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Following the same pathway as the health systems of advanced countries around the world, the public health system of Catalonia (SISCAT) is subject to tensions, challenges and opportunities that derive mainly from the aging of the population, the increase in costs, the incorporation of new technologies and medical treatments, as well as a higher level of knowledge and demand on the part of the citizens. Within this scenario, a topic that emerges strongly is the transforming role of data management and information technologies for the empowerment of: the patient, the healthcare practice, healthcare management and allocation of resources.

Healthcare has been identified as one of the sectors with the greatest potential for the intelligent use of data. At the level of operations, it allows clinicians to share patient health information throughout the chain of care (primary care, specialized care, tertiary care and home care). At the management level, it facilitates transparency and comparison to reduce the variability of healthcare practice, and increase the quality and security of care; and allows regulators, insurance companies and service buyers to establish contracts and economic conditions. At the analytical level, it is an opportunity to research new treatments, services and products that complete the promise of a personalized and predictive medicine. In all cases, they provide the patient with access to their data and information, modify their relationship with the professionals and with the health system. Health is a sector where information and knowledge play a key role.

Locally, the Health Plan is the strategic, interdisciplinary and collaborative framework that guides the actions of all SISCAT actors to improve the quality of life and the well-being of the population, the access and resolution of health services, and the efficiency and sustainability of the system as a whole. One of the strategic lines of the Plan (number 10) aims at “digital health”. Apart from this specific objective, information systems should facilitate the improvement and transformation of the healthcare model and the healthcare system in accordance with the purposes and strategies of the Health Plan. Some of the pillars of the Plan, such as the integrated care throughout the healthcare continuum, accessibility and resolution, medication policy, evaluation and transparency, or territorial integration, among others, explicitly request actions within the information systems and technologies.

The Information Systems Master Plan is designed to achieve these goals. That is, it is not just about a technology update, but a model for the management of the data and an architecture of the information systems that corresponds and, in some cases, advances to the changes which are taking place in the care model, with regard to citizen relations with the health system, in the work processes and in the relationships between the professionals themselves. That is why its approach is systemic, that is, it covers the exchange of data between the various healthcare services and, even, with other areas, such as social services, and consequently affects some aspects of the tools used by the supplier entities. Also, for this reason, it provides mechanisms to intensify collaboration between the different actors, to define semantic and technical standards, and to share and take advantage of technological innovation.

In its design, managers and technicians from the information systems of the Catalonian Ministry of Health and the supplier entities, as well as professionals and experts in the care, management and health planning of very different fields have participated. The Plan has also benefited from the sponsorship of the Catalan National Health Service (CatSalut). In total, almost three hundred people have participated in the project, over nine months, through different mechanisms.
Objectives and benefits of the Plan

The Catalan healthcare system, from the point of view of the use of ICT, successfully exceeded what could be considered the “first wave” of digitization. This initial phase consisted of incorporating information technologies within the suppliers themselves with the aim of supporting the work of professionals (this is the case of clinical work stations and, in large part, nursing, both in primary care and in hospitals), some departmental systems (image, radiology or operating theaters) and company infrastructure systems (financial management, personnel, procurement and others).

At the same time, the Catalan healthcare system has been able to carry out leading country initiatives in the use of information and communication technologies for the benefit of citizens and professionals, such as the creation of the Central User Registry (RCA) and the individual health card, the Primary Care Clinic Station (eCAP), the electronic prescription for pharmaceutical services or the health information and documentation system. Some examples of these systems are the Shared Electronic Medical Record of Catalonia (HC3), the interoperability platform (IS3), the medical imaging system (SIMDECAT) or the citizen’s personal health folder (La Meva Salut).

In spite of this, the use and effective adoption of these initiatives is still not general, and the quality and timeliness of data that the patients and professionals ask for cannot be considered satisfactory either. What is considered to be a strength, as the diversity of solutions adapted to their environment, where innovation may emerge, has become a limitation for future progress, and has created a large number of systems that do not “talk” among them, including those based on standard solutions from the same manufacturer, due to the customizations of each local implantation.

Finally, the planner, insurer and purchaser of the services has evolved towards a closer management of the demand for care of each territory and to greater needs for information in the most diverse fields. This has produced a large volume of demands for the adaptation of the systems of the supplier entities and different circuits for registering and sending information that do not add value to the best benefit of healthcare services.

It is necessary and urgent, therefore, that SISCAT makes both a quantitative and qualitative leap in its information services and technologies, in order to build a person-centered information system based on the data it provides which gives an integrated vision of the health and facilitate the continuous monitoring of the patient, regardless of the professional or the provider that can treat it at a specific time. This new model must offer the professional common, meaningful information of the clinical significance, that is relevant and of quality, easy to record, access and analyze at the time it is needed. The management of the data and the proposed technological model should make possible the extension of new assistive models, allow the automation of unprofessional tasks, and facilitate the patient access to information and the interaction with the system.
Key features of the new information system model

The longitudinal Electronic Health Record (EHR) is the main feature of the Plan and represents the functional and technical repository of all the relevant information of a certain citizen that must be recorded and shared throughout the healthcare system. It is a conceptual and technological evolution of the medical records that are kept in the systems of the different service providers, with different logic and without connection between them. A common health record solution must take into account and align process components (how to make and register events and the route of the citizen through the health system), data components (a shared structure and nomenclature) and a technologic model (how data is recorded, stored and transmitted).

The Plan foresees its construction and the modalities of integration and coexistence with the existing systems portfolio. Having a common health record represents a process of accreditation and standardization with respect to those data that are considered common, service levels and technical mechanisms for updating information in real or almost real time. This repository will progressively replace current systems based on interoperability (HC3 and IS3) and the sending of registers through multiple circuits, and will allow different actors to access the data they need at any time.

Sharing more and more quality data will make possible to interrogate and analyze large volumes of information, and compare risk factors and different practices and treatments, to return the results to patients, professionals and healthcare managers. Improve decision making and advance the way of a predictive and personalized medicine. The Plan provides for the construction of an advanced analytical repository for the treatment of structured and unstructured data (text, image, information from sensors and electromedical apparatus and the one introduced by the users themselves) in almost real time, which is nowadays called Big Data, to provide SISCAT with data products and services.

The Electronic Health Record also has the vocation of becoming an integral training system with different value services that can be offered to suppliers that need or wish to evolve or transform their current systems. We refer here primarily, but not only, to work environments, that is, the tools used by healthcare professionals to record and order their work, be it the most administrative content (revenue management systems, internal transfers and discharges) or that is done with the work, attendance, clinical or nursing work stations (the systems for the management of requests and orders of work and the inscription of diagnoses and treatments).

Some of the existing systems, such as the main primary care station (eCAP), deserve a profound technological update exercise. This update is also a good opportunity to create an integrated citizen data model that considers the vision of the condition and the patient’s regular health problem together with the logic of acute episodes, regardless of where they occur. In this way, the database of the Primary Care Clinic software will become the nucleus of the central data repository, with which it will be integrated naturally.

The stations of some hospitals have been recently implemented, they are already consolidated and only need a short-term homologation process that will make them...
compatible with the new Electronic Health Record and that is part of the accreditation system of the Health entities that contract with CatSalut. In other cases (such as acute hospitals or tertiary care centers), the change is urgent and indispensable. For these, the Plan must be an opportunity to rationalize the existing offer and offer suppliers the need to make an incentive migration to more robust and modern systems. In this sense, the model foresees the construction (or acquisition) of a new hospital management system that, in the same way as the primary care system, is integrated into the EHR.

This model ("coordinated" technologically and "participated" in its governance) is well aligned with a health model that needs to share information and that is integrating healthcare services in the territory, while maintaining the autonomy of management in the design of its organizational processes and models. The new technological solutions present in the market, more modular and uncoupled and with greater facilities for integration, will facilitate these design options.

The introduction of the longitudinal EHR can be considered a "second wave" of digitization, which are tackling in recent years the international health systems we have analyzed, both those vertically integrated (that is, where the regulator and planner is also the owner of the service provider entities) as those where different types of providers coexist. Diversified systems facilitate in many cases a greater adaptation to the way each entity works and encourage local innovation. The healthcare sector, also SISCAT in Catalonia, has been a pioneer in the creation and application of digital transformation technologies, particularly in the field of telemedicine. Despite this, a set of factors have hampered the extension and generalization of many valuable projects.

The Information Systems Director Plan wants to face this situation and facilitate a cooperative environment and an evaluation and development process. The main objective is to provide the critical mass and the economic dimension necessary to allow the growth and use of innovation throughout the SISCAT, especially those technologies that facilitate the redesign of care processes, the deployment of new ones and the development of the new EHR. This is the case with the Big Data initiatives, eHealth and mobility, the Internet of Things (and Artificial Intelligence).

**Governance**

To guarantee the success of the Plan, SISCAT must be equipped with a governance model of the information systems that combines executive and regulatory leadership with the participation and advice of the supplier entities, as well as the creation of communities of practice for the development of innovation. We could say that this is a participatory governance, which must have a representative body of the supplier entities for strategic monitoring of the Plan, technical advisory bodies for the adoption of standards, and homologation processes and lightweight structures that facilitate the collaboration and management of community knowledge. Within this participatory model,
the leadership and involvement of healthcare personnel in the design and implementation of solutions will be key.

The governance model is designed with ambition, to put the Catalan health system at the level of the most advanced organizations in the management of data and technologies. These organizations recognize the strategic role of information systems in supporting and transforming their work processes and rely on data to make decisions at any point in the institutions, even more when their users are professionals with a high rating. Normally, this recognition is associated with a corporate governance of ICT, a stable and recognized management body, a top-level management position of its managers and an adequate allocation of economic, technical and human resources.

In order for the Plan to be effective and credible, it is necessary to determine a specific financing framework that facilitates execution. The financing of investments in technology will have to be finalist (with incentives that favor the renovation of the technology park and its alignment with the model of information proposed), sufficient to achieve the objectives of the Plan and sustained over time. The relationship model with the Telecommunications and Information Technology Center (CTTI) must also be reviewed in order to adapt it to the specificities of the healthcare sector and the fact that a very important part of the agents and subjects that intervene in the process of transformation are not bodies of the Catalonian Government.

For the implementation and implementation of the Plan, an ambitious, but flexible and realistic executive program has been established, which wants to work simultaneously on strategic projects that make a leverage of change, improvements to projects and current services to make them converge with the future model, and immediate actions and decisions, including the abolition of services and circuits that do not provide value. In the short term, the construction and initial loading of the central data repository is anticipated with the information currently available in the system and that comes from different sources with the aim of putting it available to the community that forms the SISCAT.