Historia Clínica Compartida de Catalunya (HC3), Carpeta personal de Salud (LMS) y sistemas de integración social i sanitaria en Cataluña. ICT services for integrated Care

“Shared Medical Record, Personal Health Folder and Health and Social Integrated Care in Catalonia. ICT Services for Integrated Care”
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1. The need for a Shared Medical Record of Catalonia (HC3)

The medical record is a dossier of information that arises from contact between the health professional (doctor, nurse, psychologist, physiotherapist, etc.) and the patient, and is compiled to ensure the correct care of the patient and their pathologies. It is therefore a valid document from the medical and legal point of view, which contains information of a healthcare, preventive and social nature.

The information compiled and ordered in the medical record constitutes a registry of data essential for the health professionals in the development of their tasks, both in the medical and healthcare aspects, of attention and curing of the patients, and from other points of view, also fundamental for the health system, such as teaching, research, epidemiological studies, improvement in healthcare quality, the management and administration of the health centres, without forgetting its legal function.

For its very evolution, the medical record faces the challenge of inter-operability with the rest of the health system, while also having to complete new contents in order to serve as a useful tool for real integral care. In this sense, the contents of the medical records must also advance towards the information related to chronicity and particularly with health and social care. To be able to provide users with true information about the care process offered to them access should also be allowed to this information in an integrated way. This article includes a brief outline of the challenges and steps being faced in the evolution of the medical record in Catalonia towards a more open setting and with new contents.

Law 41/2002, of the 14 November, basic regulator of the autonomy of the patient and of the rights and obligations in terms of medical information and documentation, and its equivalent law in Catalonia (21/2000), establish “the objective of advancing in the shaping of the sole medical record per patient” and plans for the existence of a system that “facilitates the shared use of medical records between health centres in Catalonia”, in order for the patients attended to in diverse centres do not have to undergo repeated examinations and procedures, and that the healthcare services have access to all the medical information available”, advising that the "process guarantees the participation of all the agents involved”.

Furthermore, the Catalan Health Plan 2011-2015 establishes that the management of this information, in its entire life cycle, from its compilation to the generation and dissemination of knowledge, is key to the health system, and adds that the information management model must consider the following premises:

1. The information must be managed in the sphere of the sector and to do this a unified model of governance is necessary. This model is the Shared Medical Record of Catalonia (HC3).
2. The suppliers must have the commitment to share the information about their patients online.
3. The validity and security of the information must be guaranteed.

The Catalan Health System is made up of over 160 different health providers, both in the public and private sector, which form an integrated healthcare network of public use. The multiplicity of agents in provision has given rise to a majority of these organisations and centres having their own information systems adapted to their specific needs.

This is why in the **ICT Strategy of the Department of Health** it was decided to establish a transversal platform of information to be able to share medical information between health professionals and since 2008 set into motion the **Shared Medical Record of Catalonia (HC3)**, and a year later the **Personal Health Folder (Cat @Salut La Meva Salut)** in order to empower the citizenry and involve them in the medical monitoring and 2014 saw the establishment of the Management System of Integrated Health and Social Care Processes (**i-SISS.Cat**), which interacts with the different systems of information that make up the current map of medical systems to end up providing support to the derivations and existing healthcare routes between the health and social care providers of Catalonia.

The i-SISS.cat solution will interact with the different information systems that make up the current map of medical systems in Catalonia.
1-1.- Fundamental objectives of the HC3

The HC3 is the electronic model of medical records in Catalonia, and encompasses the set of documents that contain data and relevant information about the medical situation and evolution of a patient throughout their healthcare process.

The use of ICT systems, as well as the standards of integration and inter-operability that make them compatible, added to the active role of the citizenry, enable having available a sole medical record of the patient focused on health. A common model is thus established of access to registers of the diverse systems of medical information, respecting the differences between providers or entities.

The HC3 is not the sum of the medical records of the different health centres, but a tool that enables the access, in an organised way, to the relevant medical information of the patient, respecting the different models of medical record of the diverse entities.

In the same way the setting into motion of the HC3 does not mean the elimination of the medical records of the providers, but only a common system of management of the medical information and documentation, specifically its publication and access by the professionals, which must be organised and structured to guarantee the maintenance of an integral model of public use, despite the diversity of models and legal forms of the institutions that provide the services.

Taking into account the variety of entities existent in the Catalan health system, with different information systems, a model of uniformity is not being imposed but rather of compatibility and inter-operability between all of them so that they can share the information, and to achieve this, the characteristics, objectives and basic criteria that the HC3 adopted are the following:

- The main objective is to improve healthcare for the citizenry, by means of an instrument that improves and facilitates the work of the healthcare professionals, on permitting the shared use of the information available between the different healthcare centres.
- Favour the healthcare continuity and contribute to promoting the responsibility of the citizenry towards their own health.
- Improving efficiency, with the decrease of duplicities of tests and with greater control of incompatible treatments, facilitating rationalisation in the use of the resources available.
- Contributing trust in relation to the security and confidentiality of the medical information and accessibility, for both the professionals and the patients.
To achieve these objectives it is fundamental that the systems of identification of the professionals and of the citizens are completely univocal and that the traceability of all the accesses made to the information is guaranteed. Nearly 100% of the centres of the public network are currently connected to the HC3 and in 2015 the rehabilitation and dialysis centres will also be connected. In the coming future data from the social services and other ambits will be integrated.

The adhesion of the health centres to the HC3 is undertaken through an agreement between them and the Department of Health through which the former promise to comply with the regulation established in the Constitutional Law of Data Protection (LOPD) as well as protecting the data, enabling access only to those authorised professionals and demand from them the appropriate use of the information available.

The agreements to be signed also describe the professional profiles that have access to HC3, as well as the requisites required to do so.

Medical images are also published in the HC3, both radiological and non-radiological. This has been possible due to the project of digitalisation of the images of diagnostic tests that represents a major step forward in improving healthcare on allowing information to be shared immediately between diverse professionals that have responsibilities in the healthcare process of the patient.

The objectives of this Plan are the digitalisation of both radiological and non-radiological medical images. The Plan has already achieved, for example, the digitalisation of 100% of
the radiological explorations done in Catalonia and today we are digitalising all the electrocardiograms and structured spirometry tests of primary and specialised healthcare, the non-mydriatic image of the screening of diabetic retinopathy and we have several of tele-dermatology that is being developed in Catalonia by all the health providers.

1.2- HC3 data of publication and access

By means of a series of services and integrations, the health centres publish the most relevant care information of the patients. From the setting into motion of the HC3 to the present a total of 140 million documents have been published, the publications of the centres growing exponentially. Until August 2015 the publications had increased by 47% compared to the previous year.

The publications shown below include the global number of publications in HC3 of medical reports, including documents, diagnoses, vaccinations, digital image studies, structured laboratory, spirometry tests and structured pathological anatomy.

HC3 gives confidence to the professionals in aspects of security and confidentiality of the data, since it guarantees the traceability of all the accesses and transmission of the information is done securely and univocally.

The professionals can consult the HC3 information in two ways:
- Incorporating the data from HC3 in the medical work stations (ETC) of the centres themselves: all the information in HC3 can currently be integrated into any health information system, always differentiating that the origin of this added information is HC3.

Below we show the evolution of the number of applications made to the ETC consultancy service during the last year by month.

- HC3 information can also be consulted by means of the professional visor of the very HC3 system. The professional visor of the HC3 receives a monthly average of 246,401 accesses from professionals. So far this year this type of access to information has increased by 28% compared to 2014.
1.3 – Technological basis of HC3

The HC3 is based on the principle of inter-operability between the systems. Inter-operability is one of the main challenges to overcome in the implementation of information technologies in health. This is confirmed by the majority of actors in the system, and is reflected in the report developed by Gartner “eHealth for a Healthier Europe! Opportunities for a better use of healthcare resources”, a study in which the Czech Republic, France, Netherlands, Sweden, Spain and the United Kingdom have taken part. This report shows that low inter-operability between the systems may cause medical errors and increase the frustration of the professional in the use of the medical station.

Inter-operability is the capacity that a product or system has, whose interfaces are totally known, to function with other existent or future products or systems and without restriction of access or implementation. We must distinguish between different levels of inter-operability.

![Diagram of interoperability levels]

On the other hand, it is necessary to respond to the need to cover all the healthcare processes of the patient independently of their placement and that of the professionals who attend to them in order to guarantee healthcare continuity.

Inter-operability in the Shared Medical Record of Catalonia

Inter-operability is a process that can be divided into different levels through which it gradually progresses:
The Shared Medical Record of Catalonia (HC3) has worked, and continues working, to achieve the first 4 levels of inter-operability, with the aim of achieving the completion of the semantic level over the next few months in some spheres.

To reach the semantic inter-operability it is necessary to work with international standards that are widely adopted by all the agents, and in health these standards are focused on the syntactic and semantic level.

Below are detailed, for each level of inter-operability, the actions that have been undertaken.

1. **Functional**

It is the basis of inter-operability. Despite the complexity of the Catalan healthcare model, the Catalan health system has identified the healthcare processes, the different scenarios of inter-operability, as well as the most relevant actors that intervene in the exchange of medical information in the HC3.

On the other hand, the diversity of health providers makes it necessary to define a framework of inter-operability that enables the guarantee of healthcare continuity.

2. **Legal**

Both Law 21/2000 and the Model Agreement to which the entities from the health system adhere when incorporating into the HC3 cover the legal aspects that permit inter-operability between these systems. In this framework is included the guaranteeing aspects of security and confidentiality of the information (use of digital certificates, SAML tokens, application of the data protection law, integration with the auditing system, etc...).

3. **Technical**

At the end of 2009 the landmark was reached of total incorporation of the SISCAT Catalan health system centres into the HC3, thus corroborating that the use of standard technologies (SOAP, XML, WS-Security, WSDL, etc.) facilitates communication among the Catalan health system.

4. **Syntactic**

The HC3 has evolved its formats of information exchange towards structured contents that comply with standard HL7 v.3. Gradually, the different entities have adapted their messages to comply with this new standard. For those entities that are in the process of incorporating into the HC3, the messenger service that they must implement to undertake the exchange of information is that which complies with format HL7.

The new functionalities incorporated, such as the results of laboratory tests, pathological anatomy and digital image, have only been defined following standard HL7 v3.

The standard used to share the medical information is the HL7 CDA r2: this standard allows for the progressive incorporation of the structured information.

5. **Semantic**

To achieve inter-operability between the systems, it is not enough to achieve the above levels. So that the systems are able to make use of the information exchanged, it is
necessary that we use a controlled vocabulary, based on international terminology. For this reason, from HC3 the use of standard semantics is being promoted, as in the case of the use of the benchmark medical terminology SNOMED-CT (in an initial stage, for the pathological anatomy reports) and of LOINC as a standard in the sending of results of laboratory tests (remember that, in both cases, the information is also exchanged in format HL7 CDA r2 level 3). We must also not forget the generalised use of other catalogues of standards such as CIM-9, CIM-10, SERAM, or NANDA.

<table>
<thead>
<tr>
<th>Information</th>
<th>Format</th>
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<tbody>
<tr>
<td>Pathological anatomy reports</td>
<td>SNOMED-CT</td>
</tr>
<tr>
<td>Results of laboratory tests</td>
<td>LOINC</td>
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<tr>
<td>Medical information</td>
<td>CIM-9</td>
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<tr>
<td></td>
<td>CIM-10</td>
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<td></td>
<td>SERAM</td>
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<td></td>
<td>NANDA</td>
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1.4-The current challenges

The coming challenges of the HC3 in the sphere of inter-operability are boosting the exchange of information in HL7 CDA in those systems that at the moment are not adapted and also to extend the use of SNOMED-CT as a standard of medical terminology in this exchange with the other domains. On the other hand, the effort made and which is being made to facilitate healthcare continuity at an internal level in Catalonia enables us to cross the frontiers of the Catalan health system. The future is the interconnection at a state level between the systems of the autonomous communities and at a European level, through the HCDSNS projects promoted by the Ministry of Health, Social Services and Equality (MSSSI).

And in the process of continuous improvement with the aim of complying with law 49/2007, in reference to equal opportunities, no discrimination and universal accessibility of disabled persons, the HC3 is committed to accessibility and usability and tools of collaboration, one step further towards human inter-operability.

As well as the development of new interfaces that favour the integration of the HC3 into the work stations of the professionals, ensuring that the information is not only accessible through the visor of the professional, but also through technical interfaces (Web services), which enable the health provider to integrate this information into the information systems under their custody, and ensuring the information reaches the work station of the professional. In this way, the care professional has all the information necessary to take
the care decisions, from their work station, irrespective of the origin of the information (their own health provider or shared medical record).

1.5- HC3 as ICT support to the care processes to chronicity

HC3 has accompanied the chronicity strategy in Catalonia with different ICT developments that have made it possible to improve the flows of care of these patients, giving support to the healthcare route of chronicity between the different health providers.

HC3 enables the integration of medical data between different centres, the marking of chronic patients, the stratification of risk of the chronic patients showing the Clinical Risk Group (CRG), the individual intervention plan shared in chronic patients, the warning system between levels of care to the chronic patient, between all the different centres of the Catalan public health system.

In 2011 a strategy was initiated of marking complex chronic patients (PCC) and patients with advanced illness (MACA). Since then all primary health providers have begun to identify these patients.

**Total marking done: (July 2015)**

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<tbody>
<tr>
<td>PCC</td>
<td>113,354</td>
</tr>
<tr>
<td>MACA</td>
<td>24,837</td>
</tr>
<tr>
<td>TOTAL</td>
<td>138,191</td>
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The different centres of emergencies, hospitals and emergency services such as the 112 telephone integrate this marking into their medical work stations by means of the WS of HC3. Therefore it is integrated data in the different medical stations and visible in any health centre of the public system.

**Shared individual intervention plan (PIIC)**

The shared individual intervention plan (PIIC) is a document sustained in the HC3 and which collects the most important health and social data of the patients with complex health needs, placing it in a shared information setting. The proposal is that all PCC or MACA patients have elaborated a PIIC and published in HC3 to be visible in all the centres of the public health system.

It represents an act of communication between professionals, where those that best know a patient synthesise and offer the most relevant information of the case, with the aim that other teams can understand the most essential and thus guarantee that the best decisions
are taken in the absence of the professionals of reference, at any time, in any healthcare device.

The PIIC contains information automatically updated about the particulars of the patient, their carers and their professionals of reference, as well as about their health problems, active medication, allergies and results of the multidimensional valuation tests.

Additionally, there are other spheres of information that require that the professional actively introduces them: description of the most probable crisis/imbalances/acuteness and recommendations for their handling, planning of anticipated decisions, information relevant to health and social services that attend to the patient and any other additional information of interest.

The PIIC is drawn up by the professional team in reference to the patient (usually primary care). The patients themselves participate directly in the contents referring to decision-making, so that these are adjusted to their needs and preferences.

Today, more than 100,000 people with complex health needs have PIIC in HC3 and 100% of health providers can access this information at the moment they attend to the patient.

The preliminary data available inform of the positive impact of the PIIC on the quality and suitability of the 7x24 responses and increase in satisfaction of the patients attended to.

The PIIC project is a singular initiative of the Catalan health system. Only the Scottish health system is capable of having a similar shared care model.

1.6-Evolution and new HC3 projects

Structured information

The aim of the HC3 is to have the majority of the information structures, for better operability and monitoring. It began with the Laboratory and Pathological Anatomy which meant a major improvement compared to the initial PDFs:

In laboratory the structured information enables comparatives to be made of the patient's results in the professional visor, which facilitates the process of evolution and monitoring. In Pathological Anatomy it facilitates the publication of the results and their integration into the Central Cancer Registry (RCC).

The Individualised Shared Intervention Plan (PIIC) is a report drawn up in all cases of PCC and MACA markings that has also been structured.
The objective of HC3 is to gradually structure the majority of the information contained in HC3, such as vaccines, diagnoses, allergies or spirometry to facilitate the use and management of it.

Other projects that are being developed to improve the HC3 and therefore provide better support to the professionals between the different healthcare levels:

In July 2015 the shared medical course of the patient in HC3 was implemented, the different healthcare centres publishing the objective annotations of medical monitoring in primary healthcare and external consultations of specialised healthcare, with what represents an advance in the improvement of healthcare continuity between the different providers and healthcare levels, avoiding duplicities and increasing security in the healthcare process of each patient.

At the end of 2015 the plan is to incorporate structured medical variables and the incorporation of structured functional scales by all the connected centres.

In brief these evolutions and developments place us in a change of paradigm where the HC3 is no longer a large repository of information but becomes a medical management tool that supports the Catalan health system.

2. Towards the necessary exchange of data between the Social and Health systems. Integrated care.

Based on the government agreement GOV / 28/2014, of the 25 February, through which in Catalonia the Inter-departmental Plan of Social and Health Care and Interaction (PIAISS) was set up, the section of general considerations state “the need to incorporate Information and Communication Technologies (ICT) as an area in which it is considered necessary to establish strategic objectives and guidelines, given the relevance that in collaborative approach of the person and the family it acquires the status of being able to share data between all the healthcare devices involved and that in the Government Plan 2013-2016 it is made clear that the health and social needs of the population evolve and that the healthcare model must be adapted; strengthen the value of integral healthcare of people and value of the efficiency and quality of the service model, and establish, among its objectives, to promote the combining of social and health services.
In this setting a project is started up to integrate the data between the primary healthcare centres and the social care centres of the different councils using **HC3 as an exchange platform**.

The Catalan model of integrated care is defined as multidimensional care to people with complex health and social needs. This model is based on the recognition of the active and empowered role of the people attended to as well as in the integral evaluation, the proactive planning and shared practice by the professionals of all the organisations and spheres of care involved. Their objectives are: the improvement in the health and wellbeing results, the adaptation in the use of services and the perception that people have of the care they receive.

In the size of the system, other essential transversal elements must also be guaranteed for the implementation of the model (shared governance, systems of inter-operable information, shared vision in the use of resources, framework of common evaluation, models of population stratification and capacitation of the professionals).

In the setting of evolution of the Shared Medical Record and with the aim of increasing the coordination between the social and health services, during 2015 a pilot project has been initiated which analyses how to undertake the integration of the areas of social and health services of the Barcelona City council. This project includes actions at a functional, technical and legal level.

A model of collaboration of care between health and social services has begun to be built with the intention of sharing data and information of common interest in order to make good medical and care decisions for people with health and social needs.

The idea is to gradually incorporate common goals in the users attended to jointly by the spheres of care and make it easier for the health and social professionals to undertake a valuation process and planning of joint interventions with people who have both health and social needs.

In the context of integrating information from the Social Services to the HC3 the focus of the solution based on the following premises has been defined:

- The citizenry must authorise the consultation of their Social services information by a centre so that the professionals can accede through informed consent that it will be filed in a common repository in HC3 for both systems (Health and Social)

- The citizenry must give its express consent to the access to information of the Social Services of a centre so that both health and social professionals can access these reports.

- The citizenry must exercise this consent in person at the offices of the Council Social Services or the Health Centres.
• The HC3 system will provide the communication services to be able to undertake this consent from the applications of the social services centres’ systems.

• The advances achieved with the current registry of HC3 and the incorporation of functionalities of the platform should enable the incorporation of a relational space between health and social care, facilitating virtual work and the collaboration between the centres, social workers and other social care professionals. Environments of inter-professional communication must be shaped to encourage this model of collaboration (secure messenger service, etc.).

With all the above, the HC3 system will provide the communication services to be able to make consultations of the data and share it by agreement between the two areas of care (social and health) from the applications of the systems of social services centres.

• The healthcare professionals will be able to accede and consult the information authorised by Social Services of a citizen from the Professional Visor.

The Social Services professionals will be able to access specific HCCC information (that which has been agreed between a mixed working commission between professionals from the two spheres) of a citizen through WS in an integrated way in their social work station.

A Web Service is a method of communication between two electronic devices over a network. This will be the way to share information between HCCC (Shared Medical History of Catalonia) and SIAS (Social Service Information System of Barcelona).

### Security
- Informed consent will be signed by the citizen.
- The health or social professional will send the document to the common repository.
- Each professional can check if the citizen has signed this consent.

### Common repository
- Informed consent will be custodied in a common repository.
- It will be validated by both systems.
- It will do periodic checks.
HC3 is the first step towards the necessary exchange between the health and social systems in Catalonia. Apart from gradually introducing the improvements and requirements that are made or arise, with the aim of making it more useful to the professionals and friendlier in its use, the future of the HC3 is to transform itself into a real network of information and proactive online services for health and social system professionals as well as the citizenry.

The HC3 is the tool that makes it possible for our health professionals to have access to the relevant medical information about the patient and have a 360° vision of them.

3- PERSONAL HEALTH FOLDER (LMS)

Linked to the HC3, but with its own character, is the Cat@Salut La Meva Salut (Personal Health Folder) project that is based on the right of the citizenry to be able to accede to the information available about their health.

Cat@Salut La Meva Salut (LMS) is a virtual space where the Department of Health makes available to each Catalan citizen the data referring to their health in a secure way, ensuring confidentiality. The aim of the project, however, goes much further than being able to consult medical information, since the goal is for LMS to be an accessible instrument for the citizen, which enables them to interact with their care team and with the health system, to transmit information in all the senses (providing personalised health advice to the citizenry or for them to send the care team the data of regular controls that they do following medical advice), a model that must facilitate the monitoring of pathologies facilitating non-present care (tele-medicine and tele-care) whenever this is possible.

LMS has the mission of favouring the self-responsibility of the citizenry regarding their own health, providing them with the information and the tools that enable them to participate in the management of preventative and curative actions, improving the quality of care as well as the coordination between the different lines of services and between the professionals involved.

LMS provides major benefits to the citizenry, but also to the providers of services and the administration itself:

It enables the citizen a greater autonomy and comfort in being able to manage processes from their home, such as book appointments, check on pending appointments of any public health centre in an integrated way on the LMS agenda, etc. This year we have
started up the **econsulta** project in Barcelona so that the patient can make a non-present visit to the doctor or nurse from LMS, the professional receiving the visit in an integrated way on their daily agenda and replying from their work station in a maximum time period of 48 hours, all the information being registered in the HIS of the health centre and in LMS. In brief, LMS helps raise awareness among the citizenry to become more responsible for their health since it is a tool focused on monitoring, prevention and monitoring of the medical parameters, being able to become the main source of information about the state of health and which provides them with interaction with the professionals of their health team.

It helps the health providers reduce errors, over-medication and redundancy of tests and other activities, on providing a sole and integrated vision of the medical care that the citizen receives.

It enables the administration to optimise the use of health resources due to the greater commitment of the citizenry regarding their health and the prevention of illnesses, achieving greater efficiency of the system and facilitating the development of all the non-present care.

As regards web or App services developed or available in health providers of the Catalan health system, following criteria of inter-operability and standards defined by the Department of Health, LMS enables any centre to be able to incorporate its apps, being able to undertake personalisation according to the pathologies, needs and interests of each citizen.

With the aim of achieving this interaction in LMS it is necessary to have a framework of inter-operability to ensure that the certified external systems can communicate with LMS, making it essential that they comply with specific specifications relating to communication, portability, identification and publication that have been defined by our Standards Office.

Originally LMS could only be accessed through recognised digital certificates: idCat, eDNI, the National Mint (FNMT), etc. To broaden its use among the population, since 2014 an access system has been in force by means of a robust password. This new system of accreditation for the users of LMS is distributed around all the Primary Healthcare Centres of Catalonia and since its implementation the usage data of LMS is increasing more and more.