Turning the crisis into an opportunity: digital health strategies deployed at-scale during the coronavirus (COVID-19) outbreak in Catalonia

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Abstract

Digital health technologies offer huge opportunities to reshape the healthcare system as we know it. From the adoption of electronic medical records to the mobile health applications and through every other disruptive technology, digital health solutions have promised a better quality of care at a more sustainable cost. However, the wide-scale adoption of these solutions is lacking behind. The most adverse scenarios often provide the opportunity to develop and test the capacity of digital health technologies to increase the efficiency of healthcare systems. Herein, we acknowledge the crucial role digital health solutions play during the COVID-19 global pandemic in support of public health policy, and we report on the strategies currently deployed at-scale during the outbreak in Catalonia (North-East Spain).

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Abstract

Digital health technologies offer huge opportunities to reshape the healthcare systems as we know them. From the adoption of electronic medical records to the mobile health applications and through every other disruptive technology, digital health solutions have promised a better quality of care at a more sustainable cost. However, the wide-scale adoption of these solutions is lacking behind. The most adverse scenarios often provide the opportunity to develop and test the capacity of digital health technologies to increase the efficiency of healthcare systems. Catalonia (North-East Spain) is one of the most advanced regions in terms of digital health adoption across Europe. The region has a long tradition of health information exchange among the public healthcare sector and is currently implementing an ambitious digital health strategy. In this comment, we acknowledge the crucial role digital health solutions play during the COVID-19 global pandemic to support of public health policies and report on the strategies currently deployed at-scale during the outbreak in Catalonia.

Keywords: digital health; eHealth; telemedicine; COVID-19; coronavirus; SARS-CoV-2; public health; policy making;

Comment/Viewpoint

Policymakers increasingly explore, accept, and apply information and communication

technology (ICT) as part of healthcare systems. This shapes the way citizens and patients access and interact with the systems. The pathway to digital health (eHealth) is a cultural transformation of the traditional construct of health care that encompasses multiple features, including widespread access to electronic health records, remote monitoring solutions, patient portals, wearable technologies, mobile health applications, data analytics and all sorts of disruptive technologies [1].

For years, eHealth solutions have raised expectations on cost reductions associated with lesser traveling to healthcare facilities and prevention of non-planned admissions due to regular check-ups [2]. In the last decade, the healthcare ecosystem has remarkably progressed in this direction; however, the multi-level complexity of eHealth implementation [3] is holding back the widespread use of ICT in routine practice [4].

With roughly 7.5 million inhabitants, Catalonia (North-East Spain) has been considered a forerunner of eHealth adoption in Europe. Since 2009, a robust information exchange deployment allows healthcare providers within the public health system to share clinical information [5-7]. Currently, the region is implementing a comprehensive digital strategy - one of the few ambitious initiatives of health information systems' transformation in Europe [7, 8].

Worldwide, Spain is one of the most affected countries by the coronavirus disease outbreak (COVID-19) [9]. As of April 23, the positive cases and deaths in Catalonia amount to 46,629 and 9,186, respectively. However, mathematical models predict a worsening of this scenario in the forthcoming days, which may lead to the saturation of the healthcare system due to the lack of intensive care specialists and the total occupation of intensive care unit (ICU) beds [10].

While clinical staff remains the frontline in protecting citizens of the pandemic, non-clinical actors like engineers, bioengineers, data scientists and other ICT-related professionals are now taking the lead in fighting intensively to slow down the infection rate by deploying digital health solutions. In this context, the deployment of eHealth plays a major role in supporting public health policy [11, 12].

The objective of this comment is to present the eHealth strategies adopted by the Catalonian Department of Health and the Catalan Health Service. Strategies aiming to avoid non-essential patient contacts with the healthcare system and to improve control and diagnostic of the COVID-19 in the current pandemic scenario (see Figure 1 for a detailed timeline). We report on the different strategies, the main objectives they are targeting and the impact on stakeholders (Table 1).

Table 1: List of digital health strategies implemented during the COVID-19 outbreak in Catalonia.

Strategy	Aims / Expected benefits	Impact on stakeholders
1. Facilitation of citizens' registration to the Catalan Personal Health Folder ("My health") [13] by creating a specific call center and enabling a webform for self-registration.	- Establish a formal and secure communication channel in between the citizen and the healthcare professional. - Decrease attendance rate to health centers of citizens not essentially required to visit a health center. - Reduce infection risk for both citizens and health care professionals.	- Citizens: burden of getting used to a new communication channel; reduction of face-to-face visits. - Healthcare providers: change of care delivery model (i.e., organizational and technical workflows); training of clinical staff; change management (i.e., attitudes of reluctant professionals). - Policymakers: new appointment management system;

|		cybersecurity management; guaranteeing equity on access.
2. Expansion of the virtual visits system ("eConsult") [14] by allowing the physician to appoint a videoconferencing session with the patient directly from the patient's EMR in both primary and specialized care.	- Establish a synchronous and asynchronous communication channel in between the citizen and the healthcare professional. - Decrease attendance rate to health centers of citizens not essentially required to visit a health center. - Reduce the infection risk for both citizens and health care professionals. - Avoid the increase in waiting lists. - Ensure care continuity. - Avoid the increase of stress in health care professional because of not being able to attend their patients.	- Citizens: burden of getting used to a new communication channel; reduction of face-to-face visits. - Healthcare providers: change of care delivery model (including organizational and change management); training of clinical staff; adaptation to new technologies (i.e., integration with new platforms and acquisition of new hardware such as webcams and headphones). - Policymakers: development of new technologies and design of new financing models (i.e., recognition of virtual visits as a billable prestation).
3. Development of a mobile health application for self-assessment of the disease (STOP COVID-19 CAT) [15], which includes geolocation of patients.	- Create a heat map of the most affected areas. - Stratify the patients and proactively contact high risk individuals (Emergency Services of Catalonia). - Substitute the lack of COVID-19 tests.	- Citizens: burden of getting used to a new technological channel. - Policymakers: development of new technologies; definition of new service models; facilitate the acceptance and motivation of citizens for using the mobile health application.
4. Enabling of web access to the EMR throughout virtualization technologies.	- Ensure that health care professionals who are working in external consultations can	- Healthcare providers: change of care delivery model (including organizational and change management);

	continue their work from home (telework) during the lockdown period. - Ensure a smooth deployment of the EMR in emergency facilities (e.g., hotels and pavilions). - Avoid the increase in waiting lists. - Ensure care continuity.	training of clinical staff; adaptation to new technologies. - Policymakers: development of new technologies; deployment at-scale across all the region (including multiple organizations such as hotels and City Councils).
5. Reduction of bureaucratic barriers in healthcare processes by: a. Allowing patients to access their sick leave forms in their personal health folder ("My health"). b. Allowing pharmacies to access the medication plans throughout the electronic prescription system of Catalonia in order to reduce the burden for citizens and primary care centers. c. Automatically extending the chronic medication plans (e.g., oral anticoagulant therapy).	- Decrease attendance rate to health centers of citizens not essentially required to visit a health center. - Reduce the infection risk for both citizens and health care professionals.	- Citizens: burden of getting used to a new communication channel; reduction of face-to-face visits. - Policymakers: development of new technologies and organizational workflows within the healthcare ecosystem (i.e., pharmacies).
6. Reporting of the day-to-day status of patients in nursing homes (private and public) through web service technology.	- Ensure the availability of near real-time data to take informed decisions. - Identify nursing homes with high concentration of COVID-19 diagnosed patients. - Ensure accurate planning of actions	- Healthcare providers: development of new technologies (i.e., integration with the National Health Service system). - Policymakers: development of new technologies and organizational workflows within the healthcare

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	and allocation of resources (i.e., new ICU beds and isolation facilities).	ecosystem (i.e., nursing homes).

7. Use of data analysis techniques to:
    a. Predict the necessary number of ICU beds to prevent the overburden of the health care system (using predictive modeling techniques).
    b. Automatically analyze emergency and hospitalization reports to explore predisposing factors and non-coded positive cases (using natural language processing techniques).
	- Avoid the collapse of the health system due to the lack of hospitalization and ICU beds.
	- Ensure accurate planning of actions and allocation of resources.
	- Enabling research to advance the knowledge of the disease.
		- Policymakers: development of new technologies; incorporation of new professional roles (i.e., data scientists).

8. Management of the emotional status of citizens by deploying a web portal ('Emotional Management') [16].	- Ensure a stable emotional status of the population. - Provide a tool for self-evaluation in order to identify risk cases and proactively contact the at-risk individuals. - Provide a trusted source of information resources. - Provide the contact information of professional (emergency) services lines.	- Policymakers: development of new technologies and organizational workflows within the healthcare ecosystem (i.e., professional psychology services).

Figure 1: Timeline of the Digital Health strategies deployed in Catalonia since the onset of the COVID-19 outbreak

Preliminary results related to the implementation of the abovementioned strategies show a strong paradigm shift from face-to-face visits to virtual consultations in primary care. Figure 2 shows how face-to-face visits have reduced drastically since the start of the Catalonian lock down (03/16/2020). Face-to-face visits have been systematically replaced by both tele-consultations and eConsultations which present a sustained growth over the observed period.
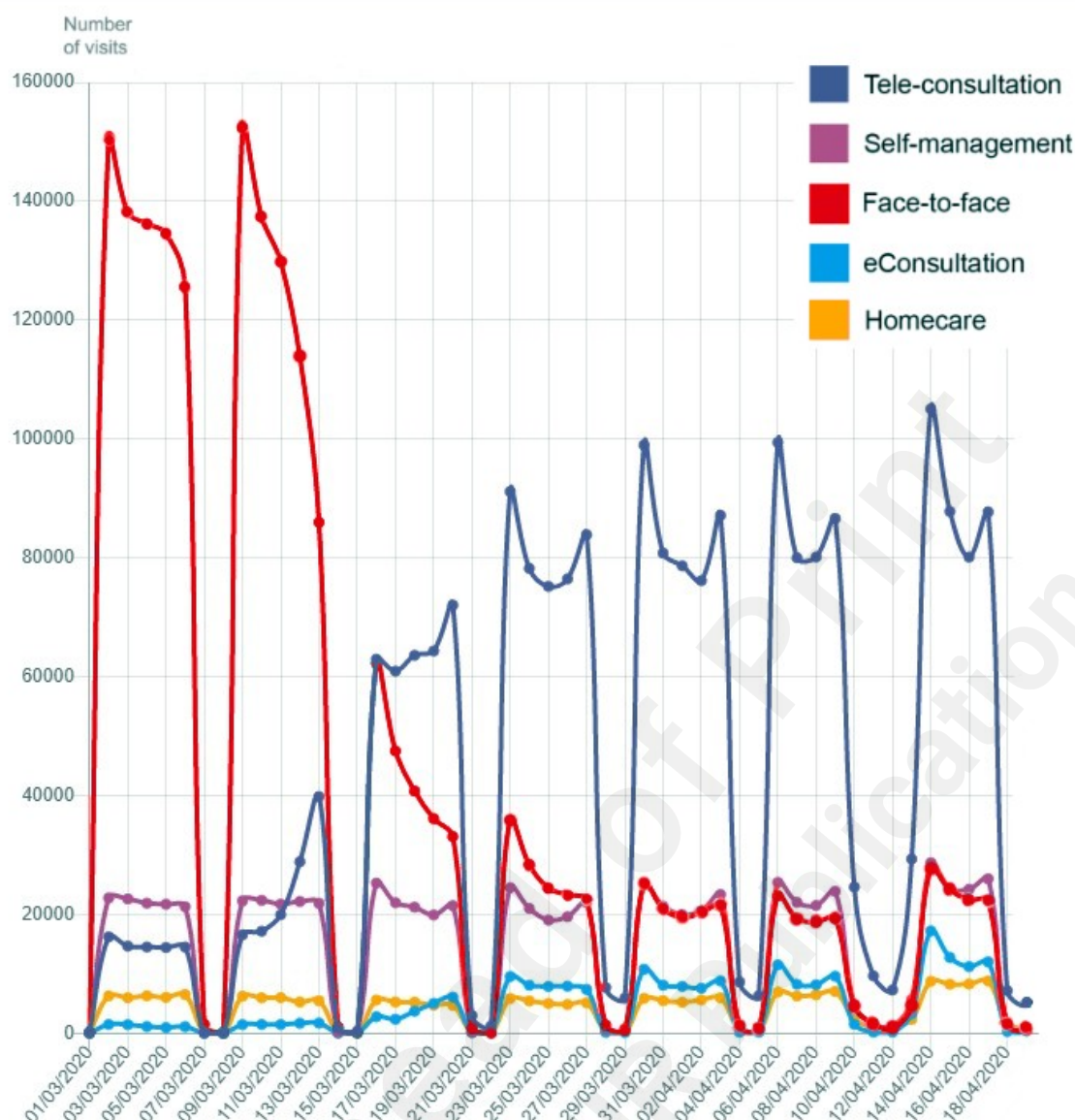
Figure 2: Primary Care visits in Catalonia classified among typology for the period 03/01/2020 to 04/19/2020.

Adoption of digital health technologies can also be observed in the number of accesses and new registrations to the Catalan Personal Health Folder. Figure 3 shows the development of both metrics between April 2019 and April 2020 (up to the 20th of April). In March and April 2020, the records clearly exceed the annual average.
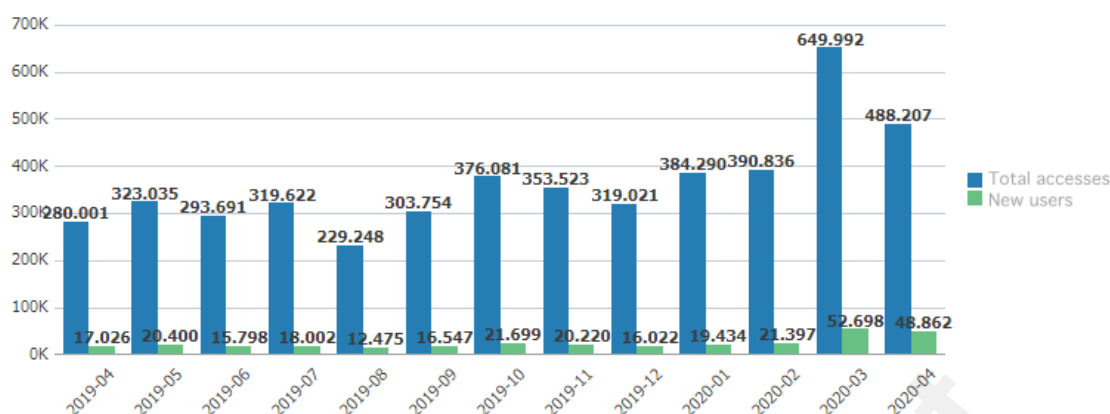
Figure 3: Number of accesses and new registrations to the Catalan Personal Health Folder for the period April 2019 to April 2020 (up to 20th April 2020).

Even though Spain and Catalonia have passed the peak of the COVID-19 outbreak [17], we still observe an increased adoption of the digital health solutions deployed by the Catalonian healthcare system. The present context suggests the continuation of the implementation processes. In fact, the current situation is unprecedented: many adoption barriers have disappeared while at the same time healthcare providers and professionals demand more and more technologies.

The COVID-19 pandemic has prompted a sudden turning point in the adoption of eHealth strategies in our area. We expect that the changes we achieved within the last few weeks will be sustained even after the pandemic is over.

Lessons learned and next steps

1. The high pressure on the healthcare system in a situation of extreme crisis has been an outstanding driver of change. We analyzed the scenario to facilitate the adoption of eHealth

technologies within our health system.

2. A long-term digital health strategy has proven to be the foundation for the accelerated change process. A good example of such is the unique EMR system we use in Primary Health Care which fostered the roll out the innovations faster than within a fragmented EMR ecosystem.

3. Having a very strong community and Primary Health Care system has allowed us to spread the different ICT strategies on a fast rate by taking advantage of the close interaction with the population.

4. ICT tools have demonstrated to be the main driver to decrease health-related bureaucratic processes. This has allowed us to save professional staff time while avoiding non-required attendance of citizens to health centers and decreasing infection risks for both citizens and health care professionals.

5. No claims against this comprehensive ICT deployment strategy have been received and noticed, either from health providers or citizens.

6. The deployment of ICT-enabled solutions should be accompanied of financial incentives for health providers aimed to remove the financial scheme barriers towards adoption. Payment systems should adapt to facilitate easier ICT adoption.

7. Closer work between health and social care services will be required in the future. The pandemic outbreak has shown us that the coordination among both areas (i.e., nursing homes and residential care) could be greatly improved by a stronger deployment of ICT (i.e., access to the primary care EMR and/or deployment of telemonitoring solutions for residents).

8. We foresee many opportunities to further develop the virtual care model with more complex use case scenarios (i.e., complex chronic needs). Current acceptance and need of ICT-enabled solutions has opened a window to further deploy the model in a system which traditionally has preferred face-to-face contacts.

9. The ICT implementation may have avoided overcrowded health centers and, in consequence, lower infection and death rates. We need to further explore the impact of these deployments.

10. It is of outmost importance to assess how sustainable the adoption of the implemented digital health solutions is within the long-term run. We will continue monitoring the different implementation processes in order to assess use over time.

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Author's contributions

JP-J wrote the first draft of the article. JP-J, PP-S, ACC, CVM, JS, RRM, OSF, PR, JCF, JGA, MMP and LGE revised the subsequent drafts critically for important intellectual content. Al co-authors approved the final version of the manuscript. All authors gave agree to be accountable for all aspects of work ensuring integrity and accuracy.

Conflicts of Interest

All the authors are public servants involved in the deployment of the digital health strategies as mentioned within the manuscript.

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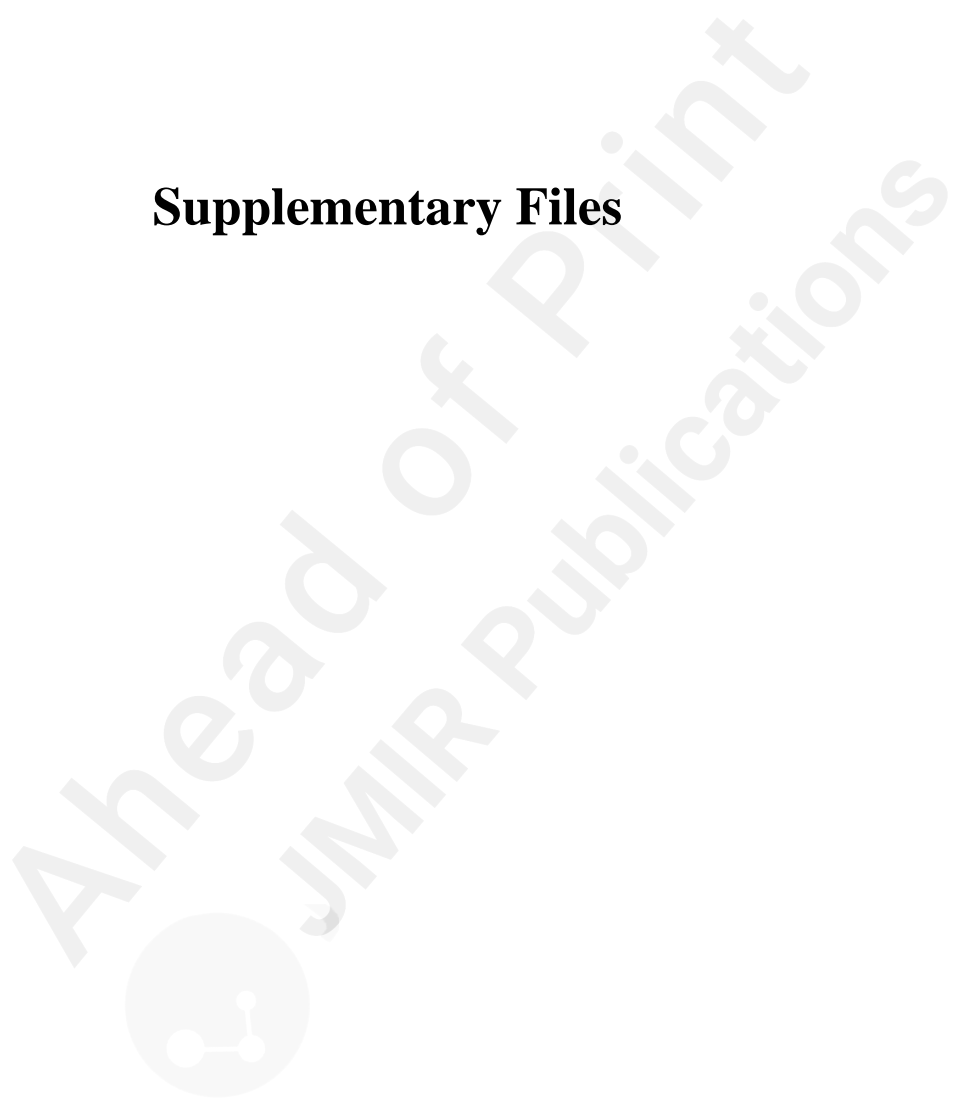
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