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Sustainable Digital Transformation

Paving the Way Towards Smart Organizations and Societies

Springer

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Contents

Sustainability in Digital Transformation

COVID-19 Pandemic and New Cardiology Telemonitoring Organization: How to Cast the Others

Alberto Zanutto , **Diego Ponte** , **and Enrico Maria Piras**

Abstract Over the last decade, ICT innovation in healthcare have been explored and extensively tested. While such implementation and use were not straightforward, the COVID-19 pandemic has accelerated a widespread use of new online services like telemonitoring. This paper takes a closer look at the cardiology telemonitoring to shed light on the technology adoption in the healthcare system. While, on the one hand, healthcare professionals have known how to quickly gear up to respond to the new constraints, on the other it seems that the stakeholders of the system show mixed feelings about them. Looking at two different cardiology departments, the paper highlights that this resilience can be allied with organizational innovations underway and in some cases assume an acceleration that is not easily predictable.

Keywords Telehealth · ICT · Organizational change · Telemonitoring

1   Introduction

The recurrent pandemic waves of COVID-19 provide an important opportunity to investigate the responses of public health systems to adapt to an increasingly unstable environment. The pandemic has required health organisations to perform part of their work through Information and Communication Technologies (ICTs) most of which pre-existed but were seldom used in clinical practice. Such technologies on the one hand have allowed work to be performed in accordance with social distancing protocols, and on the other to be transformed through the rearrangement of usual practices. One of the opportunities that have emerged in this period are televisit and

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telemonitoring interventions. This practice has made it possible to maintain important monitoring and control functions in various areas of health. Thus, during lockdowns established by governments, facilities have identified different strategies to respond to the needs of health departments.

In so far, the more the process of advancement of telemedicine consolidated, the better were the effects in the patient management during the pandemic (Menardi et al. 2020). While short term expectations are not revolutionary, the increasing availability of devices and wearables could allow for a widespread adoption of telemonitoring for several cardiological conditions in the long run (Miller et al. 2020; Piro et al. 2020). The pandemic has generated a plurality of approaches leading to a rearticulation of patients-providers encounters due to a number of contingent factors (Badawy and Radovic 2020) such as regulatory constraints regarding safety protocols on the one hand, and on the other, the changing professional practices of health service provision. Interestingly, research is beginning to identify both organisational and clinical effects due to COVID-19 restrictions (Bertagnin et al. 2021).

This scenario offers us the opportunity to understand how digitisation processes were affected by the pandemic in the specific area of implantable cardiological devices such as pace makers and cardioverter defibrillators.

Organisational theory applied to healthcare infrastructures has been exploring these dynamics for some time and today, thanks to the pandemic that has sustained widespread use of new online services, it is possible to take a closer look at an increasingly consistent phenomenon (Bokolo 2021). We have considered both changes on the organizational side and on the implementation of IS. As we shall see, the current experiments have generated various direct and indirect effects on health care work organization and the reliability of IT infrastructures.

The paper aims to understand whether the acceleration triggered by the pandemic on the implementation of digitalisation projects will generate stable changes and to understand how organisations are positioned between resilience and innovation pressures. Indeed, the non-linear situation in project development suggests that these changes have different effects depending on the maturity of the contexts. For this reason, it should be possible to observe a gap between system management directions and the actual adoption of new information systems by health departments.

The fieldwork consisted of an analysis of the management of a regional health authority for about a year. The work carried out on the management side was geared towards implementing a telemonitoring system in two cardiology departments. The system aimed at facilitating the process of monitoring data transmitted from implantable devices. The system was developed by a public regional research organisation that over the years has promoted various systems for digitising healthcare practices. In this case under analysis the system was first deployed in a cardiology department during the first wave of the pandemic and subsequently implemented in a second cardiology department. The research work tried to compare the two departments and two different work organisations.

The paper is organised as follows. First, it briefly reviews the related work on telehealth and cardiology monitoring. Section three describes the case study and the methodological framework adopted for the telemonitoring system. An analysis of

the outcomes is provided to understand which are the limits and possible barriers for a final inclusion of the service in the healthcare system beyond the COVID-19 contingency period.

2 Related Work: Telehealth and Telemonitoring

2.1 Telehealth

The World Health Organization defined telehealth as "the delivery of health care services, where distance is a critical factor, by health care professionals using information and communication technologies (ICT) for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities" (WHO 2009).

Over the last decade, scientific literature has supported the idea that the use of ICTs might improve the overall efficiency of the healthcare system. Many case studies and experimentations show advantages and disadvantages for both the patients and the healthcare providers (Kruse et al. 2020). The most important benefits might be summarized as: improved access to health care, improved quality of services, decreased management costs and reduced duration of the services.

In the field of cardiology, the use of ICT has received a lot of attention and at the same time many technologies have been produced that can read the clinical condition of patients at a distance. Telemonitoring has become another field of improvement of health services offered to patients. The multiple variabilities between different patients, different contexts of use and different healthcare systems have led to further development of ICT in healthcare and in particular to an increase in remote monitoring tools. Telemonitoring has become an integral part of therapeutic processes in many fields including heart failure implants (Planinc et al. 2020; De Backer et al. 2003).

A boost to these implementations has been given by the COVID-19 pandemic that forced organizations and people towards their utilization (Bokolo 2021; Doraiswamy et al. 2020). Despite these benefits, the path to a real wide implementation and use of such technologies is still a long path as their adoption and integration in healthcare practices is very complex (Tersalvi et al. 2020).

2.2 Telemonitoring in Cardiology

Telemonitoring in cardiology is therefore a particularly interesting field of observation. It is an area where ICT-mediated communication between patient and provider is already an established practice. Remote monitoring of the parameters produced by

implantable devices (i.e., pace makers, implantable cardioverter defibrillators) is not a novelty. However, pandemic offered the opportunity to extend monitoring to other facets of cardiological monitoring. Problems arising from poor adherence to treatment and the non-linear trend in patients' attention to cardiological health (exercise, diet, therapy) is a source of hospitalisation and worsening quality of life. During the pandemic, patients with heart failure were one of the most affected subgroups as face-to-face visits were all cancelled. Therefore, their vulnerability required specific measures to ensure follow-up visits while preventing accessing the hospital (Graham et al. 2006).

Various forms of telemedicine and remote monitoring were developed rapidly and widely implemented for these patients (DeFilippis et al. 2020). While telephone calls often replaced face-to-face visits, this led to some complexities and limitations that cannot be managed on a large scale by the current hospital organisation. In addition, telephone monitoring requires specific skills as it generates a large amount of data that must be managed by staff trained for this purpose and it is a time-consuming process (Angermann et al. 2012).

While these studies have demonstrated the effectiveness and positivity of remote monitoring in cardiology patients, the interpretation of the organisational phenomena that have accompanied these sudden transformations seems much more complex. Organisational resilience in these situations is one of the most difficult challenges in order to make the changes stable over time (Testa et al. 2022).

Our paper analyses how pandemic allowed for new forms of telemonitoring of cardiologic patients. Drawing on a pilot implementation carried out in an Italian region, we discuss the challenges in developing and scaling up a multiprofessional remote monitoring practice aimed at becoming a part of the healthcare service.

3 Context and Methodology: Cardiology Departments in Two Different Hospitals of the Same Public Health Company

The purpose of the empirical research was to capture the implementation, evolution and institutionalization of a telecardiological remote monitoring practice set up at the onset of COVID-19 pandemic. We adopted a qualitative research design to flank the phases of the evolution of the project from its design to its piloting, from its refinement to the redesign and scale up. To this aim, we conducted a longitudinal analysis involving the institutional stakeholders, the innovation managers in charge of the design of the remote monitoring system, two departments of cardiology, and the patients involved in the first piloting. In total, our informants were seven professionals (in brackets the number of times we interviewed each informant).

- The General Director of the Regional Health Department (1)
- The Director of technological innovation for the health sector of Regional Health Department (1)

- The Director of the Research Centre for health technology innovation (2)
- The Project manager of the Provider of technological infrastructure (2)
- The Project manager of the telemonitoring system (2)
- The Head of the Cardiology Department 1 (1)
- The Head of the Cardiology Department 2 (2).

The research has been conducted in two distinct phases. In the summer of 2020, we focused on the pilot implementation in Cardiology 1 through seven interviews with the stakeholders involved. In early 2021 we conducted four new interviews with the Director of technological innovation for the health sector of Regional Health Department, the Director of the Research Centre, the project manager, and the cardiologists of Cardiology 2.

Besides interviews, information about how departments are organized was gathered from scientific articles authored by the cardiologists and documentation regarding the remote monitoring system design and implementation was also analysed (Maines et al. 2020, 2021). Contextual information regarding the development of the project was gathered by the first and third authors of this paper which, at the time of the first piloting, worked in the Research Centre that developed the technological system.

Cardiology 1 is a department with a long history of experience with telemedicine and the associated organisational redesign. Patients with implantable devices are monitored by two dedicated nurses that perform a systematic check of the signals coming from the devices. The manufacturers of the devices allow health personnel to pick up specific alerts to monitor the situation in detail. Cardiology 2 belongs to another territorial hospital of the same health authority and it has a less mature and less institutionalised monitoring system in place. Monitoring is still performed by medical staff who check alerts from devices in their free time and between scheduled visits to the outpatient unit. Contact with patients is still mainly by telephone.

During the first pandemic wave a collaboration with the Research Centre led the design and implementation of some telemedicine systems. Cardiology 1 benefited from the first implementation of a telemonitoring system to allow routine visits to be performed online to comply with the social distancing protocols adopted by the hospital. The system was further developed and it integrates data from both the implantable devices and other sensors such as portable devices (e.g. smartwatch, scales) and it is now implemented in both piloting sites.

Previously, the signals from the devices were organised according to proprietary applications provided by the device manufacturers. The hypothetical number of patients with cardiac monitoring/support devices is about 5000 people in the territories covered by these cardiology services.

The paper attempts to compare the organisational processes triggered by the adoption of the telecardiology system. From an organisational point of view, it is interesting to understand how the same health authority interacts with two different of the cardiology services. Both services work to meet the needs of patients with implantable devices. Since COVID-19 has accelerated the organisational process, it

is interesting to investigate these contexts in order to understand how the organisational transformations determined by the pandemic are the outcome of dynamics that affect the different internal articulation work. The institutionalised processes and the perception of the constraints posed by the healthcare system demonstrate how the work of articulation also generates a redistribution effect of organisational power that is not linear. We will try to understand in this regard why the two organisational models of Cardiology 1 and Cardiology 2 differ and why (Fig. 1).
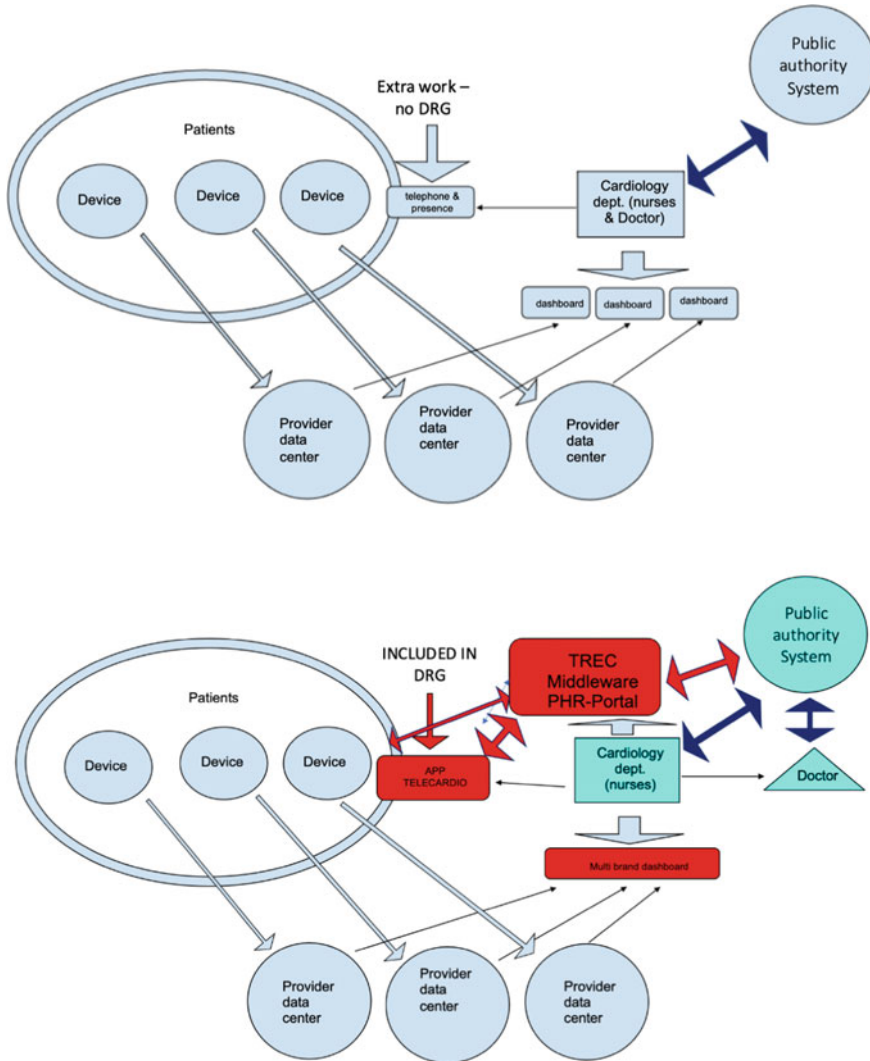

Fig. 1 Cardiology department 1 and 2

4   Findings

4.1   Organization Experience

The regional administration has a longstanding history of promotion of technological innovation in healthcare which has led over time to several telemonitoring projects. The partnership with the Research Centre, allowed the designing, piloting, and implementation of systems to connect patients and providers in several domains, from diabetology to cancer care, from asthma to peritoneal dialysis. Such endeavour has been largely made possible by adopting a common technological platform adapted and customized for each domain (Eccher et al. 2011).

Despite some success, the institutional stakeholders have mixed feeling with regards to the overall results of the innovation activities, blaming the healthcare trust for being not responsive enough in adapting to the possibilities offered by technology.

The director general of the Regional Health Department outlined several times in the interview that complexity "*is all in the field of the slowness of the health authority in adopting the proposed solutions*". At the same time, the director's interview revealed that the administrative structure does not understand much about the complexities of working in the health structure. These complexities appear much clearer to the Director of Innovation, who has always insisted on the point that transformations must be multi-stakeholder, although he admits: "*we are usually too slow in these processes, both in terms of development and in terms of adopting the various solutions*". The administration side, therefore, presents an approach that is a push for innovation but which alone is not enough.

In the two piloting settings the monitoring of patients has been traditionally carried by means of a telephone call that periodically allowed to check, through few questions, the patients' adherence to the therapies. Subsequently, implantable devices made monitoring possible via digital sharing of data accessed by clinicians through a proprietary dashboard created by manufacturers.

Thanks to the pandemic a new remote monitoring system provided patients with an app for monitoring and doctors with a dashboard to control the devices of all the implantable devices used. This application allows patients and nurses (or doctors) to perform televist as well. So, when requested by situation, patients and clinicians can interact with a dedicated infrastructure that can support traceability of the overall process.

At the time of writing this paper, in Cardiology 1, visits are scheduled when the need arises. This new way of monitoring patients has also allowed to reorganise the work of the staff. A first element that clarifies the effectiveness of the therapeutic model implemented can be derived directly from the account of the doctors of Cardiology 1 when they state that their experience has become the basis for the promotion of a Diagnostic-Therapeutic Care Pathways (DTCP) adopted by the regional health authority. Cardiology 1, in recent years, was able to receive additional resources and recruit two dedicated nurses trained in remote monitoring of devices.

"*Our philosophy is the winning one (…) consider our model (DTCP) on heart failure: we started with heart failure patients which are the most delicate ones, which is just to manage a little bit like device carriers. We follow you, we monitor you all year round, there is a nurse who is available during working hours every day* etc.

You can call them and manage situations. You have a problem, we schedule you a visit the week after… in short, if the doctors see the urgency immediately and sends you to the emergency room, if something that can be evaluated in the following days, we try to schedule the visit within 10 days, if there is no urge you can be seen even a month later. This is the paradigm shift in patient management, i.e., you no longer make the visit when you have scheduled it, but you make it when you need it". (Doctor1).

The reorganization is presented as a success story that allowed the redistribution of work within the department and the creation of a new approach to device data and patient management. This was made possible on the one hand with the support of the healthcare organisation, and on the other hand by the willingness to engage with private providers of heart failure devices.

In Cardiology 2, the situation is similar due to the availability of the technology provided by the public health company, but the organisation did not have a history of previous experimentation and therefore the doctors still must reorganise the department to make room for this new way of managing patient monitoring.

"As I understand it, the health administration aims to expand telemedicine. In practical terms, this means that the head nurse must remove two nurses from her shifts and devote them to the outpatient department, which I don't think she can do at the moment, otherwise she would have already done so. To relocate them, you have to define which are the essential services of the ward etc.*, it is obvious that you cannot do that"*. (Doctor2).

In this situation, the introduction of technology has not brought any real benefit to the department in terms of redistribution of work, and therefore an intense articulation work is needed to define the "agreements" needed to provide the required service. The doctors' accounts highlight the fact that this work obliges them to use their free time at weekends and during breaks from work. In addition, the doctor coordinating the pilot project reports on his additional burden created by the new organisational model stressing that it is manageable as a pilot that involves 'just' 30–40 patients but that those numbers cannot be scaled up without additional dedicated workforce.

"At the moment, as far as telecardiology is concerned, at least as far as heart failure is concerned, it is almost zero… meaning that we have started with the app, we are making a few televisits, which basically means a phone call at the moment, but we do not have, for example, dedicated nurses, we do not have a preferential channel that allows us to enrol patients, to monitor them… that is, in my free time I read the reports of the app, but at the moment we have 30–40 patients, when there will be 200–300 I doubt that I will be able to keep up with this in my free time." (Doctor2).

In Cardiology 2, the ambiguity of the terms "adoption of new technologies" and "resilience" is brought out. Organisations never cease to be potentially conflictual and open fields in this regard. Telemedicine is represented by healthcare managers as

a support to clinical practice and a viable way to increase organizational efficiency through a reorganization of internal resources. For clinicians, instead, telemedicine requires additional resources to make room for the additional time needed to perform additional monitoring. While Cardiology 1 has faced the problem in the past and it managed to secure additional staff, Cardiology 2 has yet to start to negotiate with the management and it struggles to manage the pilot performing unpaid overtime. The experimental nature of the project and the possibility that this innovation may change the approach to telemedicine, clashes with the "additive" nature of the change that cannot take place without a proportionate choice of resources and support from the organisation.

4.2   The Double Face of Resilience in Organization

While cardiology departments are urged to make room for experimentation, the framework of competencies takes on different dynamics between the pilot sites.

In the case of Cardiology 1, the greater experience and the reorganisation of the department allows doctors to envision new target groups eligible for telemedicine. The reorganisation has generated a new arrangement of people and technology. This shows a new "outlook" on the diagnostic pathways to be offered to patients who are currently treated by the department in traditional ways and not through the new monitoring system. As the doctor 1 reports, these organisational processes also require patients to change their perspective regarding being taken care of. For the new model to function, patients must systematically input personal data in a timely manner into the app to share them with the department. Committing to such a task implies recognising the dominance of the new technological system over the care process.

"In the philosophy of the app now, the philosophy has been to say let's start with the decompensated heart failure patients, because we have a project for that, but the philosophy afterwards is to extend [the model] to all the chronic. The strength of the app, in my opinion, lies in this, in educating the patient to manage these things, to give you the data and to be [active] part of his disease [management]… that is, it is not me who has to manage everything, it is you who are involved in the management because you have to weigh yourself, you have to do this, you have to give me the data, you have to call me if there is a problem. This is the winning thing here." (Doctor1).

In this perspective, the system must go through various moments of fragility and complexity for both the department and the patients, because the rules of engagement in the distribution of the various tasks of monitoring are changing. Moreover, the technology, as an experimental one, shows its vulnerabilities that can feed resilience in two directions. A first direction is that of the organisation not being able to rely 'entirely' on the new technology. In this case the resilience is of the health personnel who find suitable pathways to 'survival' and effective camouflage against technological innovation.

"But my philosophy will not be to use [so far] the televisit instead of the phone call because it's still a bit more cumbersome, it will only be when I can use the

app to make a phone call to the patient without having to give them advance notice, without having to go into the… [phone call] tell him that we're going to do it, because otherwise we'll lose more time." (Doctor1).

Moreover, until the new technological set-up has obtained sufficient guarantees of stabilisation, it is neither possible nor convenient to abandon the previous methods when adopting the new technological solutions. For example, since recruitment of patients is represented as a cumbersome and lengthy process doctors have decided to reduce the number of patients involved. Moreover, since the pilot did not foresee detailed inclusion/exclusion criteria, doctors enrolled patients deemed able to manage the app discarding other potential candidates. As the experimentation progressed, in fact, doctors realized that some skills and workarounds were needed to ensure the use of the app and some senior patients could not be relied upon if not properly assisted by a relative or a caregiver capable of using a smartphone.

"The televisit, for example, still has a problem in my opinion, because the way the app is structured requires me to phone patients, tell them to switch on [the phone], tell them to access the app, give consent, and do the tele visit. Yesterday the tele visit didn't work, because they changed something about the support, etc. *So, the technology needs to be a bit more stable. So, an 80-year-old with the mobile phone is not always mean eligible to have the app because if there's no family member with him [anti COVID-19 rules], if they can't remember the password, or maybe they can turn it on but to download the app the phone asks you for the password again… In short, technically it is not always feasible."* (Doctor2).

This last account helps us to understand how room is made available for resilience on the patients' side, especially if they are particularly old. There is, also, the resilience of some patients who do not accept this incorporation into monitoring systems and therefore try not to allow themselves to be included in a flow created by apps and devices.

"There is a 3% of patients with devices that do not have remote monitoring. There are some who don't want it because of strange beliefs or some who have old devices that cannot be monitored." (Doctor1).

4.3   The Technologies, the Choices, the People

While cardiologists provided a shop floor perspective of the implementation of the new monitoring system, the project manager was interviewed to position the initiative in the broader picture of a more comprehensive initiative to push telemedicine in the region. The primary challenge here is creating the conditions for direct adoption of the system. The attention is on the possibility of intercepting traditional monitoring practices and making them compatible with the automated ones of the system made available.

"So, we basically created a very simple platform, but during the year COVID was able to take on patients. We did an initial beta test with Cardiology 1, which lasted three to four months with about thirty patients. We then had an evaluation by the

internal sociologist staff, so I would say that the results were very comforting. In the beta test phase, we changed and optimised a few things with the development team, so that the app would be confident with both the patient part and the dashboard for the doctor." (PM1).

As this extract shows, there does not seem to be anything 'new' in the way technological solutions are proposed by the health authority, but the novelty this time is in the change of context generated by the pandemic. Telemedicine, having been regarded as a second-best option to provide care services, does not belong to a long distant future but it has become the only viable option to deal with the constraints of social distancing. The Research Centre that built the new telemedicine system became a relevant partner to provide services needed to grant the continuity of care during the emergency. The emergency allowed to push the boundaries and envision systems which do not simply allow to deal with the pandemic but aim at becoming a cornerstone of a new form of service provision by integrating external devices to have some monitoring work delegated to technological devices and wearables.

"We've done this with Apple Watch, we're coming out next week with the release of the Cardiology app with the ability to give direct download of data coming from Apple Watch… Apple Watch the latest version… There's also the ability to have a one-lead ECG that got FDA approval a couple of months ago regarding the diagnosis of atrial fibrillation." (PM3).

These experiments are combined with other experiments to gain a better understanding of how subgroups of patients act and to have retail technologies that are also considered acceptable by the authorities in the medical field, even for carrying out particularly sensitive biometric checks (e.g., FDA approval about Apple watch). This greatly reduces the resilience of medical staff, who usually do not trust patients' self-measurements. Patients have less and less work to feed the databases on which healthcare companies and private operators rely heavily. In seizing these opportunities, stakeholders recognise that "this time" the step seems firmer and more decisive to generate a paradigm shift with the patients involved. The system itself becomes a new opportunity for a new "digital therapy" prescription which they hope will soon be included in the procedures delivered by the health system.

"So, the app starts to become a digital therapy tool… this is the step we decided to take. The next step is to codify this service, because currently it is not codified… or rather, the telemonitoring is codified but the app is not codified as a service of the healthcare system. In the region, at the beginning of this year, we defined the DTCP for heart failure. The DTCP is basically a document for the diagnostic and therapeutic evaluation of certain chronic pathologies. We have reworked the DTCP for heart failure with the healthcare authority, and it is the first time in Italy that a DTCP has the possibility of integrating the care of a patient with technology. So, it is the first time in Italy that such wording appears." (PM1).

The new DTCP paved the way to semi-automated data monitoring by an algorithm and a limited intervention of healthcare professionals to check and validate a suggestion to be sent through the app to the patient. The PM, a cardiologist herself, represents this shift in terms of organizational challenges and opportunities. COVID-19 provided the opportunity for telemedicine services to find a legitimate space in

the daily organisation of the workload. Some clinicians could work from home, the offices were empty and available for urgent, unpostponable visits, and the time for sanitization between visits was reduced. Beyond the pandemic, the cardiologists remarked the importance of organisational changes for a new technological approach to be successful. The introduction of the telemonitoring, in the medical areas involving cardiological consultation and monitoring, encouraged a shift from the traditional periodic visits to on-demand visits, where the patient is constantly remotely monitored and it is called for a face-to-face visit with the clinician only when a visit is needed, in a proactive way. In addition, the adoption of telemonitoring was perceived as a viable solution leading to a significant decrease of workload of health professionals on one side, and in terms of interfering with patients' agenda on the other.

"The big problem now is organisational change: if I have technology without organisational change, it is useless and creates even more confusion. In Cardiology 2, they managed to change the decompensation outpatient clinic by adding another nurse to the nurse who was following the telemonitoring patients on a part-time basis. Now it is [Cardiology 2] that has to make some choices, also from an organisational point of view, the number of nurses who follow and will follow these patients remotely." (PM1).

According to the project manager, the potential benefits are significant and range from the reduction of unnecessary visits, shortening of waiting lists, and the possibility to avoid face-to-face encounters when not strictly necessary. However, such results largely depend on how each department will confront the associated organizational challenges. Each department, in fact, is required to rearrange their working practices to accommodate the new technology ("*Now it is Cardiology 2 that has to make some of choices"*) to benefit from what the system can offer. Among the others, the system can provide some practical solutions to streamline work routines by providing a unique access point to several data sources. Before the introduction of the systems, in fact, the considerable complexity of cardiology monitoring of implanted devices in patients depended also on the different dashboards healthcare professionals had to switch between during the visits if they wanted to have an overall picture of their patients. In addition, the bureaucratic constraints associated with the administrative recognition of these services require that the work carried out by healthcare personnel be documented. This requires particularly intense "junction work" performed by staff (Piras and Zanutto 2016).

"They [healthcare professionals] had to enter all 4 dashboards, so it's a waste of time anyway. On the other hand, telecardiology service is now recognized as a legitimate service by the healthcare authority, but you have to prove that you have done that service. So, the nurse had to go to the portal of the healthcare authority, copy the PDF, the summary of the final PDF, and paste it in the healthcare IS which is the hospital system so that, at the annual reporting, they would say that the cardiology department has made a certain number telemonitoring visits to process to claim regional reimbursements from the Health Ministry…" (PM1).

Besides the mundane details of the technologies and the organizational constraints and challenges, the project manager presented the new initiative as a part of a broader

strategy put forth by the regional healthcare authority to promote telemedicine leveraging on the opportunities offered by the pandemic. On the one hand, the emergency made it possible to strengthen the partnership between the regional government, the healthcare authority and the Research Centre. The funding for the project came from a COVID-19 dedicated funding scheme which allowed experimentation without investing a budget. On the other hand, the pandemic played a decisive role creating a fast lane for telemedicine projects aimed at reducing the risk of infection in hospitals during the critical phases of the infection.

"I admit that if it hadn't been for COVID, we probably wouldn't have reached this level. I mean that I often hold conferences, I often speak at courses, and I have seen a palpable difference between when I spoke before and when I speak now. Before the audience of doctors, when they heard about these things, was quite lukewarm if not reluctant, now I must say that the attitude has changed a lot. I don't expect 100% of decompensated and arrhythmic patients, hypertensive patients, post-infarction patients to be monitored with the app, not at all. I expect a proportion of these patients to be remotely monitored. Obviously, the amount will depend on the type of patient, on how many resources the hospital decides to include." (PM1).

The adoption of the system has allowed the healthcare authority to develop organisational potential both on the side of infrastructure and on the side of organisational behaviours and practices of healthcare personnel. This means that the solution adopted must be able to grow and be compatible with the different levels of maturity of the organisation so that it can be used with the appropriate patients for this new monitoring organisation. Clearly, this is largely dependent on making proprietary device data available in a way that is transparent to the patient, who no longer has to deal with it. At the same time, healthcare professionals can access this data without having to change interfaces and access protocols. This proved to be practically suitable for the target population, which often has low IT literacy, low commitment to specific data entry and limited resources from caregivers at home.

5 Discussion and Conclusion

According to a widely mistaken etymology, the Chinese word for "crisis" is (incorrectly) said to be composed of two characters signifying "danger" and "opportunity". Despite being a misinterpretation, the idea that an emergency creates room for a positive change has found significant echo in popular culture and it summarizes quite accurately the representations of the actors involved in the process of designing, deploying, testing, and scaling up a telemedicine solution described in the previous pages. All actors involved concur that while implementing telemedicine service requires lengthy and painstaking processes, the pandemic has offered an unparalleled opportunity not to be missed to take a giant step forward. The sense of urgency of clinicians and healthcare managers is largely due to the unparalleled alignment of loosening of institutional constraints, funding opportunities, and an overall favourable environment. The opportunity was seized firstly by re-adapting an

existing system to the needs of cardiology, and subsequently by designing a specific layer to address the requests of the two departments. This strategy is consistent with the perceived need to 'strike the iron while it is hot' and introduce changes during the pandemic and work to make them permanent.

The first pilot conducted in 2020 highlighted several positive implications of adopting telemedicine such as the possibility of avoiding unnecessary travel and contacts during the COVID-19 epidemic; the possibility of reducing the organizational burden linked to visiting patients for simple routine follow-up visits at the clinic; the potential scalability of the tele visits and its adaptability in different departments.

Despite the overall positive results, however, there is one significant tension. Such tension stems directly from our analysis and it has been suggested by the comparison of the two trial sites and it relates to the different expectations regarding telemedicine by doctors and the healthcare organization. Datafication of healthcare is a phenomenon that predates the COVID-19 pandemic. Most likely, though, the prolonged emergency will boost the spreading of IT in different healthcare domains requiring new kinds of expertise, organizational change, data management practices just to name a few adjustments. As clinical practice becomes intermingled with "data work" ("*the activities related to creating, collecting, managing, curating, analyzing, interpreting, and communicating data*", Bossen et al. 2019) healthcare infrastructures and IT systems become a cornerstone of many services. IT systems, however, may be regarded quite differently by healthcare managers and clinicians. As illustrated by the excerpts presented above, they do not share the same perspective with regard to the effort needed to redesign the organizational processes implicated in the furnishing of telemedicine. Moreover, while managers envision a more efficient care delivery, clinicians represent telemedicine as a different way of working rather than a more productive one.

While managers claim that the increased volume of data received through devices will allow for personalized forms of care, clinicians are more likely to point to the additional resources needed to scrutinize those data. Doctors regard telemedicine as requiring the acquisition of additional skills. While data analysis can be assigned to nursing staff under medical supervision (Cartwright 2000), new staff needs to be hired to perform the additional data work. Such difference is well illustrated by the different way the pilots were handled in the two departments under scrutiny. While Cardiology 1 was able to secure new resources and assign them to telemedicine, Cardiology 2 did not yet manage to acquire new nursing staff leading doctors to practice telemedicine in his spare time.

Telemedicine schemes require patients to acquire new competences that go beyond the ability to deal with IT. Doctors involved in the pilots imply that a new therapeutic alliance needs to be established with patients. As one doctor put it "*it is you [the patient] who are involved in the management because you have to weigh yourself, you have to do this, you have to give me the data, you have to call me if there is a problem*" (see Sect. 4.2). The willingness to adopt a proactive approach, however, could not be taken for granted. However, remote monitoring assumes that professionals and patients play their part in dealing and sharing health information on a regular basis.

Involving patients in data collection, however, can be a daunting task and its success ultimately depends on making data collection a meaningful activity for patients and for the organization. The model envisioned by the departments, however, may not be suited to generate the desired patient engagement neither for the professionals. Patients with cardiac implantable devices have no access to the data automatically sent to the department and they would not be able to interpret them unless they were properly trained to do so.

At the same time, doctors and nurses must fit these new practices into a framework of meaning that is still unstable. Thus, the system is asked to consolidate a complex setting that still has to align all its allies.

In this sense the system can evoke the new but without being able to "generate" it. However, it has the capacity, by design, to redistribute work and to promote new ways of representing the working practices of the various human and non-human actors in health data management.

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