



Cover Story:

COVID-19 Care Continuum

212 **Giuseppe Galati:**
Management of COVID-19 in Italy

220 **Prof. Mamas A. Mamas:**
COVID-19 Pandemic: The Importance
of Testing and Social Distancing

226 **Prof. Eugene Fidelis Soh:**
Smart Hospital for the Future

234 **Prof. Andy Tatem:**
COVID-19: Data Uncertainty and
Effectiveness of Interventions

248 **Rafael J. Grossman:**
Telemedicine Post COVID-19

258 **Eric de Roodenbeke:**
Filling the Gaps: Learning from Each
Other During the COVID-19 Pandemic



Going ‘Liquid’

Digital Transformation and Big Data Strategy in SJD Children’s Hospital

Summary: An innovation expert talks about the challenging transformation journey of a hospital in Spain, triggered by the economic crisis and the growing digitalisation of the modern world. While realised mainly through introduction of technology, this journey is, first, about organisational innovation and change.

Sant Joan de Déu (SJD) Barcelona Children’s Hospital is a private non-profit institution. Founded in 1867, it is the biggest monographic paediatric hospital in Spain and one of the biggest in Europe – there are over 300 beds and 12 operating rooms with almost 2,000 professionals attending to around 350,000 patients every year.

SJD Hospital is a member of the Hospitaller Order of the Brothers Hospitallers of St. John of God, a non-profit organisation with more than 300 hospitals around the world in 50 countries. In 1973, the hospital was concerted by the public health service and since 1983 has been providing public healthcare services through an agreement with the Catalan Health Service (CatSalut).

It is also a teaching hospital, linked to the University of Barcelona and specialising in the fields of paediatrics, gynaecology and obstetrics.

Almost all of the hospital’s activity is public but being private gives it some management capacity and freedom to have private and international patients. Furthermore, the CEO and governing board have been leading the hospital for 15 years, which allows for continued strategy and gives stability and vision to hospital projects.

World Goes Data Driven

Disruptive digital technologies have become indispensable elements in our daily lives. A good example is a smartphone, with over 5 billion unique mobile

users in the world (67% of the world population). In Spain, users spend an average of 5h 18m per day online (Kemp 2019). We are undergoing an exponential disruption in the habits of the population and the provision of services that challenges the healthcare status quo.

“If 2000s saw the introduction of digital life-style devices, the 2010s will be known as the era of digital medical devices” (Topol 2010) and personalised treatments, and the 2020s will probably be the decade of automation and data driven care (Topol 2019).

Care is becoming ubiquitous and ‘liquid,’ moving from the hospital-centric diagnosis and treatment to a continuum that moves with the patient. 90% of healthcare will happen outside the hospital walls, in the daily life of each person. This thesis is in line with the statements of Singularity University at the World Economic Forum, that by 2030 health would move from hospital to home-spital, or even phone-spital (Walker 2016). This is particularly evident in a hospital like ours. Most of our patients are young parents and kids. They are tech-savvy and expect to be able to interact with the hospital through digital channels.

Meanwhile, in 2000s society underwent major demographic and lifestyle changes. Advances in research and medicine lead to increased life expectancy – and with it to the prevalence of chronic diseases and rising healthcare costs. Thus, care processes, especially

for patients with chronic or complex pathologies, which are the most expensive for the healthcare system, must become more efficient, ie “the best patient outcome at the lowest cost” (Porter and Tiesberg 2006).

The available technologies are plenty. The problem is to implement them to solve the real needs. Today we see many pilots and trials, but the main challenge is the organisational change necessary for their adoption. It is especially true in demanding and fragmented systems like ours – public, private and international.

The business model must also be adjusted to demonstrate the value of the impact and outcomes and be less activity-centred, ie more value-based.

Crisis as Innovation Driver

In 2008, the financial crisis began in Spain. Also known as the Great Recession (Bentolila et al. 2012), it had a devastating impact on the public revenue with a 15% decrease between 2008 and 2014. There was a decrease in births as well, which also affected the hospital’s economy. At the same time, complexity was growing (46.3% from 2004 to 2013). In response to these developments, the hospital introduced an adjustment plan: salaries were cut by 12.5%, the number of professionals by 5% and the number of beds by 10%.

However, these initiatives couldn’t work in the long run if complexity and activity were to be maintained. As a strategy of survival, the hospital

decided to focus on maintaining quality care and accessibility, offsetting the drop in revenue by developing the private and international directions. The hospital needed to adapt to these new circumstances, and the accompanying strategy, the 'Liquid Hospital' (LH) was launched in 2010.

Strategic Perspective

The journey of digital transformation has been underpinned by several strategic plans, 'Paidhos,' renewed every five years.

The first 'Paidhos' (2004-2008) reflected the need to position the hospital as a local paediatrics reference centre. During the next stage (2008-2014) the hospital was converted into a national centre of reference through specialisation in care. Due to the deteriorating economic conditions, this plan was revised in 2010 towards more international activity and alternative sources of funding. The latest plan (2020) is focused on becoming an international reference hospital.

In 2009 the hospital – first in Spain – created the Innovation Department, an outlet for its professionals' various innovative ideas. Over 150 innovation projects have been analysed since then and more than 50 carried out, with 44 patents generated as well as 5 start-ups and 11 licences for use.

The Liquid Hospital (H2O)

The LH was created to move care beyond the hospital building, leveraging innovation to advance healthcare. Its main objective was to provide services and offer health contents to patients, families and professionals to improve clinical outcomes and patient and professional experience via collaboration and knowledge exchange. If in the 20th century the medicine was paternalistic, hospital-centred, one-size-fits-all, reactive and siloed, in 2010 the objective was to make it more participatory and virtual. The plan was to create a virtual space for the patients to interact with the hospital and actively engage in their health with new digital tools.

Box 1. E-Health: Practical Examples

PrevenGo: a programme to prevent childhood obesity

Problem: The data indicate that 31% of child population in Spain have an overweight and obesity problem (as compared to 34% in the U.S.), and obese children have a 5.4-time higher risk than non-obese ones of developing type 2 diabetes mellitus in the future (Ludwig et al. 2011).

SJD Hospital is treating more than 500 patients for obesity. The data indicated that 40% would not come back following the first visit, since socially obesity is not viewed as a disease.

Solution: PrevenGo is a hybrid health programme (technology + professionals) that aims to increase children's adherence to treatment (diet and exercise). Each family is given two monitoring devices (fitness trackers), one for the child and the other for the parents. This is accompanied by the help of a specialist (nutritionist, expert in lifestyle changes) who supports and motivates children and their families throughout the programme.

With PrevenGo, not only patients but also their family members become active and involved through lifestyle changes, monitoring and professional help. In addition, it is an efficient way to prevent type 2 diabetes and cardiovascular complications.

Current status: Study conducted in 2013-2016 with 40 children participating. Now active, running a new study.

The concept of the LH draws from 'Liquid Society' (Bauman 2000) suggesting that healthcare can happen anytime anywhere. LH strategy had four pillars.

E-Health segment includes online care and telemedicine services with online consultations, telerehabilitation, telemonitoring, second opinions, patient portal (integrated with the 'La Meva Salut' public healthcare system portal and other external platforms) and services for home care (see Box 1).

E-learning was designed to promote knowledge exchange among professionals through online platforms for continued training.

Online communities, where patients interact with professionals, focus on chronic diseases and promotion of health. One example is 'Faros,' a web portal dedicated to health promotion (10 million visits in 2019). It is connected with KidsHealth.org and collaborated with the American Academy of Pediatrics. It informs parents on first aid, child's education, importance of sports in health, and more.

In terms of **social media**, SJD Hospital has been the first European hospital, both for children and adults, and one of the first in the world, to

define and publish a Social Media Policy. The hospital followed a multiplatform strategy focused on:

- Promoting a new model of care delivery, in which a patient is more responsible for their health.
- Getting feedback, listening to patient needs, and interaction.
- Increase brand value (building hospital brand).

Challenges for Clinical Teams

The adoption of these new digital formats has created a challenge for the clinical teams, who are willing to make a change but struggling under workload. Analysis of the data coming from digital sources needs time, so clinicians have to adjust their schedules accordingly. Currently, the public service doesn't cover the cost of these services, and health is still measured by activity and not by result.

To solve this challenge the hospital decided to include telemedicine service in clinicians' schedules equaling it to 'traditional' visits. In some cases, a health coach was allocated to help with services' adoption. However, we still need to find a way of paying for such treatments. The biggest challenge is not technology, but the organisational change. Yet, while technologies help drive innovations and

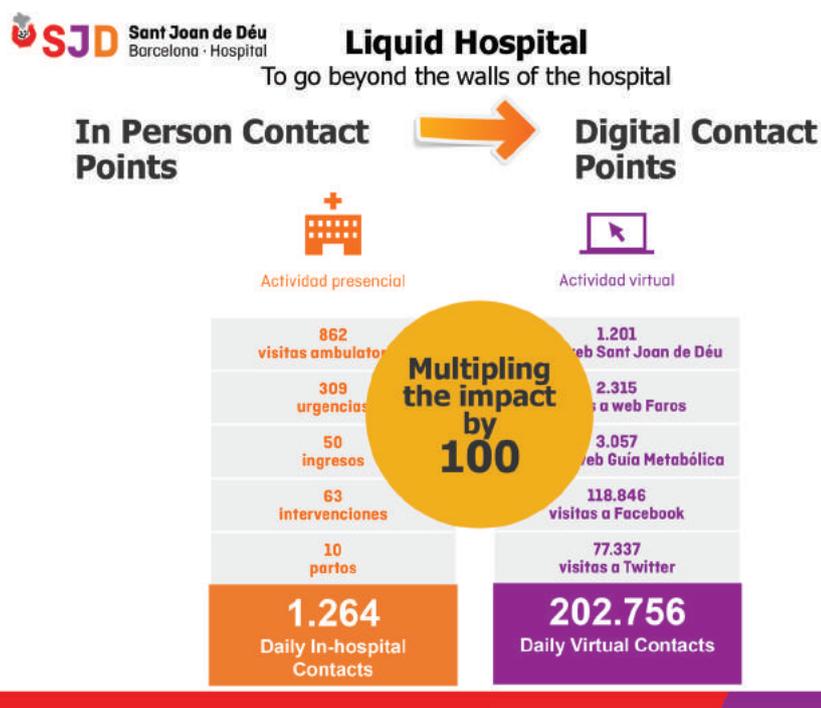


Figure 1. The Number of Daily Personal and Virtual Contacts, 2014.

automate processes, human factor keeps inhibiting breakthroughs. The co-creation of requirements and processes as well as behavioural change are key to implementation.

At the early stages, for clinicians, except for certain champions who were involved in the project, going digital wasn't easy. Aside from the scheduling issues, clinicians also need training to handle the digital tools. The way they interact with a patient is different. The collection of data they need from digital sources is also challenging. Basically, the very way of how services are provided to patients on a daily basis is changing. However, gradually their attitude is becoming more positive as they start to see the potential benefits of digitalisation – both for patients, themselves and the hospital.

Outcomes and Conclusions

In 2014, the first LH (H2O) was completed. The analysis of the 20 comprising projects led to the following conclusions:

- Digital services and content to support patients and families had been created helping them to play a more active role in their health, and paving the way for a new, more col-

laborative model of healthcare.

- The success of several projects resulted in new technological and organisational challenges.
- The evolution of the main projects required further development of service provision.
- New communication channels were created: hospital-patient, patient-patient and professional-professional, which had to be organised and managed.
- The H2O helped the 'Paidhos' strategy in terms of brand development, digitalisation, knowledge and internationalisation.

Two main outcomes of LH were:

- **Virtual visits.** In 2014, virtual clinical visits (patient portal, scheduled and unscheduled telephone visits, virtual interconsultations, etc) accounted for 2.5% of all visits. By May 2017 this share grew to 12.5%, and – leaping ahead – by May 2019 reached 16.1%, which means 42.000 visits a year! COVID-19 has added over 950 daily virtual visits.
- **Brand and daily contacts.** The four social networks created ([Faros](#), [Share4rare](#), [Rarecommons](#), [Metabolic](#)

[Guide](#), [Diabetes Guide](#)) had more than 10,000,000 annual visits in 2019, with a large share coming from Latin America. Thus, if the total number of in-person daily contacts at the hospital is approximately 1,264, the number of virtual contacts is more than 200,000, multiplying the hospital impact by 100 (Figure 1).

Patient Experience and Services Stratification

Moving towards patient-centred care is a must. Solutions and services should be co-designed following real patient and professional needs if we want innovations to be implemented and used. It is important to consult patients and professionals for any new solution, as they can educate the hospital about the services they need.

Moreover, each patient is different and so are their needs. There are some who are not used to digital technologies. In such cases, their clinical reference specialists – nurses and physicians – can help them to understand what they need to do. However, not all the services fit all the patients, so depending on a patient's profile we would have to adapt treatment, benefiting from digital solutions those who are tech-savvy while providing the rest with more traditional care.

Building Upon Experience

Having completed the first LH, we saw that we did go 'beyond the walls' of the hospital, but in the process created a complex ecosystem, with numerous points of contact. At the same time, the sources of data have been multiplied with data in silos, coming from inside and outside of the hospital. Simplification and order were needed.

On the one hand, with the increase of information sources and the ease of access to them, patients have become actively involved in their treatment, whether by seeking online consultations, participating in online communities or using wearables and apps. Moreover, the ability to store and collect large volumes of data from multiple sources is, and will increasingly be, an essential element in enabling healthcare providers to have a holistic, real-

time view of patient health and wellbeing with a 'Digital Twin' of each patient. This comprehensive vision will allow for more informed decisions improving both treatment and outcomes and facilitating the emergence of new non-face-to-face health services.

With all this in mind, we aimed to progress from the participatory model of the previous LH (H2O) to a more collaborative model with predictive, preventive, personalised and connected medicine. This became the basis for the Liquid Hospital 4.0 (2016-2019) – as in the 4th industrial revolution.

The Liquid Hospital 4.0: Going Data-Driven

The new LH (LH4.0) was co-funded by the EU through the European Regional Development Fund (ERDF) with the support of the Government of Catalonia through the Public Procurement of Innovation in Health programme.

It had two major areas of work and four main projects:

1) Create a model of attention and provision of services that ensures the multichannel approach. We aimed to transition from a reactive model based on receiving and managing calls, direct contacts or emails on a disaggregated basis, to a more efficient model of proactive and informed health management. The main idea was to route several channels (phone, email, social networks and other digital channels) into the same system to provide the same experience to everyone.

At the 'front office' we wanted to change the model of communication and service provision with the following main projects:

- The COACH (Centre of Operations and Administration of Community Health), which includes a customer relationship management (CRM) system and the Contact Centre to connect with patients and the environment through multiple channels.
- The Contact Centre is the 'front door' to the hospital for certain services. This system uses the data and information captured and analysed by the CRM to monitor

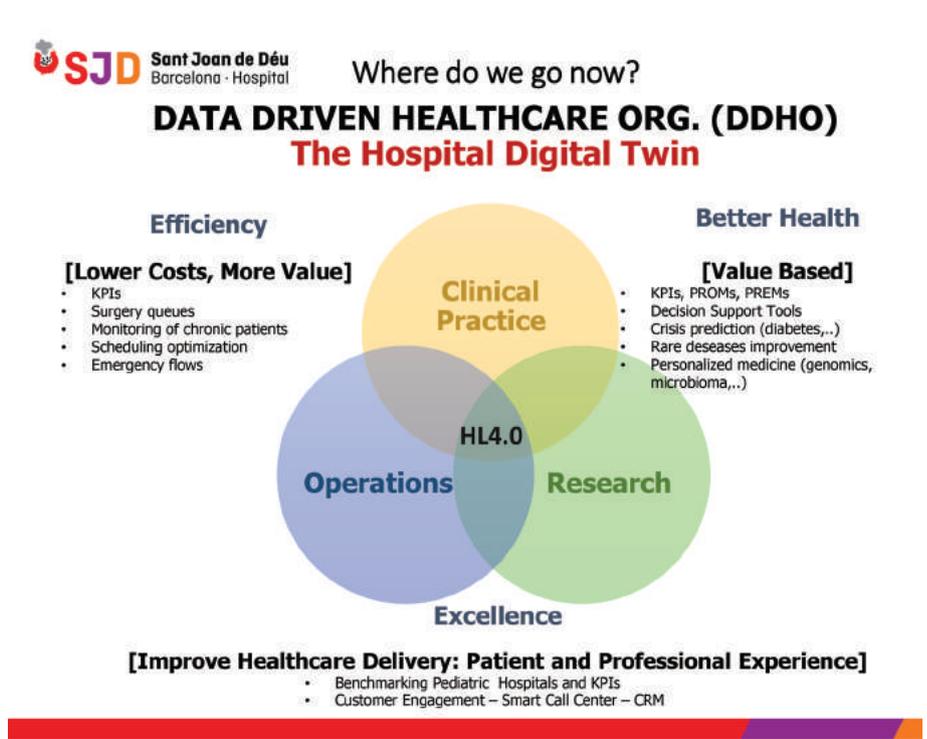


Figure 2. The Concept of the Data Driven Healthcare Organisation.

patients' status and offer them personalised information. This has led to redefinition of the internal contact processes helping to move to a more efficient structure. The Contact Centre is focused on offering medical consultation and telecare services and deals with relatively easy cases. Health professionals respond to patients and, if the case is complicated, remotely refer them to physicians.

- The new patient portal is a digital channel that promotes communication and training and is equipped with self-management tools to provide patients with access to personal information (via a website or an app).
- Health Literacy is focused on communicating medical information and clinical results to patients and families in a clear and efficient way enabling informed decision-making.

2) Create healthcare value from data. The goal was to identify, prepare and gather all the relevant health data from inside and outside of the hospital – both those already existing in the

EHR and hospital silos (clinical data, genomics results, biomedical, laboratories or other hospital systems), as well as those generated by patients through online health communities, mHealth or patient portal – and exploit them to support clinical decision-making, operations and research.

To that end, a data lake, Health Data Management (HDM), was created to complement the Business Intelligence Warehouse (BIW) and other information systems of the hospital. Its main focus is to improve clinical assistance through clinical decision support systems, data analysis and exploration. HDM allows us to have, in a single place and in an organised way, integrated information from different sources that are currently fragmented, which will open the door to a lot of possibilities for secondary use of data for research. The solution is based on a number of standards (HL7 – FHIR, ICD10, ICD9, ORPHA, etc). We piloted its use with external data coming from wearables in the PrevenGo project (see Box 1) to improve the follow-up treatment. The second pilot conducted is on

type 1 diabetes.

The LH4.0 was a big step towards the ‘Triple (now Quadruple) Aim’ (Berwick et al. 2018), ie improvement of the patient experience, improvement of the reference population’s health, reduction of the cost per capita of the provision of health services, and improvement of professional wellbeing (Bodenheimer and Sinsky 2014).

Next Steps

The current data elements are the following:

- Digital tools at the front line: patient portal and app, online communities and wearables.
- The COACH in the middle where different types of interactions with the hospital are brought together.
- The HDM, BIW and other data tools at the back office, with all the relevant data, knowledge and intelligence of the hospital.

Our next goal is to create an AI-driven holistic command centre for consolidation and intelligent use of data as well as better access to relevant information for decision-making in real time. This will be the ‘brain’ of the hospital to help in operations, to have all the decision-makers at the same place with the same information, enabled to answer and adapt to changes as quickly as possible. In other words, we want to be a data-driven healthcare organisation effectively utilising our data to improve the provision of services and the model of care (Figure 2).

Challenges, of course, persist. The hospital has achieved some success in changing the organisation, but we are still at the beginning of this long journey to make medicine collaborative and adaptable to each patient’s needs, with the patients being well-informed and taking part in the decision-making process. Governance, finance and policies must be adjusted and, to succeed, healthcare has to aim and evolve towards an outcome-based and value-based model. ■

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Key Points

- The world is going digital, and we must adapt. The main challenge here is the organisational change.
- 90% of healthcare happens outside of a hospital, so we need to go ‘beyond the hospital walls’ becoming liquid and adjusting our business model accordingly.
- The first step was to move from paternalistic and hospital-centred medicine to participatory and virtual one.
- With five-year strategic plans the hospital defined the direction and started implementing innovative solutions.
- Transferring some services to digital platforms is challenging for most of clinicians. Solutions must be found for issues like scheduling, professional digital training and payment for the services delivered online.
- At the next phase the digital ecosystem had to be simplified and the data utilised more efficiently.
- We now aim to a more collaborative model with predictive, preventive, personalised and connected medicine, moving towards a data-driven organisation. Our next step is creating a holistic command centre to support decision-making in real time.

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