Methodological recommendations for the measurement of access and use of Information and Communications Technologies (ICT) in the Health Sector

Working Group on Measurement of Information and Communications Technologies (ICT)

Statistical Conference of the Americas (SCA) of the Economic Commission for Latin America and the Caribbean (ECLAC)

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Contents

1. Introduction

In Latin America and the Caribbean substantial inequalities persist in access to health services as a result of various factors that limit the possibilities of people receiving timely and good quality medical care. These factors include the shortage of human resources, infrastructure, equipment, and drugs, as well as the physical and cultural distance between the public provision of health services and the low-income population that needs them (1).

Information and communications technologies (ICT) and eHealth[1] applications play an essential role in promoting access to the health services. These tools alter the way in which the population lives, works and interacts, and the ways in which the health authorities and health professionals can contribute to ensuring longer and healthier lives for citizens, wherever they live (2).

ICT are currently considered to play a leading role in generating, storing, transferring and managing information, and in generally contributing to the beneficial use of the available communications networks.

The use of ICT in businesses and other facilities has encountered a range of obstacles similar to those which the health sector will need to face over time. The main obstacles are due to the fact that ICT involves the interaction of different areas with different opinions about the use of the technology, infrastructure, applications, and solutions required to meet the specific and general needs of a given process. Among these obstacles, the limitations imposed by the human factor are also of crucial importance.

There are numerous areas of opportunity for measuring, assessing, and evaluating the inclusion of ICT in the health sector. In order to ensure that the data collected is coordinated and accurate solutions must be found in important areas such as:

- Identification of the target population. Since the large number, dispersed nature and organization of units of information leads them to being assigned to residual groups, it is necessary to obtain data on the smaller units.
- Absence of standardized statistics and calculation algorithms leads to data being collected and presented haphazardly, making comparison difficult.
- There are no figures for many information variables. Even when data are reputed to be available, they are not included because they are not in standard format.
- Agreed schedules are not adhered to and continuity in the capture of all the variables is not assured.

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[1] The World Health Organization (WHO) defines eHealth as: "the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health care services, health surveillance, health literature, and health education, knowledge and research."

Thus, with a view to harmonizing ICT Health statistics, the <u>Working Group on the Measurement of Information and Communications Technology</u> [2] of the Statistical Conference of the Americas (SCA) of ECLAC—with valuable support from the Pan American Health Organization (the Regional Office of the World Health Organization), and its expert David Novillo, from ECLAC as Technical Secretariat of the Action Plan on the Information and Knowledge Society for Latin America and the Caribbean (eLAC2015), and from Brazil´s Regional Center for Studies on the Development of the Information Society (CETIC.br)—herewith submits methodological recommendations aimed at facilitating comparisons of health statistics in the different countries of Latin America and the Caribbean. We also wish to acknowledge and thank the various health ministries and specialists of the region for their support.

More information on eHealth or on the use of ICT in the health field can be obtained from the Pan American Health Organization (e-mail: ehealth@paho.org or web page: http:/www.paho.org/ict4health).

REFERENCES:
(1) Economic Commission for Latin America and the Caribbean (ECLAC). Third Ministerial Conference on the Information Society in Latin America and the Caribbean. Lima (Peru). Santiago (Chile); ECLAC; 2010.
(2) eHealth and innovation in women's and children's health: a baseline review: based on the findings of the 2013 survey of CoIA countries by the WHO Global Observatory for eHealth, March 2014. Available at: http://www.who.int/goe/publications/baseline_fullreport/en/

2. Conceptual framework

2.1.   Objective

The objective is to have information on the access and use of ICT in the health sector in order to prepare consistent, comparable, up-to-date and representative statistics for reporting the progress made by the countries of the Region on implementing technological innovations aimed at enhancing the effectiveness and efficiency of their public and private health systems.

Based on the model survey of the Organization for Economic Cooperation and Development (OECD), the module presented below is based on three fundamental principles. Firstly, it is assumed that countries possess different levels of maturity in terms of eHealth. While some countries´ policy imperatives mean that data collection is based on availability, others use ICT. Secondly, the survey is composed of independent and autonomous modules that ensure its flexibility and adaptability to changing environments. The core modules can be included in existing surveys or can be used as independent surveys, while the complementary modules can be used according to countries´ needs. This approach allows a broad measurement of core areas on an internationally comparable basis, while the different countries can adapt the contents to meet their specific needs. Finally, one of the key challenges is to ensure that the terminology is

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[2] Member countries: Argentina, Brazil, Chile, Colombia, Cuba, Mexico, Panama, Dominican Republic, Surinam, Uruguay and Venezuela.

comparable between countries, so that when the questions are changed they still retain a basis of comparability. For example, in many cases, the terms used in electronic medical records (EMR) or electronic health records (EHR) can be interpreted differently. These differences between countries´ interpretations can undermine comparative evaluations. In order to avoid such problems, the indicators focus on the use of ICT based on functionality, i.e. on a consensus among the basic types of health care activities that can be compared by using different electronic systems. This approach is compatible with the principle of technological neutrality, i.e. the questions do not require or adopt a particular type of technology, and preclude technological obsolescence by having a forward view (i.e. they do not preclude the use or development of future technologies).

Definitions

Internet access (fixed and mobile)

The Internet is a global public communications network that provides access to a series of services including the world wide web (WWW), e-mail, news, entertainment, data files, voice, images and social networks, regardless of the device used (it cannot be assumed that services can be accessed only by computer. There are alternatives such as mobile telephones, tablets, PDA, gaming devices, digital TV, etc.). Access can be through a fixed or mobile network (ITU, 2014).

The fixed network (wide or narrow band) includes cable technologies (e.g. dial-up, RDSI, DSL or fiber optic) and wireless (e.g. satellite, WiMax, fixed CDMA). The mobile network involves the use of mobile access technology through a telephone via 3G (e.g. UMTS), a card (SIM card installed in a computer) or a USB modem.

The ITU (2014) classifies the types of Internet access by:

- Fixed narrow band (cable): includes analog modem (dial-up through a standard telephone line), ISDN (Integrated Services Digital Network), DSL (Digital Subscriber Line) at data transfer rates lower than 256 kbit/s, and other forms of access with a data transfer rate lower than 256 kbit/s.
- Fixed broadband (cable): refers to the technologies with data transfer rates of at least 256 kbit/s, such as DSL, cable modem, high speed leased lines, fiber-to-home/building, high-voltage lines and other fixed band widths (by cable).
- Terrestrial fixed broadband system (wireless): refers to the technologies with data transfer rates of less than 256 kbit/s, such as WiMAX and fixed CDMA.
- Satellite broadband (connection via satellite), at a theoretical data transfer rate of at least 256 kbit/s.
- Mobile broadband (at least 3G, e.g. UMTS) via telephone.
- Mobile broadband (at least 3G, e.g. UMTS) with use of a card (e.g. a SIM card in a computer) or a USB modem.

Web Presence and Website

Web Presence: This involves a website, a homepage, or the presence on the website of another entity. It excludes incorporation in an online directory and in any other web page where the entity has no control over page content. Web Presence includes social network pages and other types of

accounts (e.g. Facebook, YouTube and Twitter) if the entity has control over the content (Partnership and ECA, 2012).

Website: Location in the WWW identified by a web address. Collection of web files on a particular subject includes an introductory file called a homepage. The data is coded in specific languages - Hypertext Markup Language (HTML, XML, Java) - that can be read with the use of a web browser such as Netscape or Internet Explorer (ITU, 2009).

2.2.   Target population

The target population for ICT health statistics corresponds to all the active public and private health facilities in the national territory classified as facilities "without inpatient hospitalization" and "with inpatient hospitalization".

If a certain country is unable to cover the abovementioned target population due to time or resource constraints, or other reasons, we suggest that priority should be given to the public health sector.

Health facility without inpatient hospitalization:

- Primary care outpatient clinic: Health facilities that provide general medical and professional specialist basic or primary care.

- Specialist outpatient clinic: Health facilities with specialized medical facilities.

- Emergency clinics: Health facilities that provide specialized medical services and emergency care.

- Diagnostic and therapeutic support service: Health facilities that provide specialized diagnosis and/or therapy support services.

Health facility with inpatient hospitalization:[3]

- Low complexity facility: Health facilities for inpatient care that possess all services except intensive care units.
- Medium complexity facility: Health facilities that possess all the services including intensive care units, but with no facilities for cardiovascular and organ transplant surgery.
- High complexity facility: Health facilities that have all the services, including intensive care units and facilities for cardiovascular and organ transplant surgery.

The facilities that are not subject to ICT health sector statistical surveys are:

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[3] Inpatient health facility: health establishments with inpatient beds, defined as specific physical facilities for accommodating patients for a minimum of 24 hours. Inpatient health establishments include low-complexity health facilities without intensive care units, medium complexity establishments with intensive care units that do not perform cardiovascular surgery or transplants, and high complexity establishments where cardiovascular and transplant surgeries are performed.

- Private clinics run by autonomous health professionals such as doctors, psychologists, nurses, etc., that do not meet the aforementioned criteria.

- Health facilities with a restricted client base such as clinics or dental surgeries in the schools network that cater exclusively to students and employees:

  o outpatient facilities or dental surgeries run by private firms or public authorities which provide health care exclusively for their employees;
  o medical clinics that are devoted exclusively to carrying out competency examinations (e.g. eyesight tests required by traffic departments).

- Health facilities devoted exclusively to research and teaching that do not regularly examine patients.

- Temporary facilities set up to support health campaigns, and mobile units (land, air, or water).

2.3. Coverage

2.3.1. Thematic coverage

Thematic coverage refers to ICT availability and use in a country´s health facilities, in the following areas:

- **Health facility profile** (characteristics of the health facility, type of care provided , number of people employed)

- **ICT Infrastructure** (Internet access, use of computers, smartphones and other electronic devices, availability of networks, web presence, Internet services, availability of an IT department)

- **ICT-based services and applications** (electronic medical records system; telemedicine services; lists of electronic services; sending/receiving data to/from other health units; information security and protection; social networks; use of computers and the Internet to handle individual patient information; use of computers)

- **Education and training** (professionals trained in ICT; ICT training programs)

2.3.2. Geographical coverage

The study aims to collect statistics which are consistent and representative of the country. We therefore recommend that data should be obtained from health care facilities by conducting a census or using a probability sampling approach.

The study will have national level coverage based on political administrative divisions, depending on the country´s requirements.

2.4.   Statistical Unit and informant

2.4.1.   Statistical Unit

The Statistical Unit refers to the health facilities described in item 2.2. above (Target Population).

2.4.2. Informant

The informant is the person responsible for providing information about the health facility, assisted by the person (s) responsible for ICT in the facility.

2.5.   Reference period and periodicity

In order to ensure data comparability, we recommend that the reference period for the access and use indicators should be three months (preferably the final quarter of the year), for purposes of comparison. This period will however depend on each country´s resources.

3. Study type

Data collection can involve conducting a census of all the country´s health facilities or using a sample design to represent the health-related activity at national level.

3.1.   Health facility census

If the country wishes to obtain ICT health statistics by conducting a census of the health facilities, we recommend:

- confirming that the health facility directory is fully up to date
- confirming the location, address and telephone number of the facility
- classifying the health facilities according to the country´s political administrative divisions

If all the health services have not been covered by the census, the results should specifically and clearly indicate which facilities were indeed covered, thematically and geographically, by the census.

3.2.   Sample design of health facilities

For the countries that, for various reasons, prefer a sample to be taken of their health facilities, we recommend a probability sampling, stratified by type of healthcare facility with and without inpatient hospitalization.

3.2.1. Sampling frame

Preparation of the sampling frame will be based on the complete directory of all the health facilities in the country that can be classified as serving the target population defined for the study.

It is essential to use up-to-date and validated data in the sample frame. It is also important to include items such as number of beds, the health facility´s complexity rating, number of annual health care interventions or average monthly interventions, number of workers, and address details.

3.2.2 Sampling methods

A possible sampling method would be to stratify by type of health facility, exclusively for purposes of selection, i.e. without sampling representativeness at this stage of disaggregation.

Stratification can be replicated for geographical areas according to the country´s political divisions, by zonal groupings (north, south, east or west), or by using other criteria according to each country´s requirements.

Additional criteria can also be used to determine which facilities should be included for census-taking or obligatory inclusion, e.g. territorial importance, treatments offered, etc.

3.2.3 Estimate of the sample size

To estimate the sample size at the national level, we recommend doing a probabilistic stratified random sampling, with a confidence level of 90% or higher, depending on the type of facility.

To estimate the number of sampling units in each stratum, we recommend distributing the sample size proportionally to the size of the facility, according to the chosen stratification.

The estimate levels will depend on each country and will correspond to the disaggregate-level of the facilities that have sample representation. The sample design should permit the representative sampling of:

- the country´s health facilities
- the country´s health facilities according to type (with and without inpatient hospitalization)
- the health facility according to number of employees

The representativeness levels of the sample design do not necessarily equal the disaggregation of the stratification. We recommend that these levels of representativeness should be less disaggregated than the stratification.

3.2.4 Selection method

The selection of facilities for the survey is carried out in two stages. Firstly, the health facilities where a census will definitely be conducted, and those that fall into the "mandatory inclusion" category, are promptly selected for inclusion.

The second selection stage involves those facilities that will be subject to sampling, This will be done randomly and independently for each type of facility. If a sample frame is available that

contains the directory of all the duly classified health facilities, we recommend systematic selection in order to ensure a complete overview within each stratum.

3.2.5 Expansion factors

The data is obtained by surveying a sample of facilities. This means that in order to obtain the estimate of the different variables under study, the surveyed data needs to be expanded.

In order to expand the data, the "mandatory inclusion" facilities must firstly be considered, given that they are "self-representing" sampling units subject to census.

Secondly, for the randomly selected facilities, we apply the inverse of the selection probability obtained in each stratum, by type of facility or by the number of employees defined in the sample frame.

4.   Collection method

For conducting the survey by census or sampling, we recommend that the national statistics organizations should coordinate efforts with the health ministries of each country, so that they can make concerted efforts to determine the development of the conceptual and operational design of the contents of the instrument, as well as the collection and processing of the statistics and indicators, the dissemination, use, and analysis of the data - all based on the institutional strengths of each country.

5. List of ICT indicators in the health sector

1.   Profile of the facilities

For the purpose of determining the general features of the country´s health facilities, the following details are required, in addition to the ICT health indicators:

  1.1 Geographical location of the health facility

  1.2 Operational status of the health facility:

   - functioning
   - partially functioning
   - temporarily closed
   - permanently closed

  1.3 Number of facilities according to their legal status
   - public
   - private

  1.4 Number of facilities according to inaugural date

1.5 Number of facilities according to type:
- healthcare facility without/with inpatient hospitalization (i.e. a hospital)

1.6 Number of beds (only for inpatient facilities)

1.7 Facilities that provide :
- general and specialized care, and care in a specialty area (standard classification)[4]

1.8 Number of people (by sex) employed in the health facility[5]:
- health professionals (physicians, stomatologists/dentists, nursing staff)
- non-health professionals
- health technical personnel
- non-health technical personnel
- others

2. ICT Infrastructure

2.1 Number of facilities and quantity of owned equipment:
- desktop computer
- notebook computer
- tablet
- other mobile devices

2.2 Number of facilities with Internet access.

2.3 Number of facilities by type of Internet access and contracted connection speed[6]:

Band width	Type of access	
	Fixed	Cellular/mobile
Less than 256 Kbps		
Between 256 Kbps and less than 2 Mbps		
Between 2 Mbps and less than 10 Mbps		
10 Mbps or over		

> **Internet access:** This is considered to be access via a connection owned or paid for by an institution or company, while Internet access via devices belonging to (or paid for by) employees is not taken into account.

2.4 Number of employees (by sex) who use ICT in the course of their work in the health facility at least once a week:

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[4] This variable, due to the large number of possible options, is excluded from measurements. This is the case, for example, of Brazil, due to operational difficulties. However, the variable can be included by those countries that wish to do so.

[5] With regard to this point (and points 2.4, 2.8, 4.3), classification by age can be included if the country requires it.

[6] World Summit on the Information Society. Target 5 - 5.1 and 5.2, itu.int/en/ITU-

- health professionals (physicians, stomatologists/dentists, nursing staff)
- professionals unrelated to health
- health technical personnel
- technical personnel unrelated to health
- others

2.5 Number of facilities that have a LAN Network.

> **LAN Network**: This is a network that connects a series of computers within a limited area, such as a building, a department, or a manufacturing plant. The network can be wireless and does not need to be connected to the Internet. A LAN requires only two or more computers to be interconnected.

2.6 Number of facilities that have:
- Intranet
- Extranet

> **Intranet**: This is an internal communications network that uses Internet protocols and permits communication within the premises (and with other authorized users). An Intranet is normally protected by a security system (*firewall*) to control access.
>
> **Extranet**: This is a closed network that uses Internet protocols that allows an institution or business to share data securely with suppliers, partners, vendors, customers or other commercial partners. An Extranet can be a secure extension of an Intranet that allows external users to access certain parts of the institution´s or company´s Intranet. It can also be a private part of the website of an institution or business accessible to users after they have been authenticated on a login page.

2.7 Number of facilities that have some individual who is specialized in (or responsible for) ICT.

2.8 Number of employees (by sex) in a health facility who are specialized in (or are responsible for) ICT.

> Persons who undertake ICT-related functions are skilled in specifying, designing, developing, installing, operating, supporting, maintaining, managing, evaluating and researching ICT and ICT systems.

3. Services

3.1 Number of facilities that have an Electronic Medical Record System:

- all the records are in electronic format
- the majority of the records are electronic but retain some paper-based records
- the majority of the records are paper-based but retain some electronic records
- all the records are paper-based

> **Electronic medical record (or electronic health record)**: An electronic record containing information on a patient´s health. It can assist health professionals in decision-making and treatment. Source: PAHO/WHO

3.2. Number of facilities, according to types of clinical data on a given patient that are available electronically in the facility:

- general patient data (address, telephone number, date of birth, etc.)
- patient´s medical history or clinical notes (outpatient notes, hospital notes, surgical notes)
- laboratory test result
- radiology report
- radiology image
- vital signs
- vaccine record
- allergies
- list of drugs
- diagnosis, problems, or patient´s state of health

3.3. Number of facilities that provide telemedicine services:

- radiology
- pathology
- dermatology
- psychiatry
- cardiology
- ultrasonography
- mammography
- surgery
- consultations
- ophthalmology
- nephrology
- obstetrics/gynecology
- diabetes
- patient monitoring
- pediatrics
- home care
- neurology
- neurosurgery
- strokes treatment
- urology
- oncology
- otorhinolaryngology

> **Telehealth (including telemedicine)**: The delivery of health-related services via information and communication technology, especially where distance impedes patients from receiving health care. Source: PAHO/WHO

3.4. Number of facilities according to type of functionalities available in their electronic system:

- list of all the patients by diagnosis
- list of all the patients by laboratory test results
- list of all the patients on specific drugs
- patient discharge summaries
- list of all the drugs that a specific patient is taking, including drugs prescribed by other physicians
- list of all the laboratory test results of a specific patient
- list of all the results of radiology tests, including reports and images relating to a specific patient
- system enables consultations, tests or surgery to be prearranged
- system enables requests for laboratory tests
- system enables requests for imaging tests
- system enables requests for drugs/medical prescriptions
- system enables ordering of materials and supplies

3.5. Number of facilities according to type of data sent to or received electronically from other health facilities:

- clinical data sent to health professionals in other facilities
- patient referrals to other facilities sent electronically
- reports on type of health care received by patient that are made available on discharge or when patient is transferred to another facility
- list of all the drugs prescribed to a patient on transferal to other health facilities
- results of patient´s laboratory tests made available to other facilities
- results of patient´s imaging tests made available to other facilities
- nursing care plan

3.6. Number of facilities that have electronic data security tools:

- Anti-spam and Anti-malware (malware includes viruses, worms, Trojans, rootkits, spyware, intrusive adware or any other malicious software)
- Firewall, IDS (intruder detection system), IPS (intruder prevention system), WAF (web applications firewall)
- data protection technology (database encryption), DAM (data access monitoring), DLP (data loss prevention system)
- authentication technologies (passwords, biometrics, tokens, OTP, intelligent cards, digital certificates)
- safe communication technologies in client-server applications (HTTPS, VPN) with some blocking devices for e.g. online stores, access to unwanted sites, music streaming, etc.

- restricted access to Internet sites (security policy with some blocking devices for e.g. online stores, access to unwanted sites, music streaming, etc.
- security information and event management (SIEM)

3.7. Number of facilities with a website.

3.8. Number of facilities according to type of website hosting.

3.9. Number of facilities that use social media for advertising their services:

- social networks (Facebook, Google +)
- instant messaging networks (Whatsapp, Telegram)
- microblogging networks (Twitter, Tumblr, Friendfeed)
- professional networks (Linkedin, Yammer)
- image sharing networks (Flickr, Picasa, Pinterest, Instagram)
- video networks (Youtube, Vimeo)

3.10 Number of facilities, according to the following types of service that can be arranged by telephone:

- appointment management
- appointment reminders
- general patient information service
- general information about services provided by the facility
- free emergency telephone line
- community mobilization and health promotion
- awareness raising

3.11 Number of facilities according to the types of online services provided:

- booking medical appointments (electronic diary)
- booking appointments for tests
- visualization of diagnostic test results
- visualization of medical record or file
- data insertion in medical record by patient

4. Education and training

4.1 Number of facilities that use ICT training programs:

- distance learning
- classroom training

> **eLearning or virtual education (including distance training or learning):** This is a means of applying information and communication technology to learning. It can be used to improve the quality of education, to increase access to education, and to bring new and innovative forms of teaching within the reach of a greater number of people. Source: PAHO/WHO

4.2   Number of facilities that have an ICT training program on:

- electronic health records (or electronic medical records)
- pharmacotherapy management
- clinical-administrative management systems
- digital medical imaging
- information systems
- telemedicine services
- public or occupational health surveillance systems
- health education distance learning programs

4.3   Number of employees (by sex) who have received ICT training organized by the health facility:

- health professionals (physicians, stomatologists/dentists, nursing staff)
- non-health professionals
- health technical personnel
- non-technical health personnel
- others

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