Interoperability for an observatory of habits and healthy lifestyles related with physical activity

Andrea Torres Ruiz, Fernando Prieto B., Jose Arturo Lagos, Nixon Duarte, Rosmary Martinez, Juan Pablo Moreno, Aldo Vilardy, Bryan Toro

Andrea.torres@umb.edu.co, fernando.prieto@docentes.umb.edu.co, jose.lagos@docentes.umb.edu.co, nixon.duarte@docentes.umb.edu.co, rosmary.martinez@docentes.umb.edu.co, juan.moreno@umb.edu.co, aldo.vilardy@umb.edu.co, bryan.toro@umb.edu.co

Abstract — It is proposed a design of an interoperable platform for the record and analysis of data related to habits and healthy lifestyles, aiming physical activity for adult and elder populations in rural regions in the country. This tool seeks to encourage the development of strategies and public policies, working as a framework for institutions that make decisions in the field of public health and sports.

Key words: E-health, HL7, HEVS, interoperability

I. INTRODUCTION

Nationally, the effort to promote healthy habits and lifestyles in the population is led by COLDEPORTES, this entity is the head of sports national system at the public level and has presence in a great part of the national territory. Organizations of this system of sports that run HEVs programs represent a primary source of information that can be gained through a web platform, the analysis of this information constitutes an input for decision-making and allows direct resources and policies for vulnerable populations. [1][2].

Among the main risk factors for the development of chronic non-communicable diseases (NCDs) are, arterial hypertension, high cholesterol index, poor diet, overweight and obesity, physical inactivity, consumption of snuff and other environmental factors which may be modified; so that interventions aimed at primary risk factors can potentially reduce the risk to about 80% in cardiovascular disease and type 2 diabetes, so as to 40% of the events of cancer [4].

Physical activity is widely recognized as a health protector factor with great influence on NCD prevention factor. Yet everyday people are less active, partly by current lifestyles, estimated that at least 60% of the world population does not perform the minimum recommended physical activity. The recognition of physical inactivity as an independent risk factor, related with morbimortality [4], [5], has generated strategies all around the globe aiming to increase levels of physical activity of populations, and the healthy habits and lifestyles (HEVs), as despite being recognized and documented the benefits of it, every day the proportions of physical inactivity are higher.

The need for interoperability between health information systems has become visible, constituting this, the way to save resources and use all available sources of information, thus avoiding having to repeat the process of data collection that may have already run another information system. Internationally, organizations such as ANSI, CEN, ISO and Health Level Seven International are working on interoperability standards; one of the most important and widespread in the world is the HL7 standard.[3].

This standard in version 3 allows interoperability from the transfer of messages and documents in XML format; HL7 has taken into account the value of information to public health and therefore has a domain of quality measures in health, in which a document to request reports, the Health Quality Report Format (HQMF), is defined. This type of document eases the punctual information amongst systems since it defines the message components, in order to balance functionality and complexity of the message, the semantic interoperability is added as the HQMF comes entirely from information model defined by the HL7 RIM organization. [1]

The response to requests made by the document HQMF generate a message response based on the structure of the Quality Reporting Data Architecture (QRDA), this standard reports use Clinical Data Arquitecture (CDA) as the foundational standard for the specification of the report (1).[1]

The equipment of interoperability in the web platform that acquires and analyzes information, opens the doors of this information system to the integration with databases of other systems, such as health. Because the HL7 standard has been adopted internationally this information may be used by other health observatories such as the OMS.

As other information systems within the health system include interoperability through the HL7 standard, the management of information may be easier for monitoring the implementation and impact of public policies on population.
II. CONCEPTUAL FRAME

A. Estandard HL7 (Health Level 7)

The HL7 was defined by the foundation with the same name, which has dedicated since its foundation to create standards for the health sector.

In the beginning, the HL7 foundation was dedicated to elaborate specifications of messages for the sending of information between institutions of health. Through time, and observing that the institutions that wanted to establish communication had to spend large quantities of money to add units or to redesign their systems (due to their lack of an standard to define the events and elements related with patients), HL7 began the task to generate standards not only for communication but also for the medical information structure. That’s how HL7 V2 was born. Following, due to the lack of a clear model of implementation, the foundation define the HL7 V3 standard, which helps the designer to don’t get sidetrack with the wide quantity of possibilities that V2 allowed before, by this way, it was accomplished in the year 2004 to generate a clear standard, easy to implement and manage [21]. In the figure 2 it is shown the time line related to the standard evolution HL7.

Like is shown in the figure 2, it was in the year 2001, when the foundation HL7 launched its first version of the CDA HL7 standard (Clinical Data Architecture), which define the structure of the electronic medical documents. For their 3 version of the HL7 standard, same as the EN1606, it was seen the necessity to add an unit of references denominated (RIM-Reference Information Model), which corresponds to the semantic representation of the elements and information recorded in clinical messages.

It is important to take in count that the Reference Model HL7 does not define the structure of the electronic medical documents, this function belongs to the CDA HL7; it is important to understand the relation that exists between the RIM and the CDA, the tags used in the documents XML of the CDA are defined in the RIM, each version of the CDA is related directly with its corresponding RIM, which takes the classes that are needed for each specification of the document parameter to define and construct what is known as the redefine reference model or RMIM [22].

In the model of the HL7 reference there are 3 superior classes for the definition of clinical domain: event (act), number of participants in the event (role) and the subject involve in the event (entity) [23].

A. Interoperability between health observatories

The interconnection of the different departments of the health institutions and between them is an actual necessity. Each time in a greater quantity is implemented in Latin America systems of file images (PACS), the information in radiology (RIS) and in laboratory (LIS), electronic clinical histories (HCE), connected to administrative systems (HIS) and the patient’s administration (ADT). This interconnection in various levels demands the use of informatic standards; for example, DIDCOM, HL7, etc. The institutions most demand, when they acquire an informatic solution, compatibility with the different standards, and its need it to know what they are about. [27][28].

The standards are protocols used by the software industry (regular form), to facilitate the interoperability or integration. The exist in the various layers of communication: - the transportation of data, that allows to transport messages with any semantic: XML, XML-HTTP, etc.; - messaging: HL7; images: DIDCOM; - vocabulary, that allows to define the controlled specific vocabulary for each domain: laboratory, pathologic anatomy, diagnose by images, nursery, procedures, etc.; - label of documents, to differentiate the different kinds of documents that can interchange and their possible content; of communications: for example, the wired, TCP/IP routers, etc. [25][26][29].

III. METHODS AND MATERIALS

The project centralizes in the use of the TIC to generate a system of interoperability that allows the consolidation of the data related with habits and styles of a healthy life, and the practice of physical activity, with the objective to promote a source of information for the surveillance of risk factors that determine the most common chronic disease. And generate an strategy to promote the practice of physical activity in regions where the access and presence, of specialized personal is limited.[5]

This is accomplished through the design and implementation of a system to manage standard data. That allows to study in detail the necessities of the population related to the acquisition of habits and healthy life styles and practices.
related with the physical activity by the population. This platform includes a developed form based in the STEPwise method, defined by the OMS, for the acquisition of information; this information is stored in a data base.

The objective of the platform is to recollect, store and process the information, the result of this analysis comprehends a battery of indicators that will be the posted information in the observatory of habits and healthy life styles (OHEVS).[7].

A. Definition of the range of interoperability

System of Interoperability is established for the messages that are generated from the web platform that are directed to other systems of external information, which allows the observatory OHEVS to be a source of information, that can be consulted by a web service by other systems of information. In overall is contemplated the generation of 32 measurements. [11][16].

B. Standard selection.

Beginning from the information to manage inside the web platform of the observatory OHEVS, is define that the standard for interoperability of the system should achieve with the following requisites:

• Specialized standard in the transference of health information.
• The standard must allowed the prosecution of messages and documents b machines.
• The standard must be accepted in the international community.
• Most exist an evidence of the use of standards in a national level.
• It has to contain information about interchanging information and reports of public health.

From this requirements it was made a revision of available standards and it came to a conclusion that the most adequate standard for the system of interoperability is the version 3 of HL7.

C. Domain identification HL7 V3.

Once is identify the standard that is going to be used, it was necessary to identify the domain closest to the necessity of the system, thanks to the time of development the HL7 have a wide range of domains that cover the principal functions of the health information systems.

The messages or reports that are generated by the observatory contain information of entire populations, by which is necessary to evaluate the information of more than one person in the consult of the date base, for the cases the HL7 counts with the domain UVQM, that standardizes the format for the representations of measurements of qualities in health HQMF. Next is shown the structure of the document HQMF.

The document is divided into two principal sections, the headline records the principal information of the document and its measure; the body of the document carries specific information that describes the measurement, and complementary information that improves the posted information. This type of messages can be utilized for the application of reports generated form the observatory. [8].

The HQMF contemplates in its domain the UVQM the generation for answers through the QRDA, the process of the delivery of messages is illustrated in the next figure.

In the figure that is being observed in the superior part the development of the application of the measurement, this is generated by a system of external information besides the observatory, the specification of the measurement is defined in the document HQMF that arrives to the providers of information, in this case the observatory OHEVS corresponds to the platforms that consults in the data base, to finally generate a message of respond or Quality Report with a message QRDA.[18].
The utility of this model of data is shown in the next illustration.

In HL7 is contemplated the use of the document HQMF and the QRDA for surveillance of the implementation of public politics, it also represents how tools or supplies for the choosing of decisions and the generation and the adjustment of politics directed to improve the population health.

It’s important to know the existence of three types or categories of messages QRDA:

- QRDA Category I – Single Patient Report: this is a report at an individual level of measurements of health quality; the elements of data content in the report are particular reported measures.
- QRDA Category II – Patient List Report: reports that allowed to include measures of quality in health for multiple patients, this types of reports refers to one or many measures for each patient of the list.
- QRDA Category III – Calculated Report: generate reports of quality measures in health with the estimate of each measurement for one population inside a period of specific measurement. Allows the extraction of information without referring to personal data with each patient, which prevents the possibility that someone access to patients personal data without permission.

Taking in count that the observatory generates the quality reports in health starting from the available information of patients in a population, the category that is closer to the requirements of the system is the category III that shows the estimate measurements of the population and protects the identity of the patients that make up the population measure.

The information flow and the interaction between messages HQMF are shown in the next figure.

D. Development methodology HL7 V3.

The version 3 of the HL7 standard base its programming from Unified Modeling Language (UML), this allows you to model real-life situations to generate messages according to the situation or event that generates them. Interoperability with HL7 is thanks to the definition of a vocabulary for all applications that may derive from the standard, all classes and concepts that can be used in HL7 messages within the Reference Information Model (RIM).

Thanks to the development time that the standard has, a revised documentation for each domain is featured, it is also possible to download the legislative package from the official website of HL7, in this are tools and examples for the implementation of the standard in specific applications. To speed the development process it was started from the refined model reference information coded message or RMIM coded "POQM_RM000001UV", this model uses the entry point named eMeasure to reference the main class QualityMeasureDocument.[17].
Within the methodology of implementation of HL7 messages begins with RIM, to this will be applied restrictions and DMIM is obtained which include messages for a specific domain, from the latter and with more restrictions you get the refined model or RMIM containing the classes to be included in a specific message type, with the tools available to HL7 is possible to pass the class diagram RMIM to the hierarchical description of the message or HDM, this is a document in which RMIM classes are obtained with their attributes in tabular form, from this hierarchical model the application can generate messages, assigning the required values for each attribute in a tag file in XML format.

Not always the model classes of the refined reference are used, or it can happen that is necessary to include other classes or attributes within the model, the standard has the flexibility to allow such changes as long as you do not go RIM.

The response message QRDA is based on CDA standard, hence the reference information model RMIM is the same as for clinical documents based on CDA, these contemplate a header with the document information as identification, author, custodian. Then there is the measurement section that has a subsection of reporting parameters with relevant information QRDA measures.

IV. RESULTS

After formulating this proposal the results that this would bring would be linked to the development of the QRDA document adapted to the requirements of the reports generated by the observation.

Likewise the implementation of the web service for automatic generation of the response message from the queried information in the database is achieved.

The development of this project will allow each of the entities that implement it improve the incursion of new technologies in view of improving response times.

V. CONCLUSIONS

This project will allow to understand the problems that often are not taken into account as it is in health computer science. Compression performed with the standard HL7 is currently not easy but what is sought is to be applied to public health and diagnoses that apply to it. The issue of health has many topics that are very difficult to address in a single proposal, however it would be interesting to take this proposal as the beginning of a full investigation that may contribute to the knowledge of this important subject for Colombia.

HL7 standard is becoming strong in Colombia, but for being a private entity, the different institutions health-providers are beginning to use it in their systems gradually, and in this moment, there are few that have adopted it.

Within the development of this proposal, the capacity is given to the government to monitor risk-factors of ECNT to guide the resources in preventive measurements that promote physical activity.

This project will allow to take as source information databases of other information systems such as the National Health System in an automated way so that the observatory has a greater capacity to be integrated with other systems and its response could be more effective and closer to the reality of the study population.

VI. BIBLIOGRAPHY

[1] Principles of health interoperability HL7 and SNOMED. Tim Benson


[22] HL7 FAQs. Health Level Seven International. Available at URL: http://www.hl7.org/about/FAQs/index.cfm


[26] LinkEHR Normalization Platform. Available at URL: http://www.linkehr.com/

[27] Methodological aspects of the process of adopting the standard HL7v3 in Colombia: the experience of the Technical Committee on Use Cases Clinical Laboratory. Gabriel Tamura, Nhora Villegas, Fernando Portilla.


[29] List of institutions providing health services registered for direct shift from nation, ministry of health and social protection, June 2012 accounts.