involved in the promotion, restoration or maintenance of health. An essential issue is facilitating access to medical care, helping people to obtain adequate health care resources to preserve or improve their health [12], which includes considering access to health care by populations living in rural and remote areas. Quality, in medical care, implies that it is safe, effective, opportune, efficient, equitable and people-centered. Additionally, it is also relevant the cost associated with the provision of health services to provide services, without loss of quality [13]. Likewise, the incorporation of guides, standards and procedures in service delivery mechanisms.
- About the information systems applied to health. Health information systems provide foundations for decision-making and support: medical data generation, data collection, analysis and synthesis, and communication. Topics like the

quality of the system, quality of the information, design focused on the end-user [14], user satisfaction [6], participation of health and ICT professionals in the development, maintenance, and continuous evaluation, have strong importance [15]. Health care requires a continuous flow of information, which is generally fragmented and distributed across multiple sources, making adequate access unavailable. In this context, it highlights the importance of the interoperability of systems [2].

- About technological infrastructure. The technological infrastructure contains hardware (computers, printers, servers, and networks), software (operating systems, databases, programming languages, and tools) and services (technical support, insurance, and communications) that, together, support the informatics systems. Bandwidth and access coverage are an important issue, as the mechanisms that facilitate interoperability and connectivity [7, 16]. Likewise, the state physical infrastructure, based on standards, through a transport and access network that allows it to integrate with other networks [16].
- On the perspective of the involved actors. The actors involved in an eHealth initiative are diverse: health professionals, patients, citizens in general who demand services, ICT specialists, and others. It highlights the need to deal with digital literacy processes, to develop capacities in their professional and private environments, within the information society, and in topics related to eHealth [1]. The development of capacities of health organization staff must include subjects as diverse as project management methods, standards and even regulations to which health institutions are subject [16]. The presence of incentives for the use of eHealth applications can motivate patients, facilitating adoption [14].
- About data and information. It is important to develop mechanisms that allow users to access health information at the appropriate time and facilitate the work of health professionals through technologies. It is necessary to understand the available information, and this must have value and meaning, whether as text, sounds, images and even data, as well as the applications and software which are necessary to access, manipulate, organize, and systematize the information. Likewise, it is necessary to consider that the information, in terms of language, is adequate for the knowledge that end-users such as patients can handle about health terminology [14]. It is important to consider the policies established for the appropriate use of information [16], and the human and organizational component of those who manage the information and use the infrastructure.
- About management. The context of policies and guidelines, at the local, regional, and national levels, is relevant when planning and executing an eHealth initiative. It is necessary to identify legal and operational frameworks about eHealth, as well as the existence of sufficient resources to start an eHealth project or program. It is required to recognize the institutional processes of planning, execution, monitoring, and evaluation pertinent to the health infor-

mation system, and to consider that the budget of ICT services includes items for the development, maintenance and evolution of information systems and health management [1, 16]. Table 1 synthesizes the aspects of special relevance in the eHealth domain, as well as the authors who have gone in depth in each of them, organized according to the topics previously exposed.

Topic	Relevant Aspects	Consulted
Health Systems	Monitoring, tracking and dissemination of information. Access to services, data and patient health information. Attention quality. Rural and urban access. Attention processes and procedures. Health services for patients: about information, access to personal data, self-care (clinical and informal), administrative services.	[1, 2, 5, 6, 7, 11, 13, 14, 16, 17, 18]
Information systems applied to Health	Systems quality. Scalability. User-centered design. User satisfaction. Use of digital technologies to enable communication. Usability. System integration. Interoperability. Participation of users during the development of systems.	[2, 5, 6, 7, 11, 13, 14, 16, 17, 18]
Technological infrastructure	Hardware, software and services that support applications for health services. Communications network and physical infrastructure. Interoperability. Bandwidth. Coverage. Connectivity. ICT standards. Government platform.	[2, 6, 7, 16, 18]
Perspective of the involved actors.	Participation of the involved actors in the operation of health services. Communication between health professionals and patients. Use of eHealth for training. Digital literacy. Privacy of patient and health professional information. Adequate language for a better understanding among the involved ones.	[1, 2, 5, 6, 7, 11, 13, 14, 16, 18]
Data and information	Collection, management and use of health data. Data and information quality. Data integration. Monitoring and dissemination of information. Use of classifications and terminologies about medical procedures. Policies for the use of health information. Trust in the contents. Information with value and meaning.	[2, 5, 6, 7, 11, 13, 14, 16, 17, 18]
Management	Support from governing entities. Plans at ministerial and local levels. Assigned budgets. Use of eHealth as a way of disseminating health policies. Legal framework for eHealth. eHealth for hospital management and administrative services.	[1, 2, 5, 6, 11, 13, 16, 18]

Table 1. Aspects of special relevance in the eHealth domain

The topics reviewed above present different perspectives that must be considered when implementing eHealth initiatives, since they complement each other and give a systemic vision of the problem. For instance, we can see that the aspects related to *Health Systems*, which can be seen as the aspects of scope and social impact of health

services, depend a lot on *Management* aspects, which focus on the performance of those services using information systems. Additionally, these health services are supported by the *Information systems applied to health* and the *Technological infrastructure* existing in the different health centers, for the management of the *Data and information* necessary for their operation and the assistance of the users. Finally, all of the abovementioned must respond to the needs and expectations of all the actors (internal and external to health services) who justify their existence; therefore, the *Perspective of those involved* encompasses aspects of great significance in this context.

The identified topics in the previous section led to the approach of the CSFs for eHealth implementation of which is the object of this work and are defined in the following section.

4 OUR PROPOSAL

4.1 Basis for the Formulation of the CSFs

For [19], some CSFs comprise a limited set of key areas that require constant and careful attention to achieve the stated objectives. In this context, a factor is considered to be critical for the implementation of eHealth services, when its presence guarantees the success of the implementation of the eHealth service. Under this premise, the CSFs were defined, which are intended to be considered by eHealth initiatives, in any of the following situations:

- When no eHealth initiative itself has been proposed as such, but efforts have been made to establish some use of ICT to improve health services. Thus, the application of the CSFs will allow assessing which aspects have been considered, and which deserve to be reinforced.
- When an eHealth implementation strategy is being defined, and the review of CSFs makes it easier to reach important considerations for their development.
- It is being executed an eHealth service implementation project; consequently, it is important to assess if all CSFs have been considered.
- If an eHealth project has been implemented and requires evaluation of its implementation.

Whatever the situation indicated above, the definition of CSFs will refer to the implementation of eHealth services as a project carried out within an institution that provides health services, whether in the public or private sector.

4.2 Formulation of the CSF

Table 2 presents the conceptual definition of each CSF, as well as a set of questions for each one, which guide the definition of the metrics that allow measuring the presence of the CSF in a project or initiative to implement an eHealth service.

Name	Conceptual Definition	Guiding Questions
Health systems	Aspects that guarantee the monitoring, tracking and dissemination of information about patient health services, including access to services, data and patient health information, both at rural and urban levels. It covers personal, self-care – clinical and informal – and administrative services data. It includes achieving the optimum level of quality of care, without it negatively impacts on costs and following the standards of care processes and procedures.	1. Do requestors of health services know about the services provided, and how to access them? 2. How do the conditions of geographic location, and the socio-economic restrictions of requestors of health services, affect access to services? 3. How well is the expected care coverage? 4. How satisfied are users with the service provided, both in medical care and in the administrative services that this involves? 5. What are the causes that motivate to a greater extent the health care needs of the population that require health services?
Information systems applied to health	Elements that guarantee the quality of the existing information systems in health centers, encompassing the user-centered design, scalability and interoperability for exchanging information between systems, as well as their interpretation and use. It considers the participation of users during the development of information systems and the satisfaction of patients and health professionals. It comprises criteria of relevance and opportunity, for the conversion of data into information to support decision-making related to health.	1. Do the existing information systems have the expected quality? 2. How satisfied are the users of the information systems (technicians, health professionals and patients) with the existing information systems? 3. What is the level of integration of existing systems that support health services? 4. What is the level of participation of technicians, health professionals and patients during the development, implementation and/or monitoring of information systems for health? 5. How does the information provided by the systems influence decision-making at different levels?

Technological infrastructure	Operating conditions of the information technology (IT) platform (hardware, software and services) that supports the operation of health centers. Emphasizes the use of standards that allow compatibility with the state's IT platform, according to the aspects of integration, connectivity, bandwidth and coverage of IT services. It comprises computer equipment (hardware), base software, tools, networks, communications and information services.	1. Do the conditions of communications infrastructure (internet access, coverage) facilitate access to health services by users? 2. Do the conditions of technological infrastructure facilitate the use and administration of the systems for its different users? 3. Does the technological infrastructure required for services respond, in its design and evaluation, to own standards of the discipline? 4. Are there computer equipment and software in sufficient quantity, and with adequate quality requirements, for the operation of the services? 5. How satisfied are users with IT services?
Perspective of the involved actors	Participation and integration of all the interested ones in the eHealth service initiative; mainly, health professionals and patients. It covers communication, opportunities for learning and digital literacy, considering the multidisciplinary of the different profiles of the involved ones. It also considers the use of language for understanding and effective communication among those involved.	1. Are there sufficient numbers of health workers, specialties and geographic distribution, to meet the requirement for services? 2. What is the level of knowledge of health workers about eHealth and its benefits? 3. What are the digital capabilities of health workers like? 4. How is the perception about the use of ICT by health workers? 5. Are there initiatives or incentives that motivate health workers to use ICT?

Data and information	It comprises the collection, management, use of health data, the incorporation of data in its different formats (text, sounds, images), trust in data and information, as well as its value and meaning. It involves monitoring and information dissemination mechanisms. It includes the use of standards for the classification and use of terminologies of medical procedures, considering policies for the use of health information, which include the security, privacy and confidentiality of the information.	1. How is the content quality of existing health data and information? 2. How can different users access their existing health data and information? 3. Are there policies or protocols that guide users and administrators on the use and treatment of data, considering the particularities of health procedures? 4. How is the security and privacy of patient data ensured? 5. Is sufficient the dissemination of information, in terms of content and quality, at its different levels (health workers, patients, population)?
Management	It involves the support for the project by the highest authority or governing bodies as a result of its pertinence with plans in eHealth or in information systems for health, both at the ministerial and local levels. Existence of budgets assigned for plans and projects. Use of eHealth as a way of disseminating health policies. Consideration of the legal framework for eHealth, and for hospital management and administrative services supported by eHealth. Existence of previous initiatives that serve as a reference for eHealth projects.	1. Are there national or regional policies focused on eHealth topics? 2. Are there national or regional legal frameworks that regulate eHealth topics? 3. Are there national or regional plans directed to implement or strengthen eHealth? 4. Are there current or future projects, calls for projects or agreements, directed to the implementation or strengthening of eHealth? 5. Are there resources, available in the short or medium term, that can be used to implement or strengthen eHealth?

Table 2. Conceptual definition of the CSFs

4.3 Operationalization of the CSFs

Having the conceptual definitions and guiding questions of the CSFs as a framework of reference, the establishment of metrics takes place, at different measure-

ment scales, that allow an adequate characterization of the conditions that serve as a reference for an eHealth implementation strategy. As an example, in Tables 3, 4, 5, 6, 7 and 8, a set of generic metrics for each CSF is shown.

	Metric	**Min**	**Max**	**Formulation**
1.	Level of knowledge of the requestors about the health services provided.	0	2	2 = Generally know about the services. 1 = Partially know about the services. 0 = Do Not Know/Not measured.
2.	Level of knowledge of the requesters about how to access the health services provided.	0	2	2 = Generally know how to access. 1 = Partially know how to access. 0 = Do Not Know/Not measured.
3.	Percentage of affectation of the geographic conditions of the requestors, for access to services.	0	4	4 = More than the 75 % of the requestors. 3 = Between 50 % and 75 % of the requestors. 2 = Between 25 % and 49.9 % of the requestors. 1 = Less than 25 % of requestors. 0 = Do Not Know/Not measured.
4.	Affecting of the socio-economic restrictions of the requestors of health service about access to services.	0	4	4 = More than the 75 % of the requestors. 3 = Between 50 % and 75 % of the requestors. 2 = Between 25 % and 49.9 % of the requestors. 1 = Less than 25 % of requestors. 0 = Do Not Know/Not measured.
5.	Level of coverage of the expected care.	0	1	4 = Total Coverage. 3 = High Coverage. 2 = Medium Coverage. 1 = Low Coverage. 0 = Do Not Know/Not measured.
6.	Level of satisfaction of users of the medical services provided.	0	4	4 = Totally satisfied. 3 = Very satisfied. 2 = Moderately satisfied. 1 = Not very satisfied. 0 = Do Not Know/Not measured.
7.	Level of satisfaction of users of the administrative services associated with the medical services provided.	0	4	4 = Totally satisfied. 3 = Very satisfied. 2 = Moderately satisfied. 1 = Not very satisfied. 0 = Do Not Know/Not measured.

8.	Inventory of causes that motivate to a greater extent the health care needs of the population requesting health services.	0	n	1..n = Prioritized list of causes that to a greater extent motivate the health care needs of the population requesting health services. 0 = Do Not Know/Not measured.

Table 3. Example of metrics formulation for *Health systems* CSF

	Metric	**Min**	**Max**	**Formulation**
1.	Level of user confidence regarding the information they receive.	0	2	2 = A lot of confidence. 1 = Little confidence. 0 = Don't Know/Not measured.
2.	Perception of the ease of use of the existing systems.	0	4	4 = Very easy to use. 3 = Easy to use. 2 = Not very easy to use. 1 = Difficult to use. 0 = Don't Know/Not measured.
3.	Existence of maintenance policies for the existing systems.	0	2	2 = There are policies. 1 = There are not policies. 0 = Don't Know/Not measured.
4.	Existence of good practices in the service management for users.	0	2	2 = Good practices are used. 1 = Good practices are not used. 0 = Don't Know/Not measured.
5.	Level of availability of clinical information for patients.	0	3	3 = Available. 2 = Occasionally available. 1 = Not available. 0 = Don't Know/Not measured.
6.	Level of integration of systems for health services.	0	5	5 = More than 75 %. 4 = Between 50 % and 75 %. 3 = Between 25 % and 49.9 %. 2 = Less than 25 %. 1 = Not integrated. 0 = Don't Know/Not measured.
7.	Prioritized list of media for the dissemination of information about health services to citizens.	0	n	1..n = Prioritized list (It can be included, Websites, Social Networks, Advertising Campaigns, Mobile applications, others). 0 = Don't Know/Not measured.

Table 4. Example of metrics formulation for *Information systems applied to health* CSF

	Metric	**Min**	**Max**	**Formulation**
1.	Existence of internet coverage in the user's residence area.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured.
2.	In case of having internet service, perception of the quality of service.	0	5	5 = Very good. 4 = Good. 3 = Regular. 2 = Bad. 1 = Do not have service. 0 = Don't Know/Not measured.
3.	Level of implementation of data center.	0	5	5 = Totally implemented. 4 = Largely implemented. 3 = Moderately implemented. 2 = Basically implemented. 1 = Not implemented. 0 = Don't Know/Not measured.
4.	Technological infrastructure has certifications in terms of design, structure, performance and reliability.	0	5	5 = Has all the certifications. 4 = Has 75 % of certifications. 3 = Has 50 % of the certifications. 2 = Only has one certification. 1 = Does not have certifications. 0 = Don't Know/Not measured.
5.	Level of competence of computer equipment for the operation of services.	0	3	3 = Sufficient. 2 = Moderately sufficient. 1 = Not sufficient. 0 = Don't Know/Not measured.
6.	Level of competence of base software (operating system, development tools, database managers) for the operation of the services.	0	5	5 = Has all the base software. 4 = Has 75 % of the base software. 3 = Has 50 % of the base software. 2 = Only has a base software. 1 = Does not have base software. 0 = Don't Know/Not measured.
7.	Equipment renewal frequency, according to policies.	0	5	5 = Annual. 4 = Biannual. 3 = Triennial. 2 = More than three years. 1 = Does not have renewal policies. 0 = Don't Know/Not measured.
8.	Level of satisfaction of users with IT services.	0	5	5 = Totally satisfied. 4 = Very satisfied. 3 = Moderately satisfied. 2 = Not very satisfied. 1 = Not measured. 0 = Don't Know/Not measured.

9.	Existence of informatics security infrastructure.	0	2	2 = Has infrastructure. 1 = Does not have infrastructure. 0 = Don't Know/Not measured.

Table 5. Example of metrics formulation for *Technological infrastructure* CSF

	Metric	**Min**	**Max**	**Formulation**
1.	Level of availability of specialist doctors for the provision of primary health care services, in the required territory.	0	4	4 = Sufficiently available. 3 = Moderately available. 2 = Scarcely available. 1 = Not available. 0 = Don't Know/Not measured.
2.	Level of availability of workers to provide health care services in the required territory.	0	4	4 = Sufficiently available. 3 = Moderately available. 2 = Scarcely available. 1 = Not available. 0 = Don't Know/Not measured.
3.	Level of knowledge of health workers about eHealth and its benefits.	0	3	3 = Advanced knowledge. 2 = Medium knowledge. 1 = Basic knowledge. 0 = Don't Know/Not measured.
4.	Existence of training programs about electronic health.	0	2	2 = Exist. 1 = Do not exist. 0 = Don't Know/Not measured.
5.	Level of coverage of digital skills of health workers.	0	3	3 = Mostly advanced capabilities. 2 = Mostly medium abilities. 1 = Mostly basic skills. 0 = Don't Know/Not measured.
6.	Perception of health workers about the use of ICT.	0	4	4 = Very easy to use. 3 = Easy to use. 2 = Not very easy to use. 1 = Difficult to use. 0 = Don't Know/Not measured.
7.	Existence of initiatives or incentives that motivate health workers to use ICT.	0	2	2 = Exist. 1 = Do not exist. 0 = Don't Know/Not measured.

Table 6. Example of metrics formulation for *Perspective of the involved actors* CSF

	Metric	**Min**	**Max**	**Formulation**
1.	Quality of the content of the existing health data and information: *a* – It can be easily accessed. *b* – It is reliable. *c* – It is obtained at the appropriate time. *d* – It is useful.	0	5	5 = All alternatives are met. 4 = Three out of the 04 alternatives are met. 3 = Two out of the 04 alternatives are met. 2 = One out of the 04 alternatives is met. 1 = None of the alternatives are met. 0 = Don't Know/Not measured.
2.	Existence of policies or protocols about the use and treatment of health data.	0	2	2 = Has policies or protocols. 1 = Does not have policies or protocols. 0 = Don't Know/Not measured.
3.	Dissemination of health information for doctors through digital media (websites, apps, social networks).	0	2	2 = It is disseminated. 1 = It is not disseminated. 0 = Don't Know/Not measured.
4.	Dissemination of health information for patients through digital media (websites, apps, social networks).	0	2	2 = It is disseminated. 1 = It is not disseminated. 0 = Don't Know/Not measured.
5.	Dissemination of health information for the target population of the services through through digital media (websites, apps, social networks).	0	2	2 = It is disseminated. 1 = It is not disseminated. 0 = Don't Know/Not measured.

Table 7. Example of metrics formulation for *Data and information* CSF

Metric		**Min**	**Max**	**Formulation**
1.	Existence of national policies directed to eHealth topics.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured.
2.	Existence of regional policies directed to eHealth topics.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured.

3.	Existence of legal frameworks that regulate eHealth topics.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured.
4.	Existence of rules that regulate eHealth topics.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured
5.	Existence of national plans directed to the implementation or strengthening of eHealth.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured
6.	Existence of regional plans directed to the implementation or strengthening of eHealth.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured
7.	Existence of projects or calls for projects, directed to the implementation or strengthening of eHealth.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured
8.	Existence of current or future agreements, directed to the implementation or strengthening of eHealth.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured
9.	Existence of previous initiatives that serve as a reference for eHealth projects.	0	2	2 = It is present. 1 = Not present. 0 = Don't Know/Not measured

Table 8. Example of metrics formulation for *Management* CSF

5 TOWARDS THE EVALUATION AND APPLICATION OF THE CSFS

Once the CSFs, and their guiding questions have been exposed, opportunities are set out to evaluate them and apply in a particular context or instance. The variables that affect health services and, consequently, for the implementation of eHealth are complex; so, it is necessary to establish a strategic context. This context can be approached taking into account different characteristics, as is the case of *Processes*. Different types of processes can be carried out within health services, as follows:

Strategic processes. They enable the health institution to plan and develop its future. It encompasses strategic planning, the design of new services and the incorporation of new instruments and equipment for patient care.

Operational processes. They allow the health institution to carry out its normal functions. They cover the promotion and performance of patient care processes, as well as the monitoring of patient satisfaction and support in administrative aspects, control of supplies and operating budget of the services.

Support processes. They permit strategic and operational processes to be carried out, and cover human resources management, budget management and information systems management.

A second important characteristic to take into account is the *Health workers*, who carry out the processes within the health institutions. According to their profile, they have the capacity to indicate the degree of compliance or presence of the CSFs in this kind of institution. A classification of the health worker profiles of interest for the application of the CSFs is following:

Doctors, nurses and patients. Suppliers and direct recipients of health services. Medical specialists or general practitioners. Patients in their different care needs.

Users operating systems and services. Administrative staff who operate the systems for care and the required procedures – medical records, medical orders, patient data, miscellaneous records.

Managers, directors. Formulation of operational, tactical and strategic plans, development of policies, guidelines, directives, regulatory and legal framework, liaison with official governmental entities, and linkages with financing sources.

IT support and management. IT technicians, systems engineers and related. Systems configuration, software development, monitoring of communications platforms, role management, access, maintenance and administration of systems and communications networks, user support, identification of requirements.

The application of the CSFs depends on the scope of each one (*conceptual definition*) in relation to the types of processes that can be executed in the health services and the types of profiles of the workers in these institutions. Table 9 shows the proposed match of characteristics (*processes* and *profiles*) according to the scope of each CSF.

To show a possible scenario for the application of CSFs, we are working on a real project for the development of a mHealth software product, in a hospital of regional scope and with and institutional cooperation and support. An eHealth strategy is being defined, and we estimated that the review of CSFs makes it easier to reach important considerations for their development. The project, named Chinpuy (Measuring or Marking, in native Quechua Language), corresponds to the development of a mobile app, oriented to the monitoring of the treatment in patients with a diagnosis of Arterial Hypertension; an urgent attention topic according to the policies and healthcare statistics in the region of Cusco, Peru. The

CSF	Process Type			Worker Profile			
	P1	P2	P3	W1	W2	W3	W4
Health systems	×	×		×		×	×
Information systems applied to health		×	×	×	×	×	×
Technological infrastructure			×		×		×
Perspective of the involved actors		×	×	×	×	×	
Data and information		×	×	×	×	×	×
Management			×		×		×

P1: Strategic processes; P2: Operational processes; P3: Support processes;
W1: Doctors, nurses and patients; W2: Users operating systems and services;
W3: Managers, directors; W4: IT support and management

Table 9. Match of processes and profiles of health service workers in each CSF

Factors were used as a framework to support the selected project, during its execution.

Finally, we can see that the application of CSFs depends to a large extent on the characteristics and capabilities of the healthcare institutions prone to the implementation of eHealth. Therefore, the proposal for the application of CSFs requires consideration of the different institutional specificities, defined by each country, which may require the adaptation of metrics according to each type of health service. Moreover, it is a fact that the use of information systems is a reality in all areas of human life; therefore, they are always present, especially for CSFs that have a marked technological component.

6 CONCLUSIONS

eHealth has shown a significant growth and penetration on a global scale, in circumstances where isolation and geographic distances represent barriers that need to be overcome to the greatest level possible, to guarantee access to health. The CSFs proposed constitute a reference that includes several dimensions and their influence on the success of eHealth implementation.

The definition of the CSFs, with the support of guiding questions, facilitates the exploration of the context, in order to identify gaps and opportunities of strengthening for the future implementation of eHealth. Metrics provide quantifiable and measurable expressions regarding those questions. The CSFs in its conception, used with a framework of flexibility and adaptation with respect to the case in which they are applied, can facilitate the planning of projects or activities in eHealth, motivating the strengths, either in IT, in management, or in another of the topics involved.

Future works are directed to the use of CSFs in its different dimensions to support the implementation of eHealth in the Andean Region of Cusco, Peru, and in the Guayas Region, Ecuador. This includes the review and prioritiza-

tion of the CSFs, considering the characteristics of the context of the institutions, specifically in terms of their processes and the profiles of health services workers, as well as the improvement of the CSFs, based on the experiences that are achieved.

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Luis E. Mendoza received his Bachelor's degree in mathematics and M.Sc. in system engineering from the Simón Bolívar University, Venezuela. He received his Ph.D. in software engineering from the University of Granada, Spain. He is currently a Non-Titular Lecturer at the ESPOL Polytechnic University, Ecuador, and was Senior Lecturer at the Simón Bolívar University, Venezuela. His main research topics include system integration, software development methodologies, software quality, critical systems, business process modelling and verification, and recently, eHealth adoption. He published more than 100 articles in journals, magazines, books and conferences on software and system engineering.

Lornel Rivas received his Bachelor's degree in systems engineering from the Bicentenaria de Aragua University, and afterwards his M.Sc. in systems engineering and Ph.D. in engineering from the Simón Bolívar University, Venezuela. He has experience in sectors such as small and medium-sized enterprises, agricultural research, energy, and territorial development. He is currently full-time Professor at the Professional School of Systems Engineering at the Cusco Andean University. His main research topics are information and knowledge management, software project management, software engineering, and eHealth. He has several publications in journals and conferences on these topics.

Cristhian Ganvini received his Bachelor's degree in systems engineering from the Catholic University of Santa Maria, Arequipa, and later M.Sc. in strategic business administration from CENTRUM – Pontifical Catholic University of Peru, and M.Sc. in leadership from the EADA Business School, Spain. He received his Ph.D. in systems engineering from the Federico Villarreal National University, Peru. He is currently Director of the Postgraduate School at the Cusco Andean University. He has participated in research projects with the Recognized Research Group Engineering and Society of the University of Valladolid, Spain. His research interests are focused on information society issues. He has written several articles on this topic.