

# **The COVID-19 pandemic: an opportunity to integrate digital health solutions within healthcare ecosystems**

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## ***Table of Contents***

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<b>Original Manuscript.....</b>	<b>4</b>
<b>Supplementary Files.....</b>	<b>12</b>
Figures .....	13
Figure 1.....	14
Figure 2.....	15



# The COVID-19 pandemic: an opportunity to integrate digital health solutions within healthcare ecosystems

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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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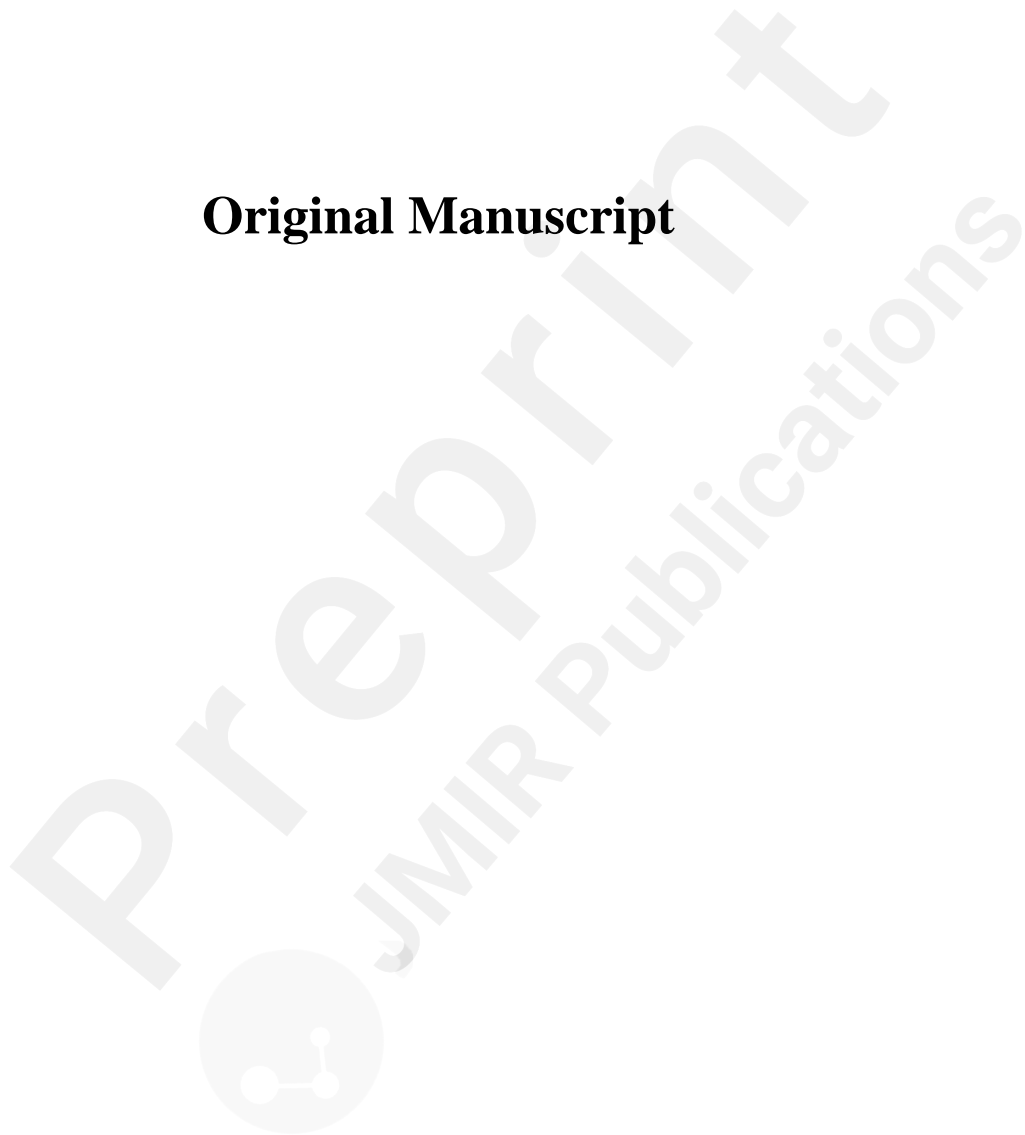
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## Original Manuscript



# The COVID-19 pandemic: an opportunity to integrate digital health solutions within healthcare ecosystems

## 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).

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

## Comment/Viewpoint

The way citizens and patients access and interact with healthcare systems is continuously changing as policymakers embrace the information and communication technology (ICT). 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 thanks 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. A robust information exchange deployment allows healthcare providers within the public health system to share all clinical information since 2009. Nowadays, the region is implementing a comprehensive digital strategy, one of the few ambitious initiatives of health information systems' transformation in Europe [5].

Spain is one of the most affected regions by the coronavirus disease 2019 (COVID-19) worldwide [6]. As of April 3, the positive cases and deaths in Catalonia amount to 23,460 and 2,335, 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 [7].

While clinical staff remains the frontline in protecting citizenship of the pandemic, non-healthcare actors like engineers, bioengineers, data scientists and other ICT-related professionals are now taking the lead and fighting intensively to slow down the infection rate by deploying digital health solutions. It is in this context where the deployment of eHealth plays a more determinant role in supporting public health policy [8, 9].

The objective of this comment is to explain the eHealth strategies adopted by the Catalanian Department of Health and the Catalan Health Service to avoid non-essential 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):

1. Facilitate citizens' registration to the Catalan Personal Health Folder ("My health") [10] by creating a specific call center and enabling a webform for self-register.
2. Expand the virtual visits system ("eConsult") [11] by allowing the physician to appoint a videoconferencing session with the patient directly from the patient's Electronic Medical Record.
3. Develop a mobile health application for self-assessment of the disease (STOP COVID-19 CAT) [12], which includes geolocation of patients, aimed to create a heat map of affected areas. The app automatically stratifies citizens into five categories and sets up an alarm for the worse cases, who are proactively contacted by the Catalanian emergency services.
4. Expand telework for healthcare professionals by enabling web access to the Electronic Medical Record throughout virtualization technologies. This is particularly important because it enables access from any browser in new emergency facilities (e.g., hotels), which are being set up almost effortlessly.
5. Reduce 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.
  - c. Automatically extending the chronic medication plans (e.g., oral anticoagulant therapy).
6. Report the day-to-day status of patients internalized in nursing homes (private and

public) through a web form accessible by healthcare professionals.

7. Use data analysis techniques to:

- a. Predict the occupation of ICU beds and prevent the saturation of the health care system (using predictive modeling techniques).
- b. Automatically read emergency and hospitalization reports to explore predisposing factors and non-coded positive cases (using natural language processing techniques).

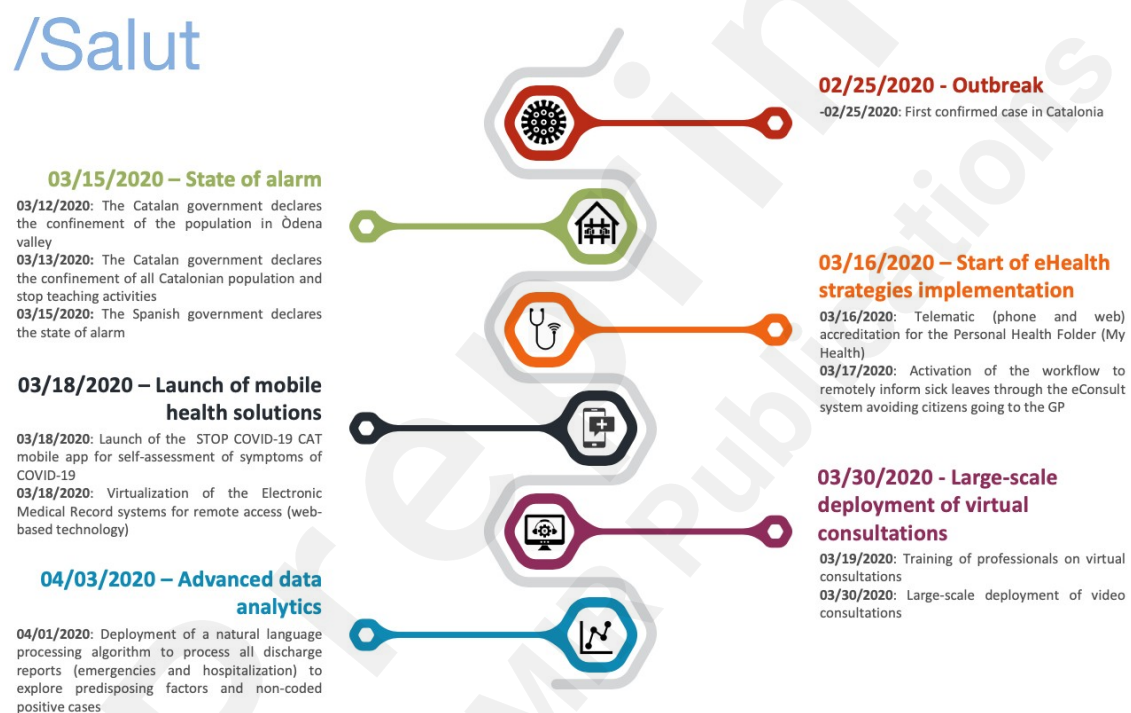


Figure 1: One-month timeline of the Digital Health strategies deployed in Catalonia since the onset of the COVID-19 outbreak

The COVID-19 pandemic has prompted a sudden turning point in the adoption of eHealth strategies in our area (Figure 2 illustrates some preliminary results on the paradigm shift in between face-to-face visits and telematic consultations in primary care); we expect the changes we achieved within the last few weeks to stay once the pandemic is over.



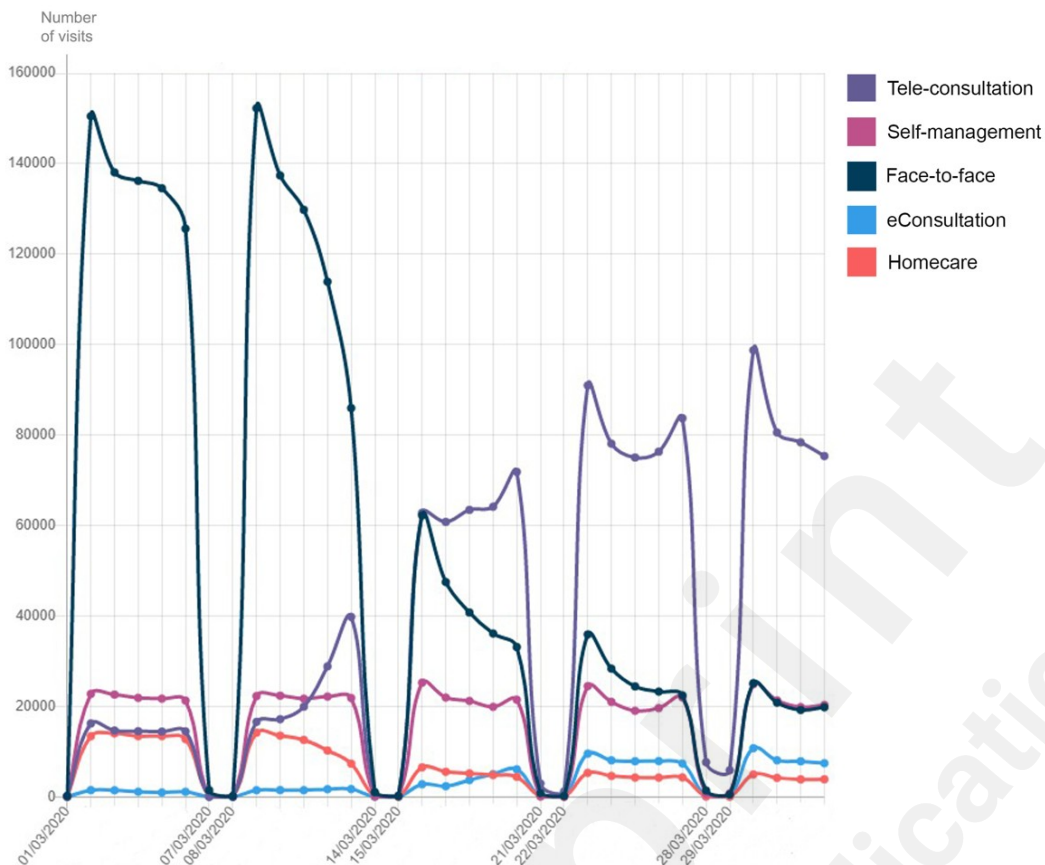


Figure 2: Primary Care visits in Catalonia classified among typology for the period 03/01/2020 to 04/02/2020.

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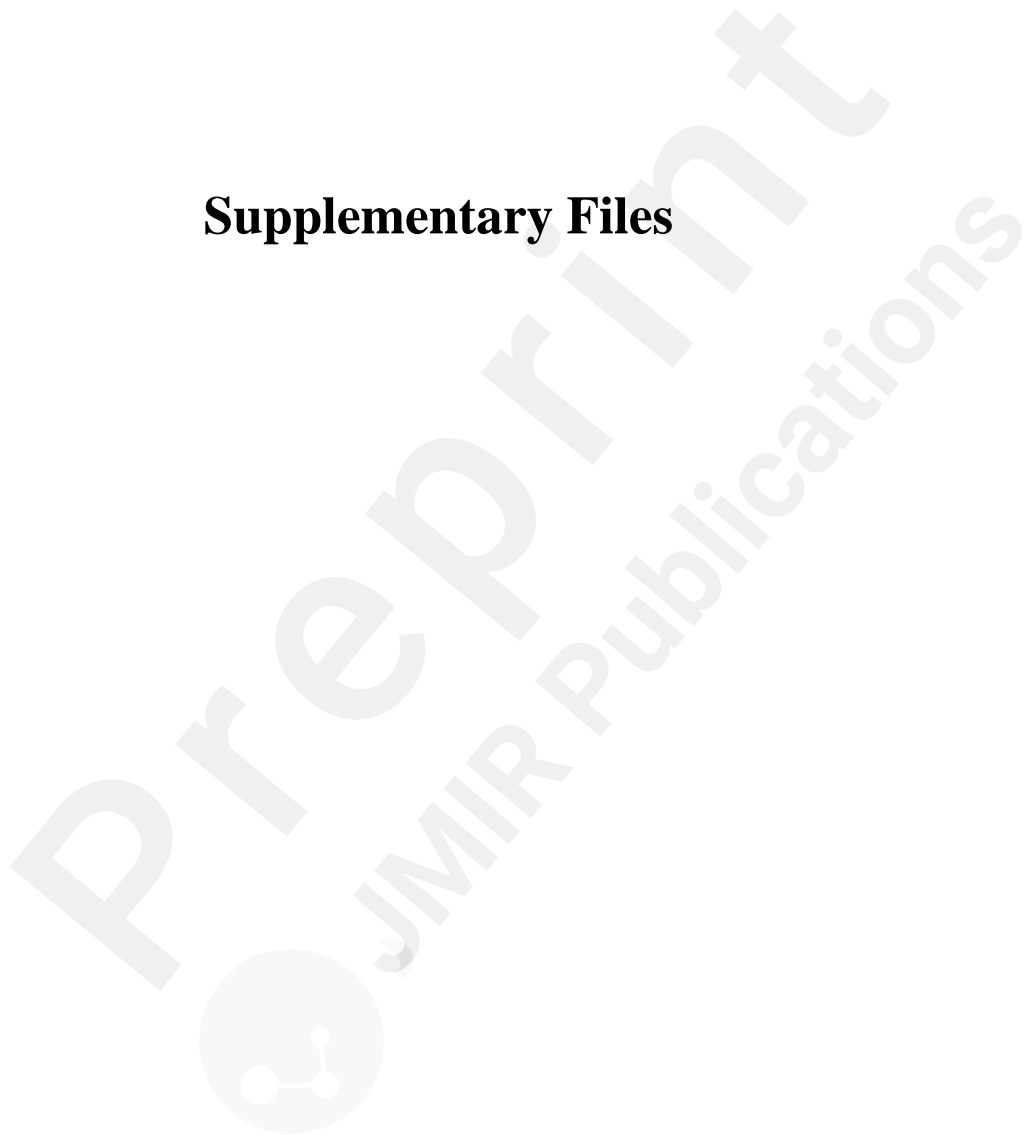
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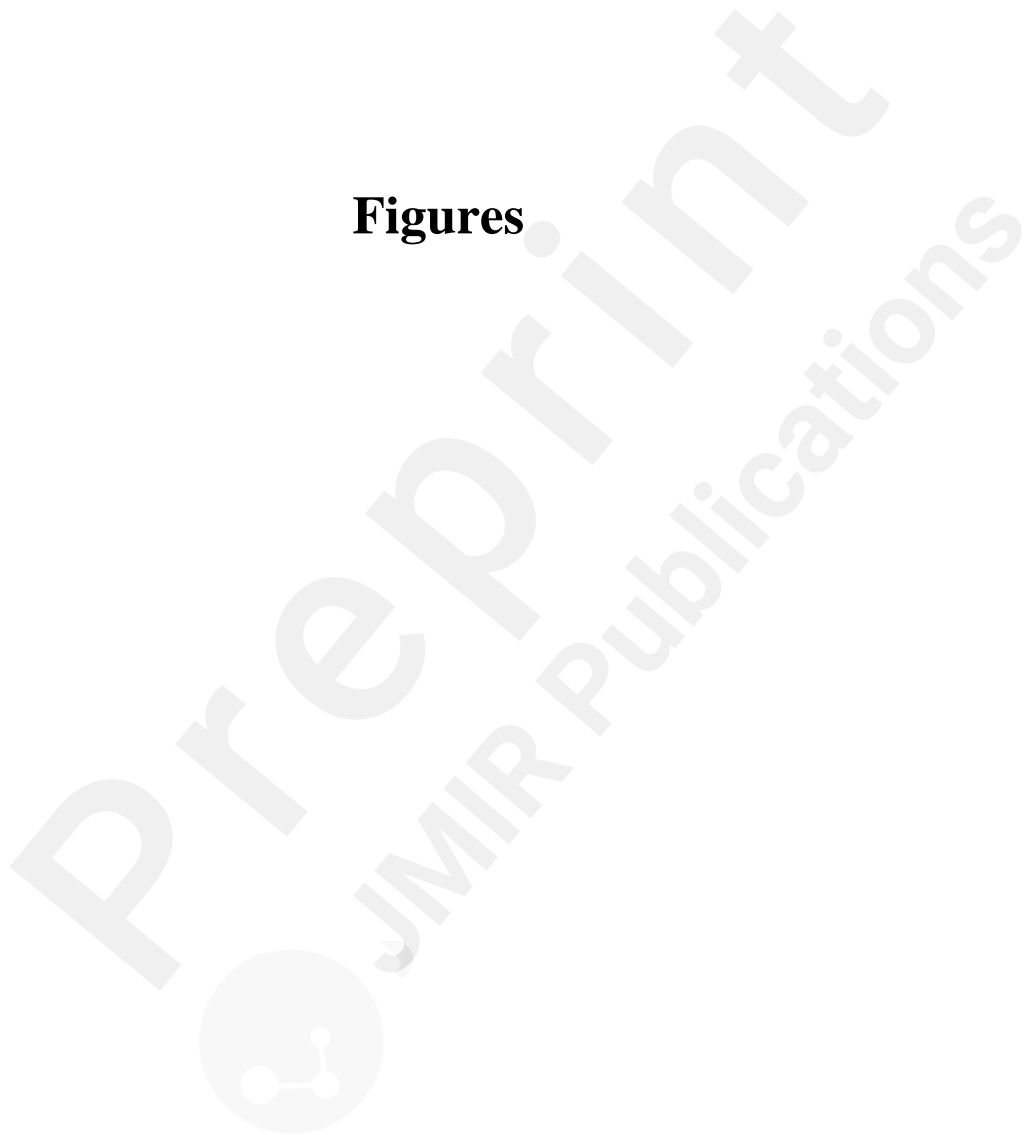
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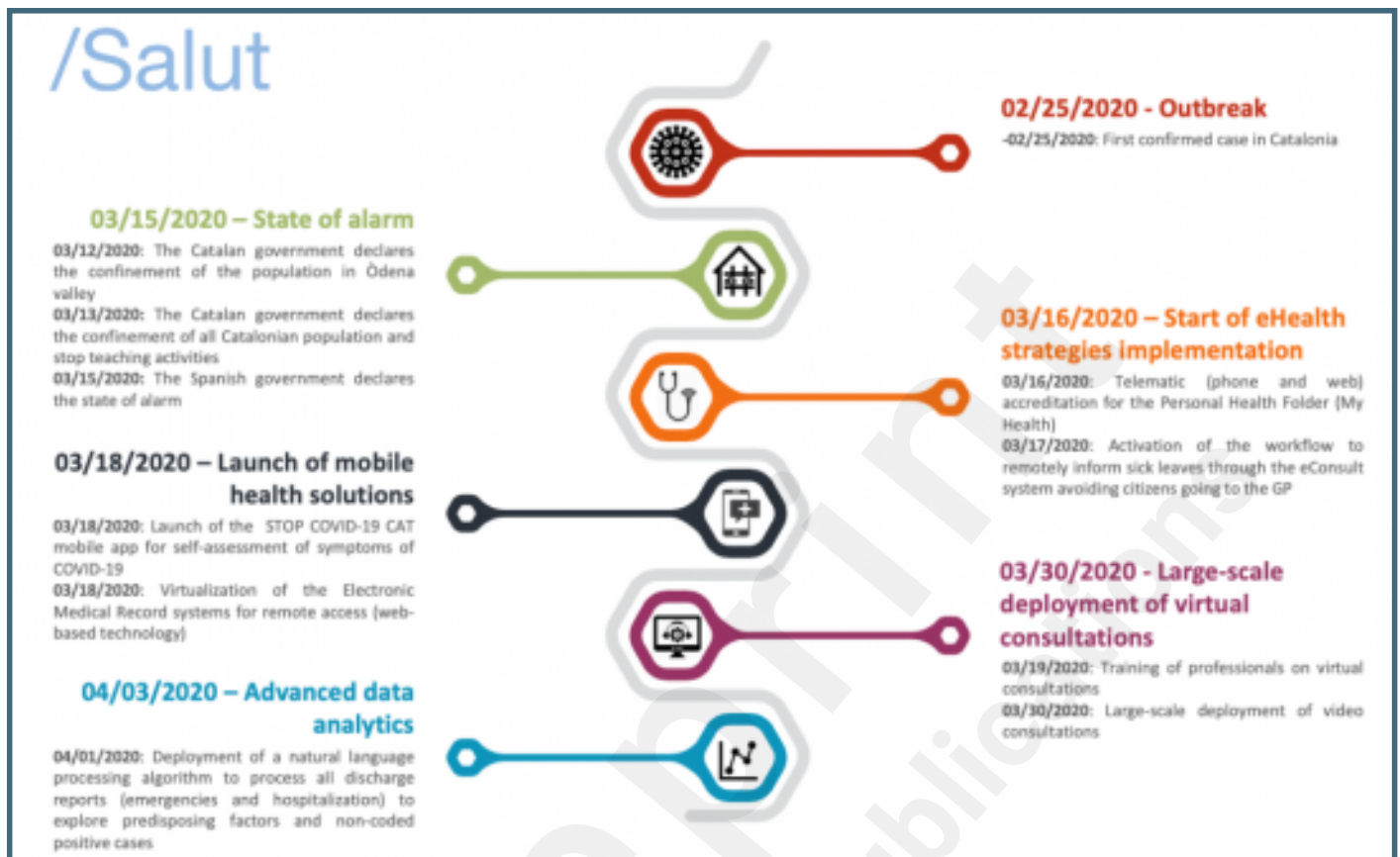
## Supplementary Files



## Figures



Timeline of the digital health strategies deployed in Catalonia since the onset of the coronavirus disease (COVID-19) outbreak. eHealth: electronic health; GP: general practitioner.



Primary care visits compared to other care delivery methods in Catalonia for the period March 01, 2020, and April 19, 2020.

