

Digital Transformation of Professional Healthcare Practices Fitness Seeking across a Rugged Value Landscape

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Digital transformation of professional healthcare practices: fitness seeking across a rugged value landscape

What a strange pleasure it is to seek (S.A. Kauffman)

Abstract

Digital transformation (DT) is typically described as a strategic, top-down initiative where new digital technologies fundamentally disrupt an organisation's structure, procedures, and processes to enhance its value proposition. We propose a middle-range theory which highlights that DT of professional practices in healthcare follows a different path. To build this theory, we transpose the metaphor of a "fitness landscape" from evolutionary biology to a professional healthcare context to build an intermediate conceptualisation, which is then refined through an empirical study. Our theory highlights that external events, such as the COVID-19 pandemic, changing patient behaviours or the availability of new digital resources, transform the "value landscape" upon which healthcare professionals create and deliver healthcare services to patients. Empowered by their professional autonomy and driven by their service orientation, healthcare professionals search for new paths and peaks for value creation and delivery across a rugged landscape. As digital resources are leveraged, new value propositions in practice emerge, and professional healthcare practices are digitally transformed.

Keywords: Digital transformation, digital technology, value proposition, healthcare practices, complexity theory, process theory, evolutionary change.

1. Introduction

Digital transformation (DT) is a much-discussed topic in management information systems (MIS) research with ongoing scholarly debate about its characteristics. Many studies have highlighted the process through which DT unfolds and leads to changes in an organisation's business model, value proposition, identity and work practices (Bharadwaj *et al.*, 2013; Sebastian *et al.*, 2017; Singh & Hess, 2017; Yeow *et al.*, 2018; Vial, 2019; Baiyere *et al.*, 2020; Hanelt *et al.*, 2021; Volberda *et al.*, 2021; Wessel *et al.*, 2021). Much of the existing literature conceptualises DT in a comparable way to IT-enabled transformation at an organisational level, that is a one-way process initiated by major strategic initiatives and a single sophisticated technology that typically leads to some desired outcome (Baiyere *et al.*, 2020; Hanelt *et al.*, 2021; Wessel *et al.*, 2021). However, we know little about the emergent and fluctuating nature of DT processes, including the role that different technologies play (Noesgaard *et al.*, 2022) at the operational level.

With this conceptual starting point, we initiated an empirical study of how French hospitals integrated teleconsultations during the Covid-19 lockdown to digitally transform their service delivery. We observed that doctors individually explored new ways of creating and delivering value to patients using digital technologies. Therefore, we wondered if DT in a healthcare context follows a different path to what has been previously presented in the MIS literature.

Triggered by these first empirical insights, we initiated this study to address the following research question: *How does digital transformation of professional practices unfold in healthcare?* In the literature, we found that professional autonomy and expertise (Engel, 1970; Mintzberg, 1979; Adler *et al.*, 2008) could be key concepts to understanding how healthcare professionals, i.e., doctors, build on their specialised knowledge to choose the most appropriate way to deliver a service to their patients (Adler & Kwon, 2013). Furthermore,

literature on the use recombination of digital resources (Henfridsson *et al.*, 2018; von Hippel, 2021) served as a suitable starting point for understanding how healthcare professionals combine different resources that provide several options for value creation.

Nevertheless, we considered that these concepts were not sufficient to address the evolutionary and dynamic nature of DT in a healthcare context. We therefore propose building a middle-range theory that leverages the metaphor of a “fitness landscape” as a literary device (Cornelissen, 2004; Røvik, 2011; Avital *et al.*, 2021). With its origins in the fields of genetics and theoretical biology (Wright, 1932; Kauffman, 1993), the metaphor describes how living organisms evolve across a landscape, composed of valleys and peaks of various levels of fitness, seeking out paths to the highest proximal peak to ensure their survival. We saw parallels between the way species combine genes to the way doctors combined organisational and digital resources to create and deliver value. Where “peaks” on the “fitness landscape” represent combinations of genes, “peaks” on a doctor’s value landscape represent possible combinations of resources for service provision. Where the evolution of species can be conceived as adaptive moves towards higher peaks of greater “fitness”, the DT of professional healthcare practices emerges from a similar walk or jump to a new “peak”. Where co-evolutionary pressures and conflicting constraints on gene combinations restrict fitness payoffs and lead to a rugged landscape of multiple sub-optimal peaks, the value peaks of doctors are similarly constrained by the difficulties they encounter when combining digital and organisational resources, and by the behavioural changes of their patients. Consequently, DT emerges from the fitness seeking behaviours of healthcare professionals across a rugged value landscape.

Beyond simply applying the fitness landscape metaphor to the studied context, it served as a powerful generative theorising tool (Hassan *et al.*, 2019; Hassan *et al.*, 2022) to develop a middle- range theory for how DT of professional practices unfolds in healthcare. Our theory contributes to the special issue on “Managing and Sustaining Digital Transformations” by

proposing that healthcare professionals are driven by their service orientation and autonomy to continuously search for improvements to their value proposition in practice, pushing them to find new paths and attempt new “peaks” on a shifting value landscape. As professionals leverage digital resources to climb peaks, new value propositions in practice emerge, and professional healthcare practices are digitally transformed.

The rest of the paper is organised as follows. First, we ground the phenomenon of DT of professional practices in healthcare, where we argue that a process theory of its dynamics is missing but needed given the characteristics of healthcare professionals’ practices and the possibilities for professionals at an operational level to combine multiple digital resources for service provision. With an aim to build a middle-range theory to better grasp this process, we then introduce the fitness landscape metaphor. The origins of the metaphor are described and transposed to the context of digital transformation in healthcare to form an intermediate conceptualisation that is refined through an empirical study and evaluated in light of alternative theories. We conclude the paper by discussing the theoretical contributions and practical implications.

2. Digital transformation of professional practices in healthcare

Existing research conceptualises DT as a strategic planning process (Vial, 2019; Warner & Wäger, 2019), in which digital resources create disruptions that result in the alignment of an organisation’s strategic choices with its processes and operations (Matt *et al.*, 2015; Singh & Hess, 2017; Yeow *et al.*, 2018; Vial, 2019; Baiyere *et al.*, 2020; Hanelt *et al.*, 2021). There is an emerging consensus on the change of value proposition (Yoo *et al.*, 2010; Barrett *et al.*, 2015; Vial, 2019; Wessel *et al.*, 2021) as a key outcome of the DT process. Despite the relevant work on DT, there has been little research on the dynamics of how DT unfolds at the operational level when there are no clear strategic intentions at the corporate level and when the transformation is not planned upfront. Contrary to this dominant conceptualisation of DT, our

study shows that the separation remains blurred between the strategic and operational levels for DT in a professional healthcare context. Here, doctors themselves make strategic decisions about how to deliver the most appropriate service to their patients. It follows that DT of healthcare practices, while strategic in consequence, unfolds at the operational level.

2.1. Digital transformation at an operational level

The primary aim of studies that take an operational view on DT has been to identify how tensions and impositions can be reconciled to ensure the strategic success of the transformation (Baiyere *et al.*, 2017; Wessel *et al.*, 2021), as well as how management can adjust and improve business processes accordingly. While existing studies show how DT processes impact work practices (Jensen, 2018) by creating impositions (Baiyere *et al.*, 2017; Wessel *et al.*, 2021), organisational inertia (Schmid, 2019; Haskamp *et al.*, 2021) and paradoxical tensions (Smith & Beretta, 2021; Wimelius *et al.*, 2021), there is only little mention of how organisational members organise and manage the complexities of DT at an operational level (Smith & Beretta, 2021). We argue that a process view of DT at an operational level may help explain its emergent and fluctuating nature (Noesgaard *et al.*, 2022) and be useful for understanding the continuous efforts that professionals make in managing and sustaining value creation and delivery over time.

Furthermore, while received knowledge suggests that one, single digital technology typically drives the transformation of business models and empowers new entrepreneurial initiatives (Chantias *et al.*, 2019; Vial, 2019; Nambisan *et al.*, 2019; Baiyere *et al.*, 2020; Wessel *et al.*, 2021), recent studies show that DT in practice may involve the use of “*several digital technologies at the same time*” (Baiyere *et al.*, 2020, p.242, emphasis added). The concurrent use of multiple digital technologies together with the rise of “consumer IT” in the workplace – i.e., easy to use, affordable and available hardware and software originally designed for

personal use – opens a plethora of new paths for value generation (Henfridsson *et al.*, 2018; Holmström, 2018).

While the existing literature on DT does not conceptualise digital technology use in relation to multiple value paths at an operational level, scholars in the field of digital innovation have done so. For example, von Hippel (2021) introduced the concept of “system of use” which represents “a collection of components that interact during use to accomplish a system-level goal” (p. 1). In such a context, users best know how a system’s components interact and they take an active part in creating value if the solutions’ designers allow them certain freedoms. This means that digital technologies are not envisioned as mere triggers of innovation but as resources that can be combined by users in the pursuit of a goal. In a similar way, Henfridsson *et al.* (2018) propose the concept of “use recombination” of digital resources, where a user generates “an individual value path by connecting digital resources in use” (Henfridsson *et al.*, 2018, p.92). Such use recombination creates multiple opportunities for value creation by users themselves.

Given our focus on how DT unfolds in a healthcare context, next we describe the specificities of professional healthcare practices.

2.2. Specificities of healthcare practices

Doctors are considered one of the most highly professionalised occupational categories (Adler *et al.*, 2008). Their service orientation implies a preference for patients’ interests over other considerations such as economic gains (Goode, 1957). As professionals, doctors enjoy an important degree of freedom or agency (Archer, 1982) to create and deliver value during their interaction with patients (Vargo *et al.*, 2008; Lindič & da Silva, 2011). They assume a “moral responsibility” in a disinterested professional-client relationship as well as legal and ethical responsibility for the choices they make concerning service provision (Parsons, 1939).

The quality of the service provided depends on the professional's expertise (Adler *et al.*, 2008) and interpretive scheme (Denis *et al.*, 2000) or schemata (Rerup & Feldman, 2011). Schemata is "the way in which organization members conceptualise the organization's mission and the principles that guide its operations" (Denis *et al.*, 2000, p.1066), which includes a categorisation of client needs (Mintzberg, 1979). Professional values, knowledge and expertise are embedded in schemata that govern a professional's goal-oriented activities as "organised practices" (Garfinkel, 1967) during the personal service relationship with the client. In the case of doctors, expertise is built on a specialised university education, on-the-job training (Mintzberg, 1979; Adler & Kwon, 2013) and clinical guidelines (Adler & Kwon, 2013). The importance of knowledge and expertise makes doctors more open to innovations that are compatible with their profession and gives them greater absorptive capacity for new knowledge (Adler & Kwon, 2013).

The profession of doctors is also characterised by the legitimate and organised autonomy they possess (Friedson, 2008) and they tend to enjoy more autonomy compared to other occupational groups (Wallace, 1995; Adler & Kwon, 2013). At an individual level, professional autonomy "involves the right to decide what kind of work is to be done and how, without bureaucratic or commercial interference" (Adler & Kwon, 2013, p.935). This means that doctors at their own discretion, and in agreement with patients, can make changes to their individual service delivery.

Professional autonomy, which also justifies and reinforces a professional's distinctive expertise (Adler & Kwon, 2013), is a consequence of the nature of professional work itself, which cannot be standardised or controlled by managers (Mintzberg, 1979). Autonomy creates a negotiated order in professional organisations where "the role of hierarchical superiors is typically advisory rather than decisional" (Adler & Kwon, 2013, p.942). Consequently, healthcare professionals rather than managers shape their own work roles at the individual level.

A professional is attached to the organisation but is “free to serve his clients in his own way, constrained only by the established standards of his profession. As a result, professionals tend to emerge as responsible and highly motivated individuals dedicated to their work and the clients they serve” (Mintzberg, 1979, p.371).

In sum, given the characteristics of professional practices in healthcare, the continual assessment by doctors of patients’ changing needs and preferences, and the possibilities for doctors to combine multiple digital resources with other organisational resources to adjust the creation and delivery of value to patients, we argue that an evolutionary view is needed to understand how doctors digitally transform their professional practices. For this purpose, we introduce the fitness landscape metaphor to conceptualise how doctors engage in adaptive moves in search of more appropriate resource combinations for value creation and delivery.

3. The fitness landscape metaphor

We find the fitness landscape metaphor appropriate to “clarify, enrich and enlighten” (Hassan, 2014, p.6) the way healthcare professionals transform value creation and delivery. Originating in the field of evolutionary biology, we believe that this metaphor helps understand and explain the evolutionary nature of a doctor’s practices. Using “disciplined imagination” (Cornelissen, 2006, p.751), we transpose this metaphor to our research setting to propose an intermediate conceptualisation. We then refine our conceptualisation through an empirical study, and evaluate it in light of extant theories to propose a middle-range theory of digital transformation of professional healthcare practices (Røvik, 2011; Hassan & Lowry, 2015; Hassan *et al.*, 2019; Avital *et al.*, 2021).

3.1. The origins of the fitness landscape metaphor

The fitness landscape metaphor dates back to the early work of geneticist Sewell Wright (1932), who developed a mathematical theory of evolution to explain how living organisms could

change in response to evolutionary pressures. Stuart Kauffman (1993) later expanded Wright's work and organised it into a fitness landscape model.

Each organism can be described by a set of phenotypes (i.e., attributes) that may serve as the basis for Darwinian natural selection¹. A phenotype is influenced by a corresponding combination of genes, called a genotype. A level of "fitness" can be ascribed to each genotype, via the phenotype as an indication of how well the attribute contributes to the organism's adaptation and survival. For example, the development of a sticky tongue (i.e., a phenotype) by the frog improved its ability to trap prey and therefore its fitness (Kauffman & Johnsen, 1991). The distribution of *possible* fitness values across all organisms is called the "fitness landscape". The peaks on the landscape represent various levels of fitness, and organisms seek out the highest proximal peak to ensure their survival (Kauffman & Levin, 1987). Adaptive evolution therefore depends on the topology of a landscape (Kauffman, 1993).

As the fitness landscape evolves, organisms go on "adaptive walks" to seek out higher local peaks that can improve their level of fitness. Adaptation typically progresses through minor changes and reconfigurations to genotypes involving local search and hill climbing across a space of possible rearrangements. This apparently straightforward process in reality "involves complex, combinatorial optimization" (Kauffman & Levin, 1987), as many parts, processes and requirements must be simultaneously coordinated. Increases in mutual or conflicting constraints lead to a more rugged landscape (Kauffman, 1993), often comprised of several sub-optimal peaks as "the fitness improvement (yield) from a particular change may be diminished because of fitness limitations posed by other parts" (McKelvey, 1999, p.303). In a rugged landscape, local peaks are often of similar height since a "[one]-mutant neighbor will tend to have similar properties, hence similar rank orders" (Kauffman & Levin, 1987, p.27). To escape being trapped on sub-optimal, local peaks, organisms may "jump" to more "distant"

¹ Phenotypes are the observable characteristics of an organism, and depend on its genetic makeup (i.e., genotypes), dominant genes and the interactions between genes and the environment.

peaks “where adaptation occurs via multiple simultaneous mutations” (Kauffman & Levin, 1987). In reality, organisms “evolve on rugged landscapes by a mixture of mutations which search the immediate vicinity and some fraction of mutations which jump long distances in genotype space” (Kauffman, 1993, p.70).

While the fitness landscape describes the environment of one homogeneous species (i.e., a population), there may exist other populations in a co-evolutionary ecosystem each with their own fitness landscape. In such a case, the fitness landscapes of each population may be coupled. Coupling implies the co-evolution of populations where an adaptive move by one population “may increase or decrease the fitness of each neighbor on the latter’s landscape and alter the uphill adaptive walks accessible to that neighbor” (Kauffman, 1993, p.243). For example, given the frog’s sticky tongue, the fly should develop slippery feet (Kauffman & Johnsen, 1991).

Kauffman (1995) was the first to draw parallels between biological evolution and the evolution of organisations and technologies, arguing that “human artifacts like tools, products, and even organizations are the fruits of a conscious struggle to invent and improve” (p. 119). Several authors have since employed the fitness landscape model in the management field (Levinthal, 1997; Levinthal & Warglien, 1999; Chae, 2012; Guthrie, 2020). Instead of living organisms, management scholars have studied employees in a workplace or organisations in a market and defined fitness relative to an agent’s objectives. For example, for an organisation, fitness corresponds to its chances of generating profits in the marketplace (Levinthal, 1997). In a service organisation, a high fitness peak would represent a service system that is creating high revenue and favourable customer experience (Chae, 2012). For a knowledge worker, fitness would be a measure of how efficiently and effectively the individual produces a given work outcome (Guthrie, 2020). Nevertheless, the fitness landscape model has often been applied in a positivistic way, in simulation-based studies, and without considering individual agency

(Poulis, 2020; Poulis *et al.*, 2021). As we transpose the fitness landscape metaphor to the specific domain of how DT of professional practices unfolds in healthcare, we consider professional autonomy (i.e., individual agency) as a key characteristic of a doctor's practices.

3.2. An intermediate conceptualisation of DT of professional healthcare practices

In this section, the fitness landscape metaphor is transposed to the context of healthcare to form an intermediate conceptualisation of the digital transformation of professional practices in healthcare. The idea that agents select and climb the most appropriate peak on a fitness landscape resonates with the way a doctor creates and delivers services. From prior literature, we learned that doctors are service oriented, driven to provide a valuable service to their patients. They mobilise their specialised knowledge and judgment (i.e., their schemata) to choose the best way to perform and deliver a service (Adler & Kwon, 2013) and they enjoy a high degree of autonomy in choosing the most appropriate combination of available resources to create and deliver value. This means that a doctor is free to choose how to organise a medical consultation.

Because professionals in healthcare use a combination of digital, i.e., devices, networks, services, or content (Holmström, 2018)), and organisational resources to perform a service, the fitness landscape metaphor can help understand how each possible combination of resources forms a peak on a doctor's "value landscape" and how the height of each "value peak" reflects the potential value created for patients, as perceived by the doctor. In a healthcare setting, service value depends on the perceived benefits that accrue to the patient (i.e., the quality of the consultation or the care) and the perceived effort required to obtain it (i.e., the financial or physical effort involved in obtaining the service). And, as doctors are driven by their professional service orientation, the metaphor can help explain the process and conditions of their fitness seeking behaviours and thus the digital transformation of their practices.

Each possible resource combination allows for a different value proposition, in the same way that a genotype (i.e., combination of genes) allows for a specific phenotype (i.e., attributes). A level of “fitness” can be ascribed to each resource combination via the value proposition as an indication of how well the combination contributes to the value of the healthcare service provided by the doctor for the patient. In a healthcare setting, the level of fitness corresponds to the level of value created and delivered on each peak. Visually, the level of fitness also corresponds to the height of the peak.

Conflicts between resources may constrain the height of peaks. For example, processes or rules may constrain the possibilities of IT use. The resulting topology of the value landscape describes the possibility space for value creation and delivery. Doctors choose the most appropriate peak within their “value possibility space” for each patient. They are driven by their professional service orientation and values to seek out the peak that provides the highest level of value. This may prove difficult for doctors if the number of mutual or conflicting constraints becomes such that no optimal peak appears on a more rugged landscape. In such cases, the landscape is comprised of several sub-optimal peaks which may dampen fitness seeking behaviour and encourage lock-in.

Value peak climbing for healthcare service delivery. Once doctors have evaluated and chosen a peak that they consider to be the most appropriate for value creation and delivery, they *climb* it by assembling and combining the required resources and managing their conflicting constraints. They may also choose to recombine existing resources including medical equipment, a telephone, an office and administrative or clinical support as well as digital resources (Henfridsson *et al.*, 2018) such as the Electronic Medical Record (EMR). When doctors choose to climb a new peak, they enact a new value proposition. In doing so, they transform the value proposition in practice² since they change the way they create and

² We consider “value proposition in practice” in a similar way to “value proposition in use” (Barrett *et al.*, 2016).

deliver value to patients. Until a doctor climbs a peak to provide the service, the peak is simply a possibility, and its height (i.e., level of value or fitness) is just an estimation and the value proposition remains unproven.

An evolving value landscape in a co-evolutionary ecosystem. A doctor does not work in isolation but rather in a co-evolutionary ecosystem with other populations, notably patients, each with their own landscape. The nature of the doctor-patient relationship implies that their landscapes are coupled: a change in one landscape can modify the topology of the other. For example, if patients change their preferences for a medical procedure, this will alter the corresponding value peak on their doctor's landscape.

The availability of new digital resources or disruptions caused by external events may also lead to *value landscape evolution*. As novel organisational or digital resources are introduced and allow for alternative resource combinations to create and deliver value to patients, new peaks appear on the doctor's landscape. Changes to existing resources (e.g., significant software updates) may also modify the height of existing peaks.

External events may also transform the topology of the landscape, since each peak reflects the fitness of a given resource combination for value creation and delivery within a specific environmental context. For example, when government regulations allow for or forbid the use of certain processes, medical devices or clinical practices, some peaks may rise, some may fall and new peaks may appear.

Hiking across the value landscape in search of higher fitness. As the value landscape evolves, a doctor's professional autonomy (Adler & Kwon, 2013) and individual pursuit of purpose and novelty (Felin & Kauffman, 2019) all motivate their *fitness seeking* behaviour to search for and test new value peaks. Once a peak is identified, a doctor may reach it by *hiking* across the value landscape: they "walk" to proximal peaks that require only small adjustments to the resources used (e.g., the substitution of one diagnosis technology for another) for value

creation and delivery to patients, and “jump” to distant peaks when several simultaneous changes to their resource combination (e.g., new digital technology as well as modified organisational processes or rules) are necessary. Doctors may have difficulty or resist modifying their resource combinations due to habit or preference (e.g., in-person consultations are preferred to tele-consultations). “Value peak lock-in” may also result from difficulties seeing or reaching higher peaks elsewhere on the landscape.

As doctors hike across their value landscape, interact with their environment, and discover new resource combinations, they learn from these experiences and expand their possibility space for value creation. Table 1 summarises the concepts related to the fitness landscape metaphor. The parent categories are in bold. They all relate to the more general category of *fitness seeking*: doctors are driven by their fitness seeking behaviour to hike across an evolving landscape in search of higher peaks.

Concept	Definition
Value peak climbing	Assembling and combining the required resources and managing their conflicting constraints to deliver value to patients.
Value peak appraisal	Appraising the level of fitness of a resource combination to provide value to patients.
Resource combination	Combining and using multiple resources to create and deliver value to patients. The resulting mode of value creation and delivery corresponds to the value proposition.
Conflicting constraints	Conflicts that arise when interdependent resources have incompatible requirements or goals. These conflicts require compromise solutions that constrain the fitness of a given resource combination.
Value landscape evolution	Changes in the topology of the doctor’s value landscape due to external events, the possibility of new resource combinations, and the changes in the topology of coupled landscapes.
External event	Exogenous changes in an organisation’s social, economic, political, regulatory, and competitive environments that affect the topology of the value landscape.
New digital resource	Perturbations to the landscape brought by the introduction of one specific digital resource.

Co-evolution with patients	Changes to the landscape due to changes in the behaviours and preferences of coupled populations (e.g., patients).
Landscape hiking	Adaptive moves by doctors to another peak in search of a more appropriate resource combination for value creation and delivery to patients.
Local walk	Minor changes in resource combinations to create and deliver value. Local walks are moves to a proximal peak (i.e., requiring only a small adjustment to the resource combination to improve value).
Distant jump	Multiple changes in resource combinations to create and deliver value. Distant jumps are moves beyond local peaks to distant peaks (i.e., requiring multiple, simultaneous adjustments to the resource combination to improve value).
Peak lock-in	Adhering to an existing value proposition (and resource combination) because of individual preferences by doctors and patients. Lock-in may also be caused by the perceived absence of an alternative peak of greater height.

Table 1. Main concepts of the intermediate conceptualisation

As suggested by Hassan and Lowry (2015), we next refine this intermediate conceptualisation using an empirical study.

4. Method

The empirical study of how doctors in French hospitals digitally transformed their service provision during the COVID-19 pandemic allowed us to observe how DT unfolds in professional healthcare practices. The pandemic was an obvious occasion to study how external events triggered changes to existing regulations, including the availability of new digital resources. The pandemic notably forced healthcare professionals to reconsider how they could deliver care to patients.

4.1. Data collection

Our data collection was based on semi-structured interviews “to obtain both retrospective and real-time accounts by those people experiencing the phenomenon of theoretical interest” (Gioia

et al., 2013, p.19). We initiated the data collection in June 2020 concerning the use of tele-consultations provided by hospitals to patients in replacement of in-person consultations during and after the COVID-19 lockdown in France. First, we conducted interviews with CIOs across eight French hospitals to understand how they managed the sudden IT related changes that tele-consultations required. We found that CIOs extended the existing IT infrastructure by purchasing digital resources such as cameras, laptops, a VPN connection, software and licenses for doctors who could then decide whether and how to offer tele-consultations from their homes or from the hospital. We then interviewed two doctors from different hospitals who explained how they complemented the digital technologies provided by their respective IT departments with other more tractable devices and software at their discretion to accommodate patients' needs.

Our initial data highlighted a transformation process that was different from what is usually described in the literature (Markus & Pfeffer, 1983; Cooper & Zmud, 1990; Bingi *et al.*, 2001) and more specifically in a healthcare context (Oborn *et al.*, 2011; Cucciniello *et al.*, 2015; Czekierda *et al.*, 2015). Rather than a top-down initiative that involved a single sophisticated technology driving the transformation, doctors would choose among multiple digital technologies to provide a consultation. The combination of different digital technologies with other organisational resources allowed doctors to find new ways of creating and delivering value to patients that better accommodated patient needs and legal requirements. Based on these initial insights, we decided to conduct twelve more interviews with doctors (between June and October 2020) to investigate the reasons and consequences of their new practices. The second round of data collection reinforced the insights gained in the previous interviews with doctors.

The data collection process unfolded as follows. The first author sent an initial invitation by email and via LinkedIn to fifty-two CIOs of French hospitals. After one follow-up message, eight CIOs agreed to participate in the study. Doctors were recruited through professional

networks and by snowballing, aiming to obtain a diversity of medical specialties and hospitals. Fourteen doctors agreed to be interviewed for the study. The inclusion criterion was that doctors conducted consultations with outpatients. All doctors were tenured (i.e., they held a position as a civil servant). Three doctors also had a university position as professors in medicine. The age of doctors varied from 35 to 50 years old. Among them, five doctors were female. All the hospitals were urban hospitals. In French hospitals, doctors can only have a medical activity related to inpatients (i.e., hospitalised patients) or a mix of medical activities for inpatients and outpatients (i.e., external patients). Inpatient care requires team coordination with nurses, other clinicians and medical departments. A doctor's direct activity in this case is mostly related to following-up and monitoring of patients. In addition, doctors have a consultation-based activity in an equivalent way to general practitioners, although only for outpatients. The sample characteristics for doctors and CIOs are presented in Appendix 1.

Interviews lasted an average of 75 minutes for CIOs and 40 minutes for doctors. We conducted the interviews in French and then translated and coded them in English. For each CIO, interview questions captured their perspectives on the external and internal changes related to tele-medicine and tele-work in their respective hospital since the first lockdown in France. We asked questions about the digital resources used in response to the pandemic and the required changes to healthcare practices in general. Interview questions to doctors captured their perceptions about the overall changes to their practices before, during and after the lockdown. We asked them about their views on the digital technologies implemented for tele-medicine (mostly tele-consultation), the devices they used, the reasons for their use, as well as the advantages and disadvantages of such use from a service provision perspective (see Appendix 2 for detailed interview guides).

We drew on two sources of secondary data to corroborate the insights produced by the primary data: documents provided by the national French Health Agency (including documents

on regulatory changes), and the professional literature on tele-medicine. The professional literature allowed us to compare our case study with healthcare practices in other countries during the pandemic since health authorities in several countries had implemented similar incentives for tele-consultation services during the COVID-19 pandemic (Baudier *et al.*, 2021). For example, in the United States of America, tele-consultation using consumer IT such as Skype, Zoom, Google Hangouts and Facetime were authorised and reimbursed at the same rate as in-person tele-consultations (Smith *et al.*, 2020), and various IT tools including telephone complemented the Electronic Medical Record (EMR) to provide tele-consultation services (Smith *et al.*, 2020).

4.2. Data analysis

In the initial stage of the data analysis, we discovered that doctors explored different modes of tele-consultation and therefore assembled different resources to perform them, taking into account patients' equipment and preferences. Hence, to better understand what was at play, we constructed a flow-chart for each doctor to get an overview of the actors, activities, events and the interactions between them over time (Langley & Truax, 1994; Langley, 1999). A sample flow-chart for one doctor is displayed in Figure 1.

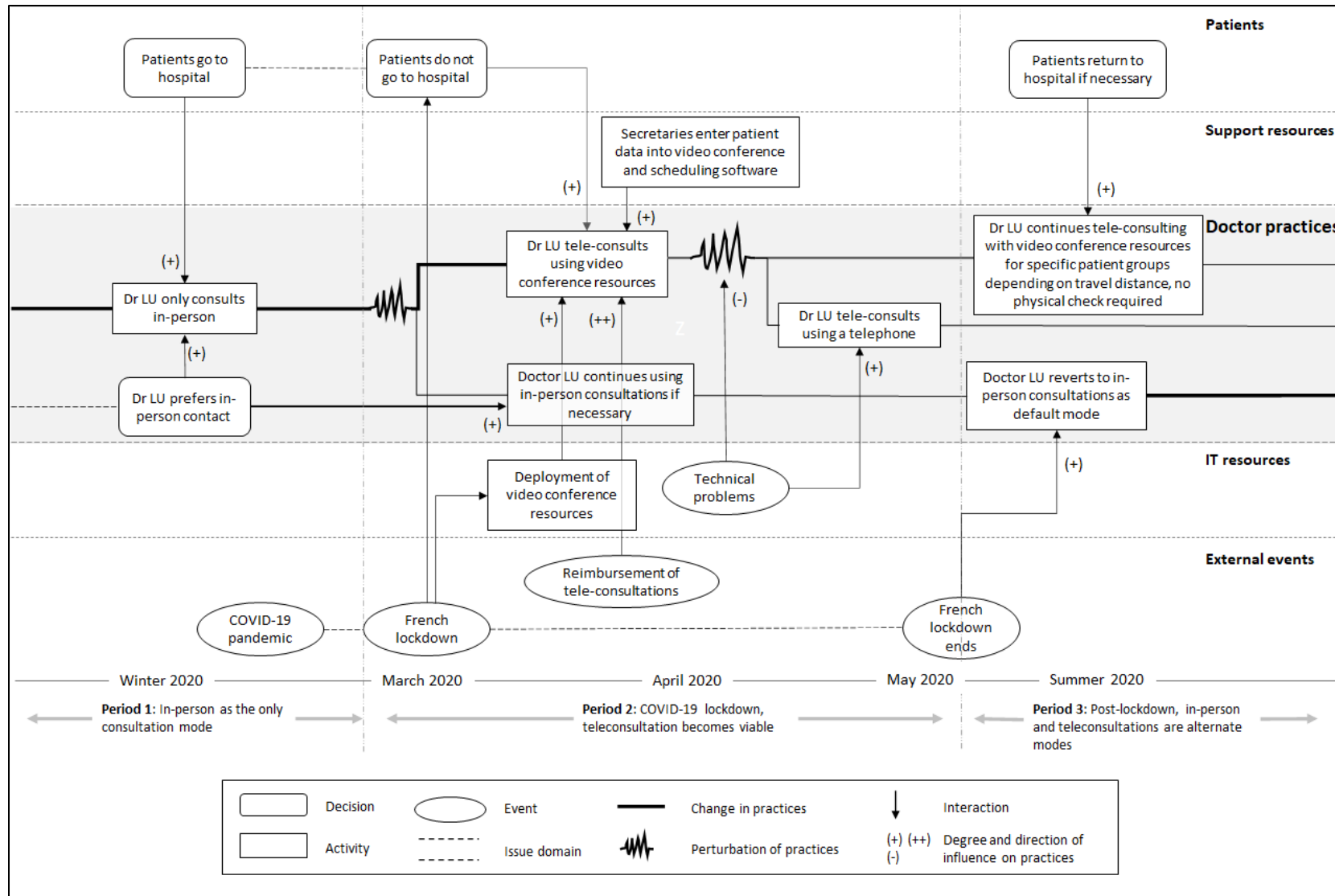


Figure 1. Illustrative process flow-chart for one doctor (Dr LU)

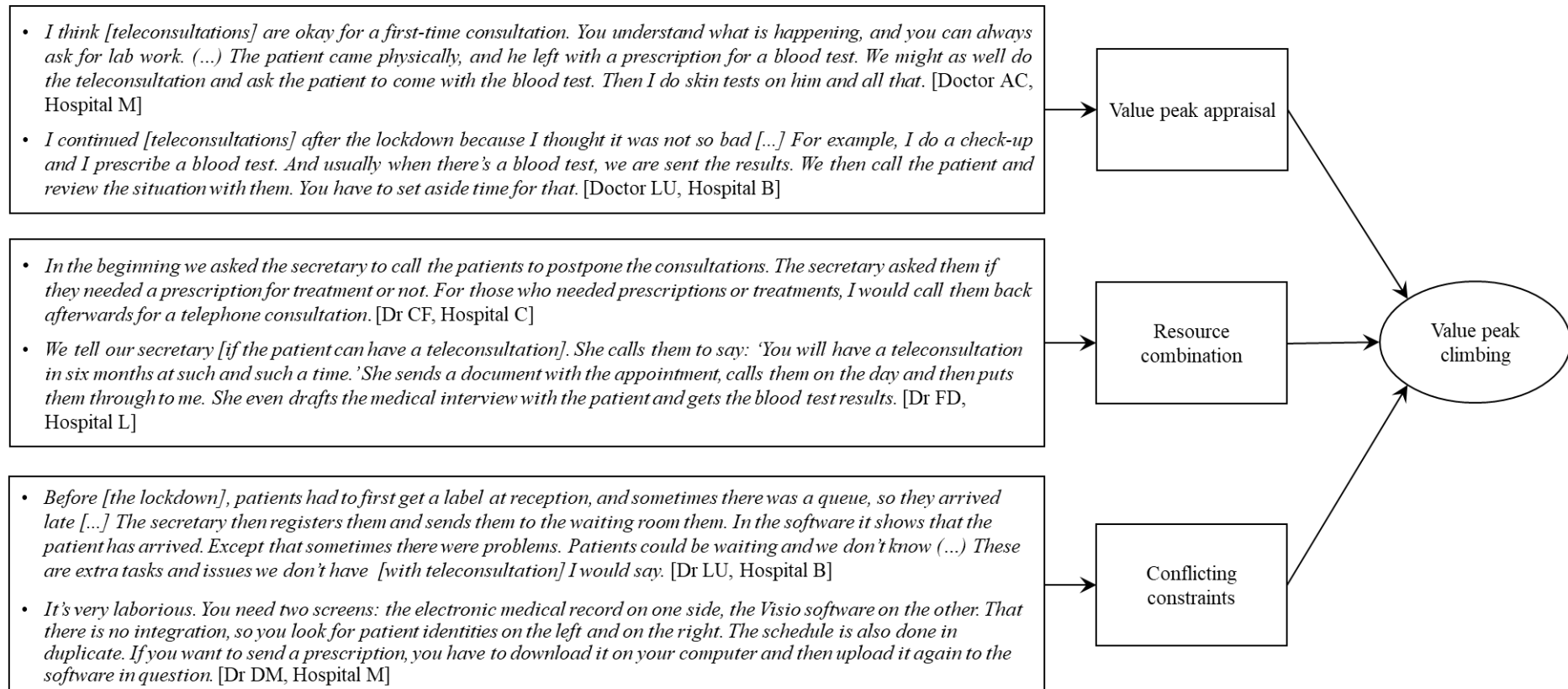
Each flow-chart was used to represent an event and activity chronology. Activities (sharp-cornered rectangles), decisions (rounded-cornered rectangles) and events beyond the control of the organisation (ellipses) were chronologically ordered. The five bands indicate the issue domain within which the activity, event or decision occurred. The central band “doctor practices” was the focus of our analysis. The horizontal lines represent the chronology of these practices, and the vertical arrows identify the influences of the events, activities and decisions thereon. The staggered line represents a perturbation of practices following an interaction with an event, a decision or an activity.

The flow-chart served as an intermediary step between the raw data and the data analysis. We observed that doctors had changed their practices by exploring different modes of consultation to create and deliver value as a response to an external change (the lockdown related to the COVID-19 pandemic). Going back to the literature, we searched for a theoretical lens to enlighten this process and we found that the fitness landscape metaphor could help us better understand the transformation of doctors’ practices as an evolutionary process. We then built our intermediate conceptualisation (Hassan et al., 2019; Hassan & Lowry, 2015) of digital transformation in healthcare practices and consequently used its concepts to code our data (see Table 1 for an overview of concepts).

Following the flow-chart overview, we relied on three analytical tools (Miles & Huberman, 1994; Langley, 1999; Pentland, 1999; Corley & Gioia, 2004; Riessman & Quinney, 2005). First, we prepared vignettes (Miles & Huberman, 1994; Pentland, 1999; Seidman, 2006; Vaghefi *et al.*, 2022) based on doctors’ and CIOs’ individual stories (see Appendix 3 for the presentation of four vignettes). Besides displaying each account of our interviewees, the vignettes served to build the chain of evidence between the empirical data with the concepts used to code them. Second, we built the data analysis scheme (Figure 2) inspired by the methods of thematic analysis (Boyatzis, 1998) and data structure (Corley & Gioia, 2004) to establish a

link between the data and our intermediate conceptualization (section 3.2). This analysis scheme includes the concepts and categories summarised in Table 1. It was developed through an iterative coding process supported by Nvivo software and discussed and refined by the authors in several rounds until an agreement was found over the final data analysis scheme.

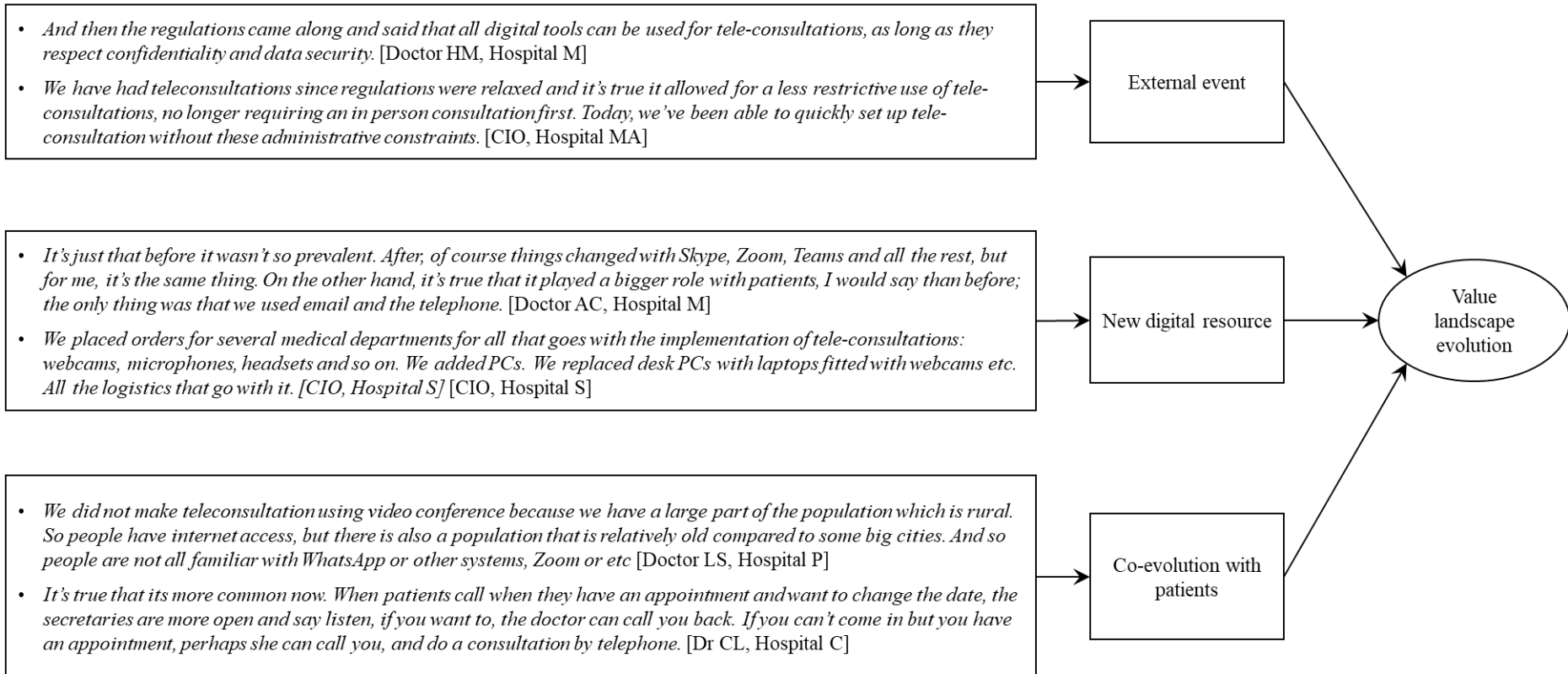
Empirical observation



Empirical observation

Concept

Category



Empirical observation

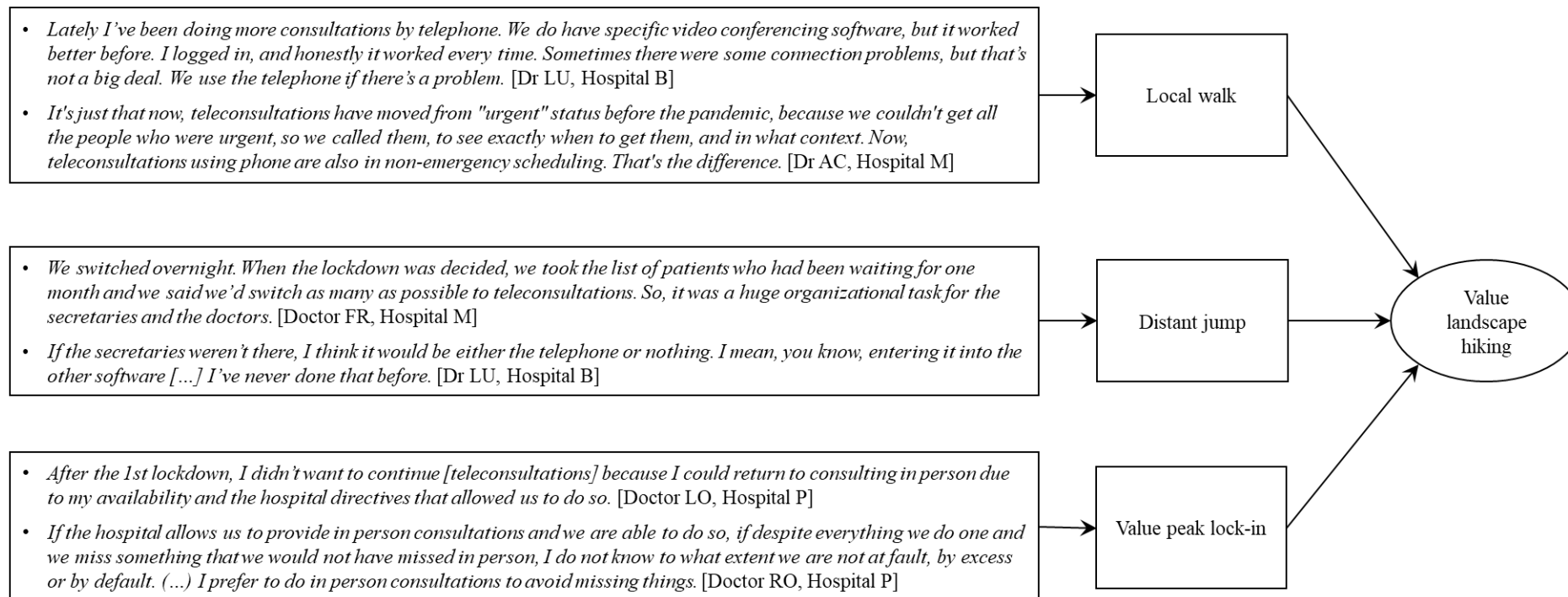


Figure 2. Data analysis scheme

Third, we constructed a generic narrative based on the vignettes and the analysis scheme (Pentland, 1999; Dunford & Jones, 2000; Riessman & Quinney, 2005). The narrative represents the evolutionary process of the digital transformation of doctors' practices. Narratives are stories of events and their consequences related to what the interviewees have experienced. They reveal the causal logic of the phenomenon at stake, taking into account the voices of different actors.

To best highlight the different voices, we illustrate the generic narrative with "texts" (Pentland, 1999), i.e., quotes or the telling of the story by a specific interviewee. The source of each interview quote is identified by the corresponding interviewee's first initials (e.g., "Dr JD" refers to Dr Jane Doe) and hospital code (e.g., "CIO A" refers to a CIO from Hospital A).

5. Findings

We present here a generic narrative of how doctors' practices evolved due to changes brought by the COVID-19 pandemic. The structure of the narrative follows the logic of the analysis scheme, including *value peak climbing*, *landscape evolution* and *landscape hiking*.

5.1. Value peak climbing

Prior to the COVID-19 lockdown, doctors undertook most consultations with patients in-person. To perform in-person consultations, doctors combined various resources, including physical facilities (e.g., an office, a waiting room), rules and procedures (e.g., administrative procedures for patient identity management) and digital resources such as patient appointment software and the EMR (i.e., for patient history and laboratory results).

Most doctors only used in-person consultations and did not tele-consult, except for some in specific medical specialties and where their hospital CIO had implemented dedicated video conferencing software. Such software was always developed by national or regional health

agencies and was mostly used for pilot medical projects. Regulations also imposed conditions concerning the patient participation in these projects; for example, patients had to have already been admitted to the hospital and consulted by the doctor in-person.

Sometimes, doctors used the phone to share information with patients, although these calls were not recognised as formal consultations by France's national health agency, and therefore could not be billed, as explained by a doctor and then by a CIO:

[Before the lockdown], we gave information [by phone], but we never billed it [as a tele-consultation]. We only billed patients who physically came here. [Dr AC, Hospital M]

[...] there were already tele-consultation tools in place in our hospital, but with a rather low level of implementation. [CIO, Hospital MA]

When doctors had the possibility to tele-consult and chose to do so, they were required to modify the combination of resources they used to provide the healthcare service. For example, they no longer needed to manage patients in the waiting room, nor wait for patients to obtain an ID label from the hospital's admissions system, but they were required to manipulate specific video-conferencing software or the phone.

5.2. Landscape evolution

As France entered its first COVID-19 lockdown³, the French government strongly encouraged patients to stay at home. Regulations were relaxed to facilitate remote consultation and ensure continuity of health services. All of the conditions required of patients to be tele-consulted were removed and billing was allowed for all tele-consultations, including those using video conferencing software and the phone. Doctors were also allowed to use consumer IT (e.g., Skype or apps on their mobile device) or dedicated tele-consultation platforms developed by

³ From March 17 to May 11, 2020.

regional health agencies. These relaxed regulations, which remained after the lockdown and were still in place in late 2022, are detailed in a legal document published by the French Government:

The derogatory measures maintained and applicable in the field of tele-consultation are:

- exemption from prior knowledge of the patient and respect for the care pathway [...];
- 100% billing of tele-consultations for all patients [...];
- Tele-consultations by phone (without video transmission) with 100% billing support. [French national health insurance website]⁴

At the beginning of the lockdown, the CIOs of most hospitals actively worked to procure and deploy new digital technologies to support tele-consultations (e.g., cameras, laptops). A CIO reports on the quick expansion of existing digital resources:

We placed orders for several medical departments for all that goes with the implementation of tele-consultations: webcams, microphones, headsets and so on. We added PCs. We replaced desk PCs with laptops fitted with webcams etc. All the logistics that go with it. [CIO, Hospital S]

In addition, most CIOs implemented the video consulting software developed by the regional health agency, providing doctors with additional resources. As this software took time to implement, some doctors instead began using consumer IT such as Zoom or Skype for tele-consultations. All these new digital resources continued to be available and to be used after the end of the lockdown period. A CIO summarises these changes as follows:

[Doctors] encountered the same problems: the supply of webcams and headsets and small equipment needed for tele-consultations. These are actions that will obviously

⁴ Source: <https://www.ameli.fr/medecin/actualites/covid-19-le-point-sur-les-mesures-derogatoires-pour-les-medecins>, consulted on 8/11/2022.

remain active in the future. They [new equipment] will be available for use over time and therefore continue to benefit all users. [CIO, Hospital A]

The decision to continue in-person consultations, to switch to tele-consultations or to postpone all consultations after the lockdown was left to the discretion of each doctor. There was no financial incentive to continue consultations during the lockdown as doctors working in French hospitals were mostly civil servants who earned a fixed monthly salary and were not remunerated on a per-consultation basis. Also, the French Health Ministry compensated hospitals for their loss in revenues due to the fall in in-person consultations during the lockdown, for cancellations of elective surgery, and for their focus on health services for COVID-19 patients.

5.3. Landscape hiking

During and after the lockdown, doctors had a wider choice of possible consultation modes: in-person consultations and tele-consultation with video-conferencing software, consumer IT, or a phone. New combinations of resources had to be assembled for doctors to be able to use these modes. For example, the use of video conferencing software notably required new administrative steps for patient registration in the EMR and video conferencing software, and other digital technologies such as dual screens to display the software output. As one doctor explains:

I look after both the data entry of medical information, and then the essentials of the report in the EMR. So, I end up working with two screens. I have [video-consulting software] on one side and the EMR on the other. That too, the fact that it is not integrated with the EMR, when you only have one screen, you must go from one window to another. Either you see the patient, or you see his file, but you can't see both at the same time. What's managed through [video consulting software], apart from tele-consultation, is the prior transmission of documents by the patient. And then it also adds extra tasks because I must leave the EMR to

generate a document and send it to the patient via the video consulting software, because it is a secure data sharing system. Otherwise, many prescriptions are sent by a simple email, which is not at all secure, I agree. [Dr PF, Hospital M]

These additional tasks are examples of conflicting constraints that arise when resources are combined. In this case, tele-consultations involve additional tasks and security risks, that counterweigh the advantages of this mode. Similarly, new consultation modes created additional tasks for secretaries when doctors relied on them to help manage and assemble resource combinations for healthcare service delivery. One doctor explains that without secretarial resources it would not be possible to use this consultation mode:

If the secretaries weren't there, I think it would be either the telephone or nothing. I mean, you know, entering it into the other software [...] I've never done that before. I don't know how long it takes [...] It's true that entering the appointment in two different programs [is time consuming]. [Dr LU, Hospital B]

As doctors gained experience with alternate consultation modes, some started to select patients for tele-consultations or in-person consultations. Doctors arbitrated between similar modes of consultation in search of the most appropriate combination of technologies and procedures to provide healthcare services to patients. For example, doctors chose to provide in-person consultations, even during the lockdown, if they judged that this was necessary given a patient's pathology and the clinical need for physical examination:

We like the in-person contact and they like it too, the patients I mean. But in addition, there is no other type of cancer where you can really follow up on the disease with a blood test and three or four questions. That's it. Finally, it's a very specific indication. For other cancers, there is no follow-up by a simple blood test that allows us to see whether things are going well or not. So that's why we didn't use tele-consultation for long for other indications. We came back [to in-person consultations] rather quickly [...] Let's say that it was a degraded [consultation]

mode because we could hardly do otherwise, but we've since gone back to our old habits. [Doctor FD, Hospital L]

Some doctors also considered a patient's preferences or personal situation such as age or required travel time to the hospital, when choosing a consultation mode. A doctor explains how she changed her practices according to this new assessment of patients' needs and preferences:

The fact is that I have quite a few patients who live far away and it's true that it suits them [to have a tele-consultation]. There are several patients who appreciate [tele-consultations], because of the time it takes in the car, finding a parking place and coming to the ward and so on. And then sometimes I'm late, etc. So, they like it. That's it. For consultations that we know won't take much time, where we don't need to do tests, then a tele-consultation works well. It suited [the patients] and we also found that it worked well. [Dr LU, Hospital B]

For some patients, the use of video conferencing software for tele-consultation was not always possible due to a lack of patient access or skill. In such cases, doctors switched to consumer IT, such as Skype or Whatsapp. As a doctor explains:

It depends on the patient's equipment and the urgency [of the consultation]. Most people already have [WhatsApp]. That allowed us to respond because we switched overnight. When the lockdown was decided, we took the list of patients who had been waiting for one month and we said we'd switch as many as possible to teleconsultations. The tools that had been developed by the health authorities and the hospital were no doubt useful, but they are sometimes a bit complicated, whereas applications, you already know how they work. I'm talking about WhatsApp because that's the one we used, but any application works well, in fact very, very well. [Dr FR, Hospital M]

Some doctors started to use the video conferencing software developed by health agencies and implemented by their CIO, but when technical problems arose or patients were unable to use the system, they quickly switched to the phone, as a doctor reports below:

But we have a population of patients that is systematically over 50 years old, even over 60 years old for a large part. And so, for one patient in three, we use a phone base tele-consultation, where we don't use the video system. Clearly, for older patients, it's complicated. [Dr FR, Hospital M]

Often, the phone was used for tele-consultations as a more convenient or failsafe mode both for doctors and patients. The CIOs were aware of these preferences:

We covered about a third of the tele-consultations with the [tele-consulting software] which is for us the long-term solution. In April we had 4,500 tele-consultations. We covered 1,500 with the [tele-consulting software]. So that means that everything else has been done either by phone or, well, mainly by phone. There are some who had videoconferencing rooms, who did them by videoconference. 80% it was done by phone. And it wasn't necessarily the fault of the patient or the doctor. If on the patient's side the bandwidth was not sufficient, or if on the doctor's side there was no webcam, they would use the phone. [CIO, Hospital SE]

Some doctors were also more comfortable maintaining in-person consultations during and beyond the stay-at-home policy, thereby not modifying health service delivery for patients. As one doctor explains:

After the lockdown, I did not wish to continue the [tele-consultations] because I was able to return to in-person consultations due to my availability and the hospital directives allowed us to do them in-person. [Doctor LO, Hospital P]

Prior to, throughout and beyond the lockdown, the choice of consultation mode, whether in-person or via tele-consultation using video-conferencing software, consumer IT or the phone remained with individual doctors. Compared to the single consultation mode (in-person) consultation before the lockdown, new modes (tele-consultation using official videoconferencing software, consumer IT, or the phone) became possible during and after the

stay-at-home orders; moreover, the choice of consultation mode was influenced by patient needs and attributes.

By the end of the lockdown, doctors' landscape had shifted from a simple landscape with one optimal peak (i.e., in-person tele-consultation), to a more rugged landscape with alternative peaks that doctors can move to depending on the categories they perceive for a patient's situation, pathology and stage in the clinical process. Often these moves involved leveraging digital technologies to deliver medical services for a specific patient category.

6. Discussion

Our empirical study allowed us to refine the intermediate conceptualisation that we had constructed using the DT literature and the specificities of professional healthcare practices viewed through the lens of the fitness landscape metaphor. We next present the refined conceptualization before preceding to evaluate it in light of extant theories of digital transformation (Lyytinen & Newman, 2008; Hassan & Lowry, 2015).

6.1. DT of professional healthcare practices: a refined conceptualization

The refinement of our intermediate conceptualisation (Section 3.2) allows us to improve our middle-range theorisation. Firstly, the empirical study highlights that *DT of professional healthcare practices is a continuous fitness seeking process, by which healthcare professionals continually adjust resource combinations and manage the conflicting constraints that arise from them to improve value creation and delivery for their patients.* Driven by their professional service orientation, doctors constantly appraised the appropriateness of consultation modes to create and deliver value to patients. The fitness seeking behaviour of doctors results in a *sustained DT* process that is both intentional and lasts over time (Taylor *et al.*, 2019). As doctors adapted to a landscape that was transformed and expanded by relaxed government regulations, changing patient behaviours and the availability of digital technologies, they learnt to adjust

value creation and delivery to specific patient groups. Doctors revised initial operational categorisations of patients (e.g., according to their health condition) by considering new criteria, such as the trade-off between the effort needed for patients to come to the hospital with the benefits of an in-person consultation (e.g., necessity of a physical examination), and the requirements of the specific stage of the clinical process (e.g., less need of physical examination for a follow-up consultation). The result was a “segmented” value proposition that persisted beyond the lockdown period.

Secondly, the empirical study enables us to refine the concept of fitness within a healthcare context. Following the metaphor, our intermediate conceptualisation defined fitness as the possible level of value created and delivered on each peak. However, while the height of a peak influences the choice of consultation mode by a doctor, in so far as it reflects the potential for value creation and delivery, *the actual value created and delivered by healthcare professionals depends on how high they climb each peak*. It is this height that describes a doctor's individual level of fitness, i.e., the value of the healthcare service that they can *individually* produce and deliver in practice to a patient within a specific environment.

Thirdly, our empirical study allows us to clarify the role of rugged landscapes. Our intermediate conceptualisation posited that a more rugged landscape composed of multiple sub-optimal peaks, would dampen the fitness seeking behaviours of doctors and favour peak lock-in. However, our empirical study highlighted that *such a rugged landscape also creates multiple and sometimes conjoint opportunities for digital transformation*. By the end of the lockdown, doctors’ landscapes had shifted from a “Fujiyama” (Kauffman, 1993) or “Kilimanjaro” (McKelvey, 1999) landscape, with one optimal peak for value creation and delivery (i.e., in-person consultations), to an expanded and more rugged Australian “Blue Mountains”⁵

⁵ Australia’s Blue Mountains are renowned for the Three Sisters rock formation that consists of three sharp peaks of similar height.

landscape with a number of alternative peaks that doctors can move to depending on a patient's situation, pathology, or stage in the clinical process.

6.2. DT of professional healthcare practices: an evaluation

Our middle-range theory of DT of healthcare practices complements previous theories of DT that emphasise DT as a process (e.g., Wessel *et al.*, 2021). Moreover, it aligns with prior literature that emphasises the role in digital transformation of changes in customer expectations (Liddell & Morris, 2010; Vial, 2019; Volberda *et al.*, 2021), consumer behaviour (Vial, 2019) and the value proposition (Yoo *et al.*, 2010; Barrett *et al.*, 2015; Wessel *et al.*, 2021) as core concepts in the process of digital transformation.

We theorise that DT in a professional context emerges from the adaptive changes that healthcare professionals make to their practices as they seek to provide value to patients in a changing environment. In this way, our middle-range theory resonates with recent studies that recommend using complexity theories to explain the dynamics of organisational change (Plowman *et al.*, 2007; Poulis & Poulis, 2016; Poulis *et al.*, 2021). It also follows calls for theorisation in the MIS field to take into account the specificities of the organisations within which transformations occur (Hassan & Lowry, 2015; Noesgaard *et al.*, 2022).

While prior literature has highlighted the role of digital technologies in creating disruptions that generate strategic responses from organisations as they seek to alter their value creation paths and manage the related structural changes and organisational barriers (Vial, 2019; Wessel *et al.*, 2021), our middle-range theory provides a more nuanced understanding of this process in the specific setting of professional healthcare practices. More specifically, digital technologies are envisioned as drivers of change but also as resources combined with other organisational resources by healthcare professionals as they search to provide the most appropriate value for their patients. New digital resources deepen the base of available resources for service provision, expand the possibility space of resource combinations (Henfridsson *et*

al., 2018) and allow for the emergence of new value propositions. We offer a dialectical perspective on this process, which highlights the role of conflicting constraints raised by resource interdependencies and the role of professional autonomy as an important mechanism in managing those constraints.

Relatedly, our middle-range theory underscores the evolutionary nature of the DT process in professional healthcare practices as “interactive, local, unpredictable, and emergent” (Chae, 2012, p.813). The process is interactive given that the height of a peak may depend on doctors’ co-evolution with their patients. The process is local in that it is bounded by the characteristics of the practices of healthcare professionals (e.g., the available resources in a hospital and a professional's preferred resource combination). The process is also unpredictable in that disruptive, external events may impact how the landscape evolves (e.g., a change in regulations due to the COVID-19 lockdown which allowed for new digital resources) and unanticipated conflicts may arise when combining interdependent resources (e.g., administrative difficulties working with video consultation). Finally, the process is emergent in that healthcare professionals transform the value proposition in practice in a continual cycle of discovery, experimentation, learning and transformation as they hike across the value landscape. At the same time, this process is also intended as healthcare professionals combine digital resources to change their practices in order to deliver new or improved value to their patients.

In sum, we believe that middle-range theories that take into account the specific context of the organisations within which they occur (Hassan & Lowry, 2015), should complement general theories of DT. Our concrete conceptualization of DT of professional practices in healthcare includes the very characteristics of this context, and in particular the role of professional service orientation and autonomy.

6.3. Theoretical contributions

Our paper proposes two theoretical contributions. First, our middle-range theory highlights the process of digital transformation at the operational level of healthcare professional practices, thereby complementing the extant literature that focuses on DT at the strategic level. Indeed, previous studies have offered somewhat linear approaches of DT, envisioned as strategic driven change (Yeow *et al.*, 2018; e.g., Vial, 2019; Wessel *et al.*, 2021). Our study shows that the value proposition can be transformed at the operational level both in an *unprompted*, emergent way, when healthcare professionals hike different paths and explore different peaks and value propositions across their value landscape. At the same time, digital transformation can also be *prompted* as healthcare professionals use their autonomy to deliberately change the value proposition in practice. Healthcare professionals make ongoing assessments and choices of the most appropriate way to create and deliver value for different patient categories. A choice is not made definitively, but for each situation according to a professional's assessment of their environment, the available resources, and their own ability to climb a peak. Value creation and delivery at the operational level is enabled by a healthcare professionals' autonomy that allows them to search for solutions to problems caused by disruptive external events, make choices relative to resource combinations used and, ultimately, to transform the value proposition in practice.

Second, our middle-range theory adopts an evolutionary perspective, which contrasts it from previous approaches that have viewed DT as strategic for organizations with a specific focus on strategic actions and plans (Yeow *et al.*, 2018; Vial, 2019; Wessel *et al.*, 2021). These studies follow the broader paradigm of organizational change conceptualised as a punctuated equilibrium (PE) (Gersick, 1991; Lyytinen & Newman, 2008; Besson & Rowe, 2012). PE purports that organizations alternate between long periods where stable infrastructures allow only for incremental adaptations (i.e., equilibrium), and short periods of revolutionary change

(i.e., punctuation) that break up deep organizational structures. While some authors have described how transformations emerge from practices (e.g., Baptista *et al.*, 2020; Gkeredakis *et al.*, 2021), PE has been the dominant theory of IT enabled organizational transformation, conceptualised as monolithic change (Besson & Rowe, 2012). Therefore, when scholars present DT as the evolution of IT-enabled organizational transformation (e.g. Vial, 2019), they mainly focus on these processes. When DT is conceptualised as a fundamental and strategic transformation of an organization's value proposition (e.g., from product to service orientation), the emphasis remains on the “revolutionary” stage where transformation is driven by strategic opportunities and actions. Recently, Hanelt *et al.* (2021) conceptualised DT according to PE but admitted that organizations may stay in a state of constant change due to the inherent turbulence of digital business operations and ecosystems.

The distinction between our middle-range theory and PE may be illustrated using the metaphor of mountain ranges provided by Kauffman (1993). Here, PE's emphasis on a revolutionary state and the implementation of one digital technology corresponds to a single optimal peak, akin to Kauffman's Fujiyama landscape. Our middle-range theory emphasises a more rugged landscape, with multiple peaks of similar height, like those in Australia's Blue Mountains: there is no one, optimal peak. Instead, doctors move between alternative sub-optimal peaks for value creation and delivery depending their patient's situation, pathology or stage in the clinical process and the availability digital technologies.

One can argue that a professional's adaptive actions may also be envisioned under the well-known lens of incremental change (Wollin, 1999). Our proposed middle-range theory also differs from this perspective. Similar to PE, incremental change is a linear and simple process that reaches an identified outcome (i.e., a stable state). On the contrary, we theorise DT as a dynamic process in which professionals can go from one fitness peak to another; there is no

outcome (i.e., stasis) of this process that is characterised by movement, interaction, and adaptation as professionals seek an optimal “peak”.

Thus, our middle-range theory proposes an alternative to more linear theories: DT emerges from healthcare professionals’ individual actions as they co-evolve with their environment in the pursuit of goals (i.e., service-based value delivery). Their professional service orientation and autonomy drive and enable fitness seeking behaviours that result in the discovery of new paths and peaks on their value landscape, the emergence of new value propositions in practice, and when digital resources are leveraged, the digital transformation of professional healthcare practices.

6.4. Implications for practice

Our middle-range theory has several practical implications for professionals and managers in healthcare. DT is typically rationalised as a top-down process based on strategic actions at a corporate level. Alternatively, our study shows that the strategic and operational levels are interrelated in a professional healthcare context. This means that healthcare professionals actively manage DT when they combine digital and organisational resources to create and deliver value according to operational categorisations of their patients. In so doing, their role becomes increasingly important in terms of managing and sustaining DT over time. This role is demanding since a healthcare professional works in a co-evolutionary ecosystem where they must continuously take into consideration how patients’ landscapes evolve. Furthermore, some healthcare professionals may not feel competent in making the adaptive moves required for transforming their practices because of habits or a lack of skills that may not related to a technology but rather to its combination with other organisational resources.

The role of corporate-level managers also naturally changes. Apart from setting the strategic direction of DT efforts in collaboration with healthcare professionals, they need to not only focus on the implementation of new digital technologies but also to adjust and improve

combinations of interdependent digital and organisational resources. For example, given the influence of landscape topology on the evolution of professional practices, a CIO's actions in a hospital can be seen as an opportunity for "digital landscaping". The introduction of new digital resources can modify the structure of the landscape, while training and coaching can influence a healthcare professional's ability to find and climb peaks and move across the landscape.

7. Concluding remarks

The statement by Kauffman "what a strange pleasure it is to seek" served as inspiration in our search for understanding how and if the process through which DT unfolds in professional healthcare practices differs from the general conception of DT. An empirical study of how doctors in French hospitals digitally transformed health service provision during the COVID-19 pandemic underscored that we need to move beyond the dominant understanding of DT as a top-down and strategically planned process. Our main contribution is a middle-range theory of the DT process of professional healthcare practices. To that end, we transpose the metaphor of fitness landscape from evolutionary biology to a professional healthcare context and show how newly available digital resources increase the possibility space for value creation and how healthcare professionals, in the face of external events and co-evolutionary pressures from patients, search for and experiment with new combinations of resources. In such a context, healthcare professionals need to know how to actively manage resource combinations and their resulting conflicting constraints to deliver on the service value proposition. DT emerges from the continuous adaptive changes to the combination of resources used to deliver services of value to patients. Our theory is bounded by the specificities of a professional healthcare context in which the value proposition is transformed in practice at the operational level.

This study has some limitations that invite for further research. First, we argue that our empirical study of doctors in French hospitals is typical of the phenomenon of interest. Along with lawyers, doctors are considered one of the most highly professionalised occupational

categories. Yet, we encourage scholars to investigate other professional settings to validate and strengthen our theory. Furthermore, the COVID-19 pandemic was an obvious occasion for studying how changes in external events triggered changes to existing regulations and the availability of new digital resources. At the same time, the pandemic represented an extreme context (Hallgren & Bbuchnan, 2020) that required rapid adaptation. The process of DT may occur more slowly or encounter different challenges such as actors' resistance in different contexts. Therefore, further studies should be conducted in less extreme contexts. Also, while our model has focused on DT of healthcare practices triggered by the availability of new digital resources, it may also be extended to other types of transformations such as those brought by the availability of new organisational resources.

Second, while our middle-range theory underscores professional agency and how DT of professional healthcare practices unfolds at an operational level, future research could investigate the interplay between both strategic and operational levels.

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Appendix 1: Characteristics of samples

CIO	Hospital	Gender
1	SE	M
2	MA	F
3	A	M
4	L	M
5	ME	M
6	R	F
7	T	M
8	Mo	M

Characteristics of the CIO sample

	Doctor	Hospital	Gender	Speciality
1	PF	M	M	Internal medicine
2	LU	B	F	Allergology
3	LS	P	F	Haematology
4	LR	M	M	Cardiology
5	CC	B	M	Gynaecology-Obstetrics
6	RO	P	M	Haematology
7	CF	C	F	Infectious diseases
8	FD	L	M	Oncology
9	MH	M	M	Pneumology
10	AC	M	F	Allergology
11	DM	M	M	Infectious diseases
12	EH	L	F	Cardiology
13	AP	T	M	Gerontology
14	JD	M	M	Infectious diseases

Characteristics of the doctor sample

Appendix 2: Interview guides

Interview guide: CIOs

The questions contained in this interview guide pertain to your use or development of IT to manage the lockdown and the related cancellations of non-compulsory consultations between March and May 2020. This interview is conducted in the context of a management information systems study that explores how you dealt with the lockdown and tele-consultation use.

1. What IT (hardware, software, services, etc.) did you deploy or implement during the lockdown?
 - What was your goal in doing so?
 - Who chose them?
 - Who made the decision to implement them?
 - Were they new to you?
 - What were the challenges (if any) with this implementation?
2. Do you think that the lockdown has been a driver of digital transformation in your hospital? Why/Why not?
 - If yes, could you provide more details about this process?
3. Do you know which tools are used and how they have been used by doctors?
4. Are IT implemented during the lockdown still in use since the relaxation of regulations?
 - What has changed and what has remained the same?
 - How would you explain these changes?

We greatly appreciate your time, and we thank you for your participation in this study.

Interview guide: doctors

The questions contained in this interview guide pertain to your use of IT for tele-consultation practices to deal with the lockdown and the related cancellations of non-compulsory consultations between March and May 2020. This data collection interview is conducted in the context of a management information systems study that explores how you dealt with the lockdown and tele-consultation use.

1. What IT (hardware, software, services, etc.) did you use during the lockdown?
 - What was your goal in doing so?
 - Who chose these tools and how?
 - Who made the decision to implement them and who implemented them?
 - Were they new to you?

- What were the challenges (if any) with this implementation?
2. Do you think that the lockdown has been a driver of digital transformation in your hospital? Why/Why not?
 - If yes, could you provide more details about this process?
 - How have you continued to use the IT tools in practice?
 - How would you describe the changes related to tele-consultations during the lockdown compared to your previous medical practices?
 3. Have you continued using tele-consultations since the end of the lockdown? Why/Why not?
 - What has changed after the lockdown in terms of your medical practices compared to your pre-lockdown and lockdown practices?

We greatly appreciate your time, and we thank you for your participation in this study.

Appendix 3: Illustrative vignettes

We added transition sentences (in non-italics) for a better understanding of the retrospective accounts of the events experienced by the respondents.

Doctor LU, Hospital B

Doctor LU reflects on the beginning of the tele-consultation service and how it evolved:

*So, we started during the last lockdown (**External event**). The patients could not come to the hospital, so we started to do tele-consultations (**Co-evolution with patients**) and the idea was to bring them to the hospital if ever there was a need (**Local walk**). And in fact, afterwards I continued to do tele-consultation. I mean, I continued to do it after the lockdown because I thought it was pretty good (**Value peak appraisal**).*

She also reflects on how the change of regulation has introduced new opportunities for her activity:

*So, there's a couple of things. For example, I do my check-up and I order a blood test. And usually when we order the blood test, we get the results back. We call the patients and we review the situation with them. Now, this is already medical time, it takes time because we go back into the files. So, you have to set aside a separate time for that (**Conflicting constraints**). And so usually this was something that had not been billed before the lockdown and it's true that I use the billing now (**External event**). So, there you go. At least in tele-consultation, to discuss the results, this is something that is planned (**Resource combination**) and it avoids the patient coming to the hospital because sometimes we just discuss the blood test. We don't really need to see each other in person (**Value peak appraisal**). I think that in allergology, we can do the first consultations by tele-consultation and then we can see the patients again (**Value peak appraisal**). It's not like the other specialties; we don't really examine patients in consultation (**Value peak appraisal**).*

As Doctor LU takes into account patients' preferences and needs, she adapts her practices accordingly :

*Then there's the fact that I have quite a few patients who live far away and so it's true that when they..., well, it suits them (**Value peak appraisal**). There are quite a few patients who have good feedback on this, because the time to take the car, to find a place to park and to come to the department. And then sometimes I'm late, etc... So, they like it [tele-consultation], um, that's it (**Co-evolution with patients**). Consultations where we know we won't take much time, where*

*we don't necessarily do tests, and at that point it's not bad with tele-consultation (**Value peak appraisal**). It suits them. And then we also found that it was not bad (**Value peak appraisal**). Well, there's COVID, so patients don't do the admission labels and patients ID anymore. They go directly to the consultation. But before, the patients already had their label at the admission point and then they went up to the consultation and sometimes there was a queue at the labels, so they arrived late, etc... Whereas now, well, in fact there is no longer this problem (**Value peak appraisal**). For tele-consultations, the labels are ready in advance, or at least for us to bill, and in fact it's just that when you're there, I log on. The patient is there and so there is a saving of time. Let's just say that in the sequence of consultations it allows us to avoid any delay in terms of "I'm late, I haven't found a place to park" (**Value peak appraisal**).*

She also reports how she manages the existing and new resources as well as the difficulties raised from their combination:

*We have T, the video consultation software. It's the health regional agency software apparently (**New digital resource**) and before, I don't know, it worked better at the beginning of the lockdown. That is to say that I connected and it worked every time, frankly. Sometimes there were connection problems, but that's not a big deal. We called if there is a problem (**Resource combination**). But overall, it worked pretty well. And now it's changed. So, in fact, I connect to a platform where there is different software, I think. I don't know them very well. And one of them is T. And so, I log on T (**Distant jump**). But if I schedule a tele-consultation, I go on the platform and if there is a problem, sometimes there are sound problems or whatever, then we easily switch to the phone (**Local walk**). But it happens that sometimes for..., yes when I see that it is a little complicated and that the patient does not understand very well what I say. We call each other and that's it (**Local walk**).*

*The secretaries..., well, it doesn't seem to bother them too much. I think it makes them work a little harder (**Conflicting constraints**). Because in fact we have our consultation scheduling software where we enter the patients so that they are on the schedule according to the time. Then there is another planning software where the secretaries enter the patient. So, we also have to enter the patients in the tele-consultation software. So that's what the nurses do (**Resource combination**). So most of the time what happens is that I see the patients and I check if I have to see them again in consultation, I check their phone number. I ask them for their email address. I enter the new appointment on my own consultation schedule, the e-mail address, and then I write a little note for the secretaries, about the patient's name and the date of the appointment. And then they enter it in the tele-consultation software and that's it. When*

*I decide to make a tele-consultation for a patient, I put her name on a list. I give it to the secretary. The secretary enters it into the scheduling software (**Resource combination**). On the whole, it's done rather well, but it's true that it's an extra thing. For the secretaries too, it's an extra task for them (**Conflicting constraints**). I don't think it bothers them too much. If the secretaries weren't there, I think it would be either the phone or nothing (**Resource combination**).*

*I like to see the patients anyway (**Peak lock-in**). I think it's better when we see them in tele-consultation. But it's true that when we have connection problems or things like that, at least with the telephone, it's more practical (**Peak appraisal for consultation**).*

*When you have the patient face-to-face, there is a relationship, so it takes more time. I would say that, depending on the reason for the consultation, the quality of the consultation will certainly be better in real life (**Peak lock-in**).*

Doctor LS, Hospital P

Doctor S reflects on her practices of tele-consultation during and after the lockdown:

*We did telephone consultations, not real tele-consultations for one simple reason. When the COVID pandemic began (**External event**), we started very quickly to do telephone consultations last March (**Local walk**). We didn't have..., well on our consultation sites, we didn't have the proper computer equipment to do real tele-consultations (**Peak lock-in**). We called on the IT department, but I think that at the hospital level it was complicated to set everything up quickly (...) We had said that it would be nice to have the equipment. But it hasn't been installed (**Peak lock-in**).*

Doctor S explains how the characteristics of her local patients influenced the choice of the consultation mode:

*For several reasons. First of all, because in Perpignan we have a large part of the population which is rural. People do have internet access, but there is also a population that is relatively old compared to some big cities. And also, not all people are familiar with WhatsApp or other systems, like Zoom or etc... (**Co-evolution with patients**). The second thing is that in fact it is already very complicated for us in terms of time to organise everything (**Conflicting constraints**). That is to say that we have a very high volume of consultations in the consultation center. I'm just talking about the hematology department. There are six doctors. We have about three afternoons of consultations during which we see about ten patients, so there is really a*

high turnover of patients (**Conflicting constraints**). Then we managed to find a way with help from the IT and admissions departments to alert people with a text message sent to their cell phone, that we were going to do telephone consultations . It told people: don't come. [At first, we called them]. Then the IT and admissions departments succeeded in setting up a system for us (**New digital resources**). All the secretaries had to do was to set it up and people would automatically receive a text message saying that they should not come in and that they would be contacted by phone (**Local walk**). It was much more complicated to do things through WhatsApp, because WhatsApp must be installed (**Distant jump**). We never use our personal mobiles of course to do that. The other thing, but this may sound a bit silly, is that we work in a new building where internet access is very bad. There is an internal Wi-Fi which is used for the prescription software, but on the other hand the Wi-Fi, um, that is everything that is external internet works really badly. My cell phone doesn't even work when I'm doing consultations. We have a lot of trouble, there are places where we don't have a network, so it makes things very difficult. That's it (**Resource combination**).

And so, we went to the consultation center, as we usually did to have computer access to patient files. So that's it. We made the phone calls (**Local walk**). We would see those for whom there might be a problem. So, the patients who needed to be examined imperatively to make sure that everything was fine. Patients we were seeing for the first time. Patients who were seen for a particular concern, a relapse, an emergency or who posed a concern with a progressive disease. And the others, for all the follow-ups when the clinical examination was not necessary, we did that by phone (**Value peak appraisal**). Afterwards it was a normal consultation. That is to say, we had the telephone interview. We prepared the prescriptions for blood tests, treatments, next appointments and everything was sent afterwards to the patient either by mail or by post depending on their requests. (...) And the report of the consultation like, exactly like a face-to-face consultation (**Local walk**).

In fact, we have an on-call phone that we can be reached 24 hours a day and that we take turns using, so about once, a little over once a week. So, if one of our patients has a concern, they know how to contact us. We see them (**Value peak appraisal**). When it' comes to accepting new patients, the doctor has three possibilities. Either to send an email to the consultation secretariat, or a fax, or to call us on this phone and it's the person who is on call on the day who takes care of all the new consultations to be planned. We plan them with the secretaries who call the patients back to give them the appointments (**Resource combination**).

*But for the people, we saw for the first time, there was no tele-consultation. We saw them all in person. Because for the first consultations, we often need to examine the patient. You need to explain (**Value peak appraisal**). I think that contact is also important (**Peak lock-in**). And we often need to do tests that require people to be there. Either blood tests or bone marrow tests, so all the people who came for a first consultation we really kept, we still managed to keep our normal activity (**Value peak appraisal**). There was no delay in seeing patients. There were no poor follow-ups either. We did not cancel any consultations. They were all done. Except for the new patients in-person and for the follow-ups, we used in tele-consultations (**Value peak appraisal**).*

Doctor S reports her assessment of the phone use for tele-consultation:

*Well, the phone is more reliable. Except for people who are out shopping at the time of the consultation, or who have a cell phone that doesn't work. It happens from time to time that people have forgotten or that there is a network problem. But it's true that by phone we have fewer problems. It's rare that people don't pick up the phone when there's a consultation scheduled. It's rare that we don't get along on the phone (**Value peak appraisal**). So it's not too... It's much less... It's much simpler yes. There's much less risk that there will be little slip-ups, that we'll get stuck on a technical problem (**Resource combination**).*

She summarises her criteria to switch from in-person to phone consultation:

*So, the first criterion is the patients we see for the first time. Systematically in-person (**Value peak appraisal**). What we often did was to do a little preliminary work, that is to say we looked at our consultation schedule the week before and we looked at the people who were likely to pose problems. We know our patients, so we know which ones are stable, and which ones have problems and diseases that can potentially evolve (**Value peak appraisal**). So, there is of course the criterion of simple follow-up with a disease that has not progressed very much or a patient who has progressed a little in the last few consultations, which is better to see (**Value peak appraisal**). So that could be an influence. The other thing that mattered was whether a clinical examination was necessary for monitoring the disease. For example, we have diseases that are... I'll give you an example, myelodysplasias are diseases of aging bone marrow. We don't need to do a clinical examination. We follow the patients through blood tests that allow us to judge if the disease has progressed or not. For these patients, who are typically immunocompromised patients, we have always systematically conducted tele-consultations (**Value peak appraisal**). There are diseases that we follow for which it is necessary to examine*

*the lymph nodes, the liver and the spleen each time, so for these patients we maintained face-to-face consultations (**Value peak appraisal**). We also took into account the distance of the patients, when we know that we have patients who come from the mountains. We were a little more flexible on these conditions (**Value peak appraisal**). For example, a patient who should normally have been examined, but who we have known to be well for several years and who lives an hour and 15 minutes away in the mountains, well that also led us to choose a tele-consultation over a face-to-face consultation (**Value peak appraisal**). As well as the general state of people. The elderly, old, tired people that we know, we were a little more inclined to a tele-consultation rather than a face-to-face consultation (**Value peak appraisal**). And then what also influenced the choice between tele-consultation and face-to-face consultation was, um, it also depended a bit on the doctor (**Peak lock-in**). Because in fact we had said among ourselves that we were doing this to limit the number of patients coming to the hospital as much as possible. Fortunately, because we also have small consultation rooms and waiting rooms, so we had to avoid promiscuity (**Conflicting constraints**). But there were doctors who were rather in favour of tele-consultations and others a little less so. And as a result, depending on the doctors who consulted, the percentage of tele-consultation was a little different (**Peak lock-in**).*

*Most patients are very happy with tele-consultations, especially people who are a little older, a little far away and who are not doing too badly (**Value peak appraisal**). That is to say that the follow-up of chronic people, who have no worries, who live far away, who are a little old, were generally very happy (**Value peak appraisal**). They understood very well that it was also to protect them (**Co-evolution with patients**). That's it. And there is a minority of people who were not satisfied. I would say that less than 10% of the patients were not satisfied because they had the impression that by telephone it was not a real consultation, that they needed to see us for more psychological reasons I think than anything else (**Peak lock-in**).*

Doctor S reflects of the evolution of her practices after the experience of tele-consultation during the lockdown:

*But I think it will be interesting to keep this for certain patients (**Value peak appraisal**). We have patients who come from the mountains, who are sometimes an hour and a quarter away, and so for... I had said when we spoke with the IT department about installing systems for videoconferencing, or even telephone consultations, that it would be good, once we had left the COVID, to think about time slots, for example once or twice a month, where we would only put in telephone consultations for people who wanted them (**Co-evolution with patients**) and for whom it was medically possible (**Value peak appraisal**).*

*You see for example in my department, there are about half of the doctors who find it very good and there are two I think who like to see the patients because it's true that from time to time by telephone we may not, um, we may miss a general condition that is a little degraded or things like that that we haven't seen (**Peak lock-in**).*

Doctor PF, Hospital M

Doctor F reflects on when it is appropriate to use tele-consultations:

*I hadn't done tele-consultations before the lockdown (**External event**). I'm in the medical department that may have done the most. That is, "real" tele-consultations, with video (**Distant jump**). I didn't replace all the consultations with tele-consultations though because I didn't have the time to manage all the consultations (**Conflicting constraints**). I selected the consultations that I could postpone, and those that I couldn't. The ones that I couldn't reschedule, I used a tele-consultation (**Distant jump**).*

*I started once the COVID sections were set up, so I had to deal with the solution that became definitive, which was the video conferencing software T (**New digital resource**). But it must be said that we were also a little less freaked out in general (**External event**), and so were the patients, about coming to the hospital (**Co-evolution with patients**). At first, we had the impression that stepping into the hospital was synonymous with getting COVID (**External event**). But now we've learned to live with it, so we've been able to continue to manage face-to-face consultations (**Value peak appraisal**). So, I continued with tele-consultations for fragile patients (**Value peak appraisal**). I anticipated the fact that I didn't want to expose them too much, and if I assumed that I could manage with tele-consultation, I proceeded like that (**Value peak appraisal**). But we still have a population of patients who are systematically over 50, even over 60 old for a large part. And so, for one patient out of three, it will be a tele-consultation that will be on a purely telephone basis, where we do not use the video system (**Local walk**). Because, clearly, for older patients, it's complicated (**Value peak appraisal**).*

*Tele-consultations are also suited for the follow-up (**Value peak appraisal**). In follow-up visits, there are cases where I know I can get the information without having to examine the patient. That can work once, since you don't do that iteratively, but alternately, that's possible for most patients (**Value peak appraisal**). So, it depends a little bit. And then in the follow-up, there are some patients that we know are relatively stable, and we expect there to be no issues, other than checking treatments, blood pressure, blood work, things like that (**Value peak appraisal**). I've done a few of these for patients, what we call "first time" patients, that is, patients that we've*

never seen before. And especially for patients who live far away. Because often, a first consultation, for the type of patients we see, will often be followed by a complementary assessment, whether it's an outpatient or an inpatient consultation... and for patients who live far away, it can multiply the number of trips (**Value peak appraisal**). So, sometimes I'd get a little bit of knowledge of the situation, of the patient's record, and try and optimise the patient's in-person consultation (**Value peak appraisal**).

He also explains how he uses different tools to make an effective tele-consultation.

To start with, making an appointment for a patient that you know perfectly well, and who will come back to your consultation, it's between 10 and 15 clicks. Whether you do tele-consultation or face-to-face, it's the same thing. There is no integration of tele-consultation management in our hospital information system (**Resource combination**). This means, if it's a video tele-consultation, the secretary has to go to the tele-consultation software and re-enter everything. Enter the appointment. So, there is clearly a double entry. Paradoxically, tele-consultation adds an administrative burden to the secretariat (**Conflicting constraints**).

But it's not the same by phone. There are some cases where I know in advance that it will only be telephone, and so I inform the secretary and she does not need to enter it in the video consultation software T (**Resource combination**). Afterwards, quite regularly, the patient is entered into the video consultation software T, it's supposed to work, and if it doesn't, the tele-consultation is degraded to telephone mode. This happens regularly (**Local walk**).

I totally manage both the input of medical information, and afterwards, the generation of the report in the Electronic Medical Record (**Resource combination**). In other words, I work in double screen mode. I have the video consultation software T on one side, the Electronic Medical Record on the other. The fact that T is not integrated with the Electronic Medical Record, when you have only one screen, you have to switch from one window to the other... either you see the patient or you see his file, but you don't see both at the same time. So, I always work in a double screen with T on one side, the Electronic Medical Record on the other. And the whole patient record is managed through the Electronic Medical Record. What is managed through T, apart from the tele-consultation, can be the documents sharing beforehand, by the patient. Some patients regularly upload lab results before the consultation, in the software T, with a visibility that is not always extraordinary for the physician. It is not completely obvious that the patient has uploaded documents when you see the patient. There is nothing that, at the time of the consultation, shows us that there are documents to look at, etc (**Resource**

combination). The last time, it was the patient who told me. And then, secondarily, it adds tasks (**Conflicting constraints**), because I have to log out of the Electronic Medical Record to generate a document and transmit it to the patient via the video conference software T because it's a secure transmission. Otherwise, a lot of prescriptions are transmitted by a simple email. Which is not secure at all, I agree (**Value peak appraisal**).

Fortunately, I have a secretary who keeps an eye on things: that is, I give her the file, she looks at it when the patient comes, and she gives it back to me on the day of the consultation (**Resource combination**).

CIO, Hospital L

The CIO of Hospital L gives his account of the evolution of tele-consultations in his hospital:

We already planned to develop tele-consultations in our hospital. So, we already had the human resources in place for it. The health crisis has greatly boosted all the preparatory work that we did (**External event**). And we achieved goals that might have taken us three years to achieve. But in any case, it was already part of our strategy and now we are really going to do everything to keep it going because it is extremely important given the specificity of a healthcare facility, its expertise, and therefore patients who must travel hundreds of kilometres to come to the hospital (**Value peak appraisal**). There is a real need to manage tele-consultations in an establishment like ours (**Resource combination**).

He explains how tools required for tele-consultation were installed:

In general, it was at the request of the doctors and according to the operating constraints of their units. During the lockdown (**External event**), all the scheduled activity was deprogrammed. We cancelled all consultations, all hospitalizations that could be postponed. And then we reconfigured all the care units to make the best use of our medical and nursing resources to accommodate COVID patients. So that very quickly led to a reorganization, and many doctors were able to tele-work in this context and carried out tele-consultations. We also implemented tools for tele-medicine⁶ (**New digital resource**), which has also been deployed and which was in a ratio multiplied by 100 compared to what we knew before. In particular, the tele-consultation system has been deployed (**New digital resource**) and we have been working with many doctors to ensure that all patients who need to remain in contact with their doctor

⁶ Tele-medicine includes tele-monitoring and tele-consultations.

during their treatment can do so, either by telephone during the emergency phase of the lockdown or by videoconference with tele-consultation tools (**New digital resource**).

For tele-consultations, we gave them a tool (**New digital resource**). I think they fell back on the telephone (**Local walk**) when they couldn't, um, when they were faced with a patient who was not comfortable with this computer tool and who was not able to join a tele-consultation, that was done by telephone (**Value peak appraisal**).

In fact, this crisis has really accelerated the process and we have had a very, very large number of doctors who have started tele-consulting (**External event**). So overall, the problem that we could have had before the crisis, many doctors who said it was not possible, "I'm not going to be able to practice medicine in this way", have completely disappeared (**Peak lock-in**). And frankly, this has not been an issue at all. Sometimes, we couldn't even provide the support and equipment to meet the demand that we had (**Conflicting constraints**). And so, out of all the doctors who needed it, I think a lot of them now will continue to use tele-consultations on a routine basis. To put it another way, they really needed it, and that has removed I would say all the apprehensions that there could be in the use of these tools. (**Peak lock-in**)

I'm only talking about tele-consultations in the sense of the prior national regulation, that is using video consultation software (**New digital resource**). There were also telephone consultations. This has exploded. We had an extremely large number of telephone consultations (**Local peak**).

Overall, our weekly tele-consultation rhythm is maintained. This means that, everything that was developed during the crisis continues to be used. And when we look at the specialties that are using the tool today, they are very clearly the medical and surgical categories (**Value peak appraisal**). We could have expected that some other specialties would be more adapted or would have used tele-consultations more massively (**Value peak appraisal**). But overall, our analysis shows that it is much more balanced than expected.

The CIO mentions the different tools that were installed to allow doctors to perform tele-consultations:

Let's see; laptops, tablets, webcams, and all the devices that were necessary for patients to stay in touch with their families, and for doctors to tele-consult. Indeed, we have made huge orders for computer equipment, which were followed up very, very closely in terms of delivery so that we could obtain them within a reasonable timeframe. (**New digital resource**)

He also mentions the collaboration with doctors:

*We did lots and lots of assessments with them. What they asked us is that the video conferencing tool be completely integrated into our CIO to facilitate everything that is upstream organization and downstream coding [of medical acts for billing] (**New digital resource**). And we have initiated developments that are currently being finalised and that will soon be implemented. So, in fact, there is the possibility of scheduling a tele-consultation like a normal consultation from the agenda, and then from their consultation cubicles they can enter into tele-consultation in a completely integrated way. We think that with a complete integration of our video conferencing tool within our own patient file, we will have all the flexibility they ask for in using the solution. Afterwards, during the beginning of the containment period, there was such an explosion of tele-consultations that there were inevitably adjustments to be made (**New digital resource**).*