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A medical profession towards empowerment? The uncertain future of digitalization in private general practice

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ABSTRACT

The aim of the paper is to understand what drives private general practitioners (GPs) to introduce digital technologies, and to use them extensively. While prior research has highlighted barriers to adoption for practitioners when digital tools are introduced by managers and policy makers, we explore how GPs having their own practice introduce digital innovation and how they integrate them into their practices. Our qualitative study focuses on liberal emergency medicine in France, providing a unique context to examine how GPs at the front lines of health system failures and changes introduce and adopt digital technologies. Through in-depth ethnographic research conducted from 2021 to 2023, we reconstruct three sequences of digital innovation since the 1990s and observe current digital tool usage among GPs. We put forward two major findings. First, the introduction of digital tools is driven in this context by the organization of GPs as a professional group that aims to enhance its capacity for action and gain recognition for its expertise. Second, the adoption of digital innovations depends on how the changes in practices involved align with the professional culture of these doctors. Tensions between the most recent digital innovation initiatives that take place during and post-Covid 19 crisis, and doctors' understanding of practicing medicine as an "art", leads to the weak adoption and even contestation among GPs.

1. Introduction

In the face of ever-expanding promises about the deployment of digital solutions in the world of care (Petersen, 2019; Wamsley and Chin-Yee, 2021), social scientists have tempered expectations of a revolution in work practices. In particular, work based on the sociology of professions has shown that primary care physicians working in health-care organizations resist digitalization when introduced by managers, administrators, and policymakers (Ziebland et al., 2021). By contrast, little is known about the contexts in which general practitioners (GPs) who have their own practice, and are therefore the ideal type of professional autonomy (Freidson, 1984), decide to digitalize their work practices. Yet, this is an important topic for addressing what may drive the digitalization of general practice and makes it relevant from the point of view of the professionals involved.

In this paper, we focus on liberal emergency physicians who, in a French context characterized by a shortage of GPs, also perform tasks traditionally handled by primary care physicians. These physicians have been digitalizing their work tools since the 1990s. This gives us the

opportunity to compare successive waves of digitization. We address the following two research questions. What are the professional logics behind the introduction of digital tools in the group of doctors we studied? And what explains their long-term adoption by the doctors in this organization?

First, we show that the organization of these GPs (structured around a national federation of doctors' practices) facilitates the introduction of digital innovations. These doctors put digitalization at the service of a project of empowerment: they strategically embrace it to increase their capacity of action, to gain recognition for their expertise, and to defend their jurisdiction against potential competitors (Abbott, 1988). They co-design with IT developers the technological scripts (Akrich, 1992) embedded in digital innovations that they anticipate to empower their group. Second, the adoption of digital innovation depends on how well the changes in practices involved align with the professional culture of the group. While the innovations of the 1990s and 2000s reinforce a shared vision of good medical practices, the digitalization projects during and after the Covid-19 crisis are in tension with their conception of the practice of medicine as an art, as a warm care (Pols, 2012). As a

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result, this recent process of digitalization appears fragile, highly uncertain, and potentially reversible.

2. Literature review: digital technologies and the (dis)empowerment of general practitioners

Digital health is an umbrella term that covers a wide range of devices and technologies (Marent and Henwood, 2021). The digital devices that may have the greatest impact on the work of GPs, and that have therefore been most widely studied, are medical informatics (including electronic health records and the use of online appointment systems), telemedicine (mostly alternatives to face-to-face consultations), e-health (the use by patients and physicians of health information available on the Internet), and, to a lesser extent, m-health (the use by patients and/or physicians of mobile phones for monitoring purposes) (Ziebland et al., 2021). Other types of digital technologies, such as telehealthcare and AI-based diagnostic tools, can be used in general practice, but have only been studied for physicians practicing in medical specialties such as diabetology (e.g., Danesi et al., 2020; Mathieu-Fritz and Gérard, 2023), cardiology (Amelang and Bauer, 2019), cancer follow-up (e.g. Torenholt and Tjørnhøj-Thomsen, 2022), dermatology (Mort et al., 2003; Trupia et al., 2023).

The question of the impact of digital technologies on general practice, and their more or less imposed and constraining nature, has been addressed by studies in the sociology of work and the professions. Emphasis is put on the forms of power that digital technologies exert over GPs and on the implication of digitalization on the loss of professional autonomy and the erosion of clinical authority.

First, a wealth of studies has examined the negative impact of digitalization on professional autonomy for projects introduced in health care organizations where GPs work under the supervision of administrators, and are accountable to health authorities for the quality and cost-effectiveness of care. Projects that seem to threaten to subordinate the professional autonomy of GPs to bureaucratic logics and cost-saving objectives include, in particular, the introduction of electronic health records. For example, a study of the large-scale implementation of electronic health records in three managed care organizations in the United States showed how the system enabled a new level of bureaucratization with its own financial and organizational goals (Reich, 2012). The study also revealed that managers succeeded in “disciplining doctors” by creating the conditions for collective emulation and peer pressure around the use of digital tools. In the context of the implementation of electronic health records in outpatient specialty clinics in the United States, Hunt et al. have shown that digital technologies serve a variety of institutional purposes beyond the medical encounter, such as the need for standardized reporting to facilitate billing, quality monitoring, and institutional oversight (Hunt et al., 2017). In this case, electronic health records enforce market logics in clinical medicine, redefining the role of the clinician as less of a medical expert and more of an administrative bureaucrat. Other digital technologies introduced as part of national policy programs for the development of electronic health records have been met with resistance from primary care professionals. For example, despite political pressure and financial incentives, Choose and Book (an expert system for booking hospital outpatient appointments in England) remained unpopular and was generally used reluctantly, if at all (Greenhalgh et al., 2014). GPs did not use it during consultations because they were unwilling to take on what they saw as a more technical (and less professional) role. Finally, while EHRs place new or increased demands on medical work, some physicians are embracing these digital tools and making sense of them in their practices. This is evidenced by a study conducted by Winthereik et al. (2007) on the use of EHRs in GP clinics in the United Kingdom (Winthereik et al., 2007). While this tool was introduced to generate audit reports, GPs put it at the service of their concept of quality of care.

Second, sociological research on GPs has explored a range of digital technologies that are likely to pose a threat to clinical authority. Of

particular concern here are EHRs, which potentially interfere with diagnostic and therapeutic work. A review by Ziebland et al. (2021) shows that in most studies, GPs viewed EHRs and associated expert systems as outside their scope of practice and associated them with a source of interference with their medical judgment (ibid.). For example, a number of them which were designed to reduce errors had the effect of increasing information overload leading to clinicians missing information (Sittig et al., 2016). EHRs are also changing clinical interactions in important ways. They almost erase patients as individuals from the clinical encounter, replacing them with a digital representation as the object of care (Hunt et al., 2017). Additionally, patients themselves introduce digital technologies that can undermine the authority of GPs. Studies report that patients’ access to online information has led to the emergence of a digital health citizen, with implications for relations in front-line care, particularly for GPs (Carboni et al., 2022; Fiske et al., 2020; Ziebland et al., 2021). Self-management (Morrissey et al., 2018) and self-tracking technologies (Ruckenstein and Dow Schüll, 2017) can disrupt the power dynamics of the doctor-patient relationship by creating forms of therapeutic alliance in which patients and providers are both seen as experts (Neff and Nafus, 2016; Piras and Miele, 2017).

In conclusion, the introduction of digital innovations in general practice has mainly been studied in situations when innovations are imposed on doctors by political actors, administrative managers, or even patients themselves. Technologies are conceptualized as bringing norms to the clinic (Carboni et al., 2022) and as posing a threat to medical power, with a possible loss of professional autonomy vis-à-vis bureaucratic or commercial logics, and with the potential erosion of clinical authority. As to the adoption of digital innovations, studies have found that GPs’ responses range from acceptance and discipline (Reich, 2012) to redefinition of margins of autonomy compatible with new accountability requirements (Winthereik et al., 2007).

In this article, we investigate a situation where GPs who own their own practice introduce digital innovations. This type of situation has been little studied - with the exception of e-consultation (Banks et al., 2018; Lehoux et al., 2002; Mathieu-Fritz, 2021) - and raises new questions about the relationships of GPs with digital innovation. First of all, the question of why doctors decide to introduce digital innovation becomes central: what are professional objectives at this point in time? And what resources do they have at their disposal to make their innovation project a success? The second line of questioning relates to the long-term adoption of digital innovations by GPs: what motivates doctors who are free to choose their work tools to either use or discard digital innovations? Under what circumstances do they decide to change or adapt their tools? To address these questions, we propose a different approach to the “technology as steering approach” (Carboni et al., 2022) which has guided previous work on GPs. On the one hand, we draw inspiration on the ecological approach to professions to investigate the professional objectives behind the introduction of digital innovation by GPs. We question whether they introduce digital innovations to extend or defend their professional jurisdiction, defined as a reserved domain of knowledge, technical skills and expertise (Abbott, 1988), and use digital innovations as a tool for empowering their professional group in struggles for recognition between professions. While the term “empowerment” is highly polysemic, it is of interest to us here as a collective process by which a group comes to see itself as an actor in its own transformation (Drury et al., 2014). We suggest using it to emphasize that physicians may embrace digitalization to increase their capacity to act and strengthen their position as key actors. On the other hand, we draw on the sociology of innovation and in particular on the notion of technological scripts (Akrich, 1992). The script is a scenario that predetermines uses (Akrich, 1992) and assigns roles to actors (Carboni et al., 2022). Scripts are more or less prescriptive, and actors retain the ability to adhere to them or to partially disregard them (ibid.). Looking at scripts invites us to observe the discrepancies between anticipated and actual uses, and the multiple reappropriations, shifts of use, or even non-use. In this paper, we use the notion of scripts to

analyze the representations of uses, standards of use and user figures embedded in the digital innovations that these GPs wish to introduce. We question the links between these scripts and the practices that form the basis of their professional culture. Scripts are of particular interest to us not only to investigate the introduction of digital innovation but also to explore its adoption over the long-term. Here, we follow a “technology-in-practice” perspective (Timmermans and Berg, 2003; Carboni et al., 2022) which sees technology implementation as a complex, heterogeneous and vulnerable process (Ziebland et al., 2021). We pay particular attention to professional contexts of use (Pettrakaki et al., 2016) and to the reasons why actors apply the script embedded in innovation or, on the contrary, deviate from it in the course of their work.

3. Research design

3.1. The empirical case

The study was conducted with private emergency doctors, doctors who remain a blind spot in the sociology of emergency medicine, which focuses on emergency departments (Buchbinder, 2017; Vassy, 2001), and in the sociology of general practice, at least in France (Bloy and Schweyer, 2010). Yet both the shortage of GPs and the overcrowding in hospital emergency services blur the boundaries between general and emergency care as to the provision of unscheduled care (a term used to describe care that meets a medical need but is not a life-threatening emergency). A 2019 report found that 20% of unscheduled care provided in hospital emergency departments during office hours would fall within the scope of general practice (Cour des comptes, 2019). A few years earlier, urgent or unscheduled care accounted for 12% of the activity of French GPs, among which private emergency doctors (Collet and Guyon, 2007).

In this paper, we focus on private emergency doctors. Like 65% of French GPs (Anguis et al., 2021), they are not employed by an organization (be it public or private) but have their own practice and work independently. Another point in common with the rest of GPs is that these private emergency doctors share medical practices for consultations, and in particular they share office secretaries (this is the case for 4 out of 10 GPs in France).¹ However, what makes their organization and working practices quite unique in the national medical landscape is their structuration around a national federation of doctors’ practices. SOS Médecins is a federation of 63 medical practices throughout France that brings together 1300 doctors. The federation is a self-funded associative structure. SOS doctors are not employed by it: they earn consultation fees, share medical on-call duties and operating costs. The founding principle of SOS Médecins is to provide 24-h care for acute care and non-life-threatening emergencies. These doctors play a key role in the continuity of care, which is a public service mission enshrined in French law, and defined as guaranteeing access to unscheduled care outside normal practice hours, i.e. during nights, weekends and holidays. A unique aspect of the medical work of SOS Médecins is that almost half of the examinations are carried out at the patient’s bedside, both at home and in institutions (retirement homes, prisons, hostels, police stations), whereas GPs usually consult in their offices (Bloy and Schweyer, 2010).

Finally, this type of medical practice is in the minority, SOS Médecins represents just over 1% of GPs in France. However, its central role in addressing the current difficulties and shortcomings of the French health system (aging population, medical desertification and the resulting social and territorial inequalities in access to care, declining medical demography), is widely recognized. Indeed, they provide 70% of the continuity of care in urban and suburban areas and they carry out 60%

of medical procedures outside of office hours. In addition, the extensive and long-standing digitalization of the activities of these GPs allows us to address the extent to which doctors come to see digitalization as at the service of good medical practices, in a context marked by a crisis of private practice.

3.2. Data collection

Our methodological approach is the ethnography of medical work. First, we conducted exploratory interviews to become familiar with the functioning and organization of this medical association and the history of the digitalization of their work practices. We then identified three major phases in the digitalization of their activities, which partly overlap: a long-term digitalization of their activities; the introduction of teleconsultation at the time of the COVID 19 pandemic; and finally, a recent project, underway at the time of our study, to introduce an algorithmic tool to support medical decision-making. For each of the digital innovations, we have gathered materials that are as diverse and comprehensive as possible, through direct observations, in-depth interviews and research into the documentary records of the doctors’ federation. This involved a high level of immersion in the field in contact with the actors and their activities (Cefai et al., 2010). In addition, Author 1 established a relationship of trust with the doctors who co-designed and promoted the technological innovations, which gave her access to detailed accounts of their implementation.

Between December 2021 and October 2023, Author 1 observed 20 SOS Médecins doctors working day and night in four French cities. 16 were men - in line with the general situation of SOS Médecins, while general practice has become much more feminized in recent years (Anguis et al., 2021). In total, she observed 83 bedside visits and 49 office consultations for a total of 93 h of direct observation, half of which took place at night (between 8 p.m. and 8 a.m.). In addition, author 1 conducted 18 semi-structured sociological interviews with physicians. She systematically collected information about the doctors’ biographical backgrounds, their entry and position in SOS Medecins, the way they conceive of the diagnosis process, and finally the place and use of digital tools in their clinical practice. Lastly, she took part in numerous informal discussions *in situ*, during patient home visits and consultations, and during local and national meetings of the federation. Table 1 in Appendix 1 summarizes the main ethnographic materials used to analyze each wave of digital innovation.

Author 1 recorded and transcribed all interviews, and took detailed field notes on observations. Author 2 carried out a short ethnographic observation (3 h of home visits and 3 h of office consultations), and took part in informal conversations with doctors, so as to get a first-hand insight into their medical work, which both authors deemed useful for constructing a common sociological interpretation.

3.3. Data analysis

We analyzed our findings manually, iteratively, and following an inductive approach characteristic of the grounded theory method (Glaser and Strauss, 1967). The first step was to generate an initial list of categories for analysis from the actors’ discourses and our observations of their practices. A first set of categories describes why and how these doctors introduced digital innovations into the federation (actors’ motivations and the individual and collective resources they mobilized; projected uses for the innovations). A second set of categories describes the actual uses and changes brought about (e.g. changes in medical work, the patient-doctor relationship, and interprofessional coordination) and the actors’ evaluations of the innovations (both positive and negative). In a second step, we linked these categories to sociological themes and concepts from the sociology of professions (defence of a jurisdiction, empowerment project, unique resources of the professional group), the sociology of innovation (technological script) and the sociology of the medical professions (definition of a shared medical culture

¹ <https://drees.solidarites-sante.gouv.fr/communique-de-presse/les-medecins-generalistes-exercent-de-plus-en-plus-souvent-en-groupe-et-ont>. Accessed on November 19, 2024.

and conception of care). This enabled us to identify cross-cutting dimensions in the process of digitalization of medical work in the context studied, as well as to highlight differences between the three waves of innovation. Table 2 in Appendix 1 presents extracts for each analytical step.

4. Findings

In this section, we present three waves of digitalization in the activities of SOS physicians. We show that in all three cases, doctors co-design a digital innovation with IT developers, with the aim of empowering their professional group. Although this project is broadly shared, not all technological scripts embedded in digital innovation are aligned with the professional culture of the group, leading to different modes of adoption or rejection among GPs. First, digital technologies introduced since the 1990s to strengthen these doctors' capacity to act in clinical practices characterized by mobility have been widely "domesticated" (Pols and Willems, 2011) and integrated into their activities over the long-term. We use the term domestication to describe a dynamic relationship between professional practices and the technologies that equip them. Domestication implies that people and objects shape each other in reciprocal relationships (Pols, 2012): users develop creative practices, use technologies differently than their designers intended, and transform them to do so. Then, in the context of the COVID-19 pandemic, these GPs develop a teleconsultation solution in their medical software to defend their jurisdiction against digital health industry giants. Adoption is limited to the crisis period as the innovation is in tension with their commitment to practicing at the patient's bedside. Finally, we look at an ongoing digitalization initiative involving the use of AI technologies and embedded in the broader goal of valorizing patients' data. Adoption is low, as doctors struggle to articulate the expected uses of the algorithm with their medical practices.

4.1. Private emergency medicine in France and the "domestication" of digital technologies in the long term

The digitalization of medical work started in the early 1990s at SOS Médecins. To meet the specificities of the medical activity of these private emergency doctors, in particular, home visits and geographical mobility. These doctors then adopt and domesticate multiple digital technologies, integrating them into a repertoire of uses and adapting them to their own routines and goals (Pols and Willems, 2011). Digitization is occurring earlier than in the rest of general medicine, which began slowly in the 2000s and focused on non-shared tools (Mathieu-Fritz and Esterle, 2013). At SOS Médecins, a national structure - a federation of 63 non-profit associations - provides doctors with the capacity for collective action and innovation in practices. This situation is quite unique in France. While GPs are organized in professional unions that negotiate with public authorities on the material conditions - particularly financial ones - under which they carry out their activities (Hassenteufel, 2010), these unions do not play a role in coordinating activities and work tools.

The federation's means of action are not only financial (each doctor contributes to financing the digital infrastructure, rental of premises and salaries of switchboard operators); they also relate to the existence of the strong professional identity of SOS doctors as independent physicians practicing with a high degree of autonomy and at the same time part of a large collective. In particular, they adhere to a charter² - key principles such as 24/7 consultations and home visits - and participate in the decision-making process at the federation level.

As connectivity became a critical issue in order to move quickly and have access to reasons for calls and patient contact information, SOS doctors developed a common interest in digitalizing their activities. In

the early 1990s, doctors were equipped with pagers to receive information from switchboard operators in writing and at any time. In the late 1990s, these were replaced by cell phones and touch-sensitive smartphones. Currently, these GPs use their smartphones to consult their professional software and patient information (reason for call, patient history and any comments from colleagues when the patient has already consulted an SOS doctor). In addition, their smartphones are connected to various examination devices (blood pressure monitor, electrocardiogram, ultrasound scanner, etc.). Doctors also use a range of other digital tools, such as online medical resources, instant messaging, or connected software, to communicate with other professionals (e.g., by transmitting test results for advice, requesting further tests, requesting urgent nursing care to avoid hospitalization).

The federation has invested early on the resources needed to create a national digital infrastructure. In the late 1990s, the national association's board of directors decided to finance the construction of a secure computer network for the federation. This IT network, which required substantial investment, was presented as a modernization project for SOS Médecins. At the national level, IT and digital investments are currently the third largest expense, after operator salaries and office rent. Finally, the federation has supported digital innovation projects developed by a doctor in collaboration with IT specialists. The co-design of the tool and the definition of a technological script fully adapted to the group's professional objectives, has been decisive in the adoption of the technologies and their routine integration into use. We will illustrate this point with two developments in the association's most widely used medical software (which we will refer to here as MedicNum) that took place at very different times: the introduction of an "Wiki SOS" in the mid-1990s, and the recent adoption of a teletransmission system.

Dr. E., who joined SOS Médecins in the early 1990s, initiated both. Since his arrival, he has been at the forefront of digital development and has participated in the design of the MedicNum software. He became a "user-innovator" (Berthou and Gaglio, 2020), with a constant attention to articulating the work of IT developers with the activities of doctors. He designed the "Wiki SOS" digital resource to support clinical expertise within the Group. Wiki SOS is a MedicNum module in the form of practical information sheets organized by pathologies and syndromes. Its aim is to keep physicians up to date with the latest medical literature and to promote good practice in acute care. These sheets are provided by the doctors and are validated by the National Scientific Commission of the federation. This software module, developed in 1994, has expanded with the voluntary contributions of physicians. It was initially heavily invested in and adopted by SOS doctors; interest in the system began to wane in the 2010s, with the proliferation of freely available digital resources on smartphones. It is still accessible in the software, but its deactivation was planned at the time of our study.

The more recent introduction of a function for electronic document transmission shows how doctors are adapting their software in line with the professional culture of the group, the technical possibilities and the wider reconfiguration of their medical work.

The charter of SOS Médecins federation requires doctors to provide an "intervention report" and "information to the GP who usually treats the patient". Until recently, however, doctors did not respect this obligation. Since they had no guarantee that patients would send this document to their family doctor, they found it time-consuming and non-effective to write it on paper and leave it at the patient's home. At the end of the 2010s, in the pre-COVID era, technical developments in MedicNum and the increasing digitalization of GPs' practices opened up new possibilities for interprofessional coordination. In this context, Dr. E. proposed that the federation finances the development of automatic teletransmission of mail to GPs. He also participates in its design to ensure that the function is simple and does not require extra work. Dr. E. interacts with computer developers and becomes a beta tester in several tests. As a result, a new feature has been implemented in the software: with a single click, SOS doctors can automatically transfer observations made in the "Examination" section of their software to a pre-written

² <https://sosmedecins-grenoble.fr/mentions-legales/>.

letter for the GP, which they can then modify as they wish.

SOS doctors value this function as they see the optimization of coordination between health professionals as a means of improving the quality and efficiency of care. Moreover, this coordination, facilitated by digital innovations, allows SOS doctors to defend their expertise vis-à-vis other doctors, as Dr. P. puts it during a home visit to a 17-year-old patient complaining of breathing difficulties.

February 8, 2022. 22h. After questioning and examining the patient at home, during which he performed an electrocardiogram (ECG), Dr. P. explained that he was thinking of anxiety attacks. He tells the patient that he will send a letter to her GP, so that he can access her observations and the ECG results.

As he fills in the details of his medical software on his cell phone, Dr. P. explains to me the importance he attaches to this teletransmission process: "It makes us more professional to teletransmit mail to the GP. At SOS, we're a bit outside the GP system. They may have the impression that we're 'uber-doctors'".

While sending a paper letter to the family doctor used to be an exceptional practice, teletransmission of the intervention report becomes appropriate and meaningful when the design of medical software facilitates this practice. Digitalization is widely embraced because it increases the capacity of action of doctors practicing at the patients' bedside, and because their professional values and good care practices are embedded in the design of digital tools. This is ensured by the close involvement of a "user-innovator" in the design process.

We now explore how these doctors came to introduce teleconsultation at the time of the Covid-19 pandemic. The introduction of this digital innovation was motivated by the desire to increase their capacity to deal with the healthcare crisis in the context of the pandemic, and to defend themselves against competition from the digital health industry. Once the crisis is over, the practice of e-consultation becomes residual, as it is in tension with the professional values of these GPs.

4.2. *The Covid-19 pandemic and the introduction of e-consultation: the normative tensions around the definition of good care*

The Covid-19 crisis and the policy measures introduced to combat the pandemic (e.g., the general confinement of the population, and new health protocols) have introduced new digital needs and uses. The long experience of close collaboration between SOS doctors (especially Dr. E.) and the IT developers of the company that supplies and operates their business software, is beneficial for the introduction of digital innovations that best meet the doctors' new needs. During the first months of the pandemic, Dr. E. devoted a large part of his working time to identifying the needs of his colleagues and assessing the possibility of translating them into new functionalities. As a result, the MedicNum software infrastructure has been significantly expanded: for example, allowing partner professionals and institutions to book appointments online, or adding a "suspected Covid-19" reason for consultation when patients book appointments to prevent the spread of the virus in waiting rooms.

The Covid-19 crisis was also an opportunity to put e-consultation at the top of the agenda of the SOS Médecins federation. Prior to the Covid-19 pandemic, most SOS doctors disregarded e-consultation and insisted on the "artisanal" dimension of their clinical practice, which they wanted to be "warm care" (Pols, 2012). However, the Covid-19 pandemic brought strong arguments in favor of teleconsultation, such as the need for remote consultation to ensure access to and continuity of care (Mathieu-Fritz, 2021). At SOS Médecins, the introduction of teleconsultation is also motivated by a concern to defend their professional jurisdiction. At a time when commercial platforms that offered both online scheduling and e-consultation services were attracting an increasing number of patients, SOS doctors were concerned that many

patients were turning away from doctors who did not offer e-consultation. In fact, in the context of the first general confinement (February–May 2020), this practice, previously residual, was widely used in France (Mathieu-Fritz, 2021). At that time, some SOS Médecins doctors practiced telemedicine via WhatsApp instant messaging, a temporary technical solution allowed by public health authorities to combat the Covid-19 epidemic. Subsequently, the perceived threat to their activities removed the hesitation to develop in-house telemedicine solutions within their medical software.

As with previous innovations, e-consultation is developed by a "user-innovator" (Dr. E) in collaboration with IT developers. But while previous digital innovations have been widely embraced, the deployment of e-consultation is contentious, as well described by this doctor who also holds a position on the federation's board of directors:

Some cities do consultations, some do e-consultation, but it's a crappy kind of e-consultation. In some cities, they do a lot of teleconsultations, 20 a day per doctor. Here, we do 20 a day but for the whole practice! As a result, they don't do quality medicine, so who are they going to recruit as doctors? They're going to recruit doctors who are there just for the money, to sit at home in front of a screen.

(Interview with doctor R., February 9, 2022)

Differences in physicians' commitment to e-consultation between cities are a source of tensions within work collectives. Doctors responsible for establishing schedules may see as a problem that some doctors refuse to practice e-consultations. Just as each SOS doctor must provide his or her share of on-call duty, some doctors would like each doctor to provide his or her share of teleconsultations. The majority are opposed, arguing that this practice must be voluntary and can never become mandatory.

Even the main proponents of e-consultation are ambivalent. Having practiced telemedicine for almost 2 years at the time of our study, this doctor is also aware of its limitations:

January 26, 2022. 11h. e-consultation for "dizziness and severe headache" in a 37-year-old patient. Before bringing the patient into the virtual consulting room, the doctor opens the digital file of the patient who has already been seen at SOS Médecins. Among the antecedents indicated by the medical software is a "suspicion of stroke". Dr. E. begins by asking the patient to describe the reason for his call. The patient mentions vagal discomfort upon awakening and a severe, persistent headache. Given the patient's history, Dr. E. points out that he is "at the limit of what e-consultation can do," but offers to continue the examination. He regrets not being able to offer the patient a home visit. The patient, for his part, has no access to a local doctor, and his ailments prevent him from driving, making it impossible to schedule an emergency consultation at one of the SOS Médecins practices. Before the click to end the teleconsultation, Dr. E. invites the patient to call the emergency number 15 if his condition worsens.

(excerpt from fieldnotes)

The observation of a case described by Dr. E. as "borderline", clearly illustrates the discomfort, even unease, that e-consultation can cause for doctors deprived of the possibilities of the hands-on clinic. Unlike situations where doctors can delegate certain examinations to other health professionals (Gaglio, 2018; Mathieu-Fritz, 2021), here the doctor is left alone with missing elements. The patient, for his part, is left to cope on its own. While Dr. E. expresses his frustration with this situation, he feels that the teleconsultation is "better than nothing". He agrees that teleconsultation is similar to "tele-consulting", which often amounts to "making triage decisions rather than clinical ones" (Banks et al., 2018); however, he also believes that it provides a medical response to a deficient health care system. Paradoxically, he sees telemedicine as a suitable practice only when it can draw on nearby medical resources. Although telemedicine can compromise patient follow-up due to

fragmentation of care (Mort et al., 2003), it remains consistent with this physician's vision of care, provided it is practiced in a geographical area where the doctor can have a backfall solution for the patient.

E-consultation has eventually become a residual practice at SOS Médecins: during the first general confinement of the population in 2020, it accounted for 60% of medical procedures performed by SOS doctors, falling to 1% by 2022. The refusal to standardize the practice of medicine "in degraded mode" is the most frequently cited reason for SOS doctors who no longer want to practice telemedicine. They see this digital device as a "crisis tool" (Lüchau et al., 2023), useful in certain circumstances but at odds with the values and professional identities. Neither fear of competition from other healthcare providers nor demands from public health authorities are compelling enough to convince the profession to maintain e-consultation over the long term. However, the federation is still debating its position on teleconsultations. In 2023, a few associations launched e-consultations on an experimental basis and in a few cities, reserved for the follow-up of patients already seen during an office consultation or a home visit. This reflects the aspiration of some doctors to create a telemedicine service that increases their capacity of action while respecting their medical culture.

Finally, we will analyze how, starting in 2020, a group of doctors came to design an experimental algorithm based on artificial intelligence for assisting medical decisions. The recent introduction of this digital innovation is motivated by the objective of valorizing SOS Médecins data with a very marginal change in medical practices. Adoption is, however, limited by a sense of disconnection between the expected uses of the algorithm and doctors' professional culture.

4.3. Experimenting with AI for decision support: a lack of connection with professional practices

While some medical specialties are already using AI algorithms for decision support, particularly in imaging, general medicine is not considered a particularly good area to experiment with this type of innovation. As mentioned above, SOS doctors value a medical art based on clinical and diagnostic expertise and criticize the standardization of medical work (Berg, 1997). How, then, are we to understand that they have come to design an algorithm intended to help them in their diagnostic work?

The introduction of this innovation is part of an effort by one doctor (Dr T.) to exploit SOS Médecins' patient data for a variety of benefits. Dr. T. has an atypical career path as he spent 10 years as a computer science researcher. Because of this previous professional experience, he is particularly aware that health data is attracting growing interest from multiple actors. Indeed, healthcare organizations are increasingly invited to make data useable for a wide range of uses and for actors external to the organization, such as healthcare organizations and research centers. In addition, Dr. T. is a proponent of the use of AI in medicine. He convinces doctors who introduced earlier digital innovations (Dr. E. in particular) that the algorithmic valorization of their data will allow SOS Médecins to gain recognition for their expertise in medical AI. Like other doctors who have adopted AI technologies, they perceive them as a source of prestige, allowing them to position themselves as innovative professionals (Lombi and Rossero, 2024). They are also eager to promote expertise with AI in a fast-growing field in which the economic giants of the health sector are trying to position themselves. For example, one of the world's leading players in the digital health sector expressed its interest in their algorithmic solution at a national conference organized by SOS Médecins.

But above all, according to these doctors, an AI-based decision support system may provide additional support to avoid medical errors. Dr. T. presents the algorithm as a "double", a colleague that would help train medical judgment, particularly useful for medical interns or young practitioners - an objective often put forward by proponents of AI in medicine (Anichini and Geffroy, 2021) and by advocates of expert systems (Berg, 1997). The MedicNum business software includes 12 million

patient records collected over a 15-year period. The data set includes: the patient's medical vitals, age, sex, the presence of any previous consultations, and the clinician's written observations entered into the software during the examination. If the size of this database allows for algorithmic data processing, it is the use of the clinician's written observations that makes this algorithmic experiment so unique. The statistical model calculates the risk of hospitalization for patients after clinical examination. The result is presented as a percentage, which doctors are invited to interpret as a "test predictive of hospitalization", in the words of the computer researcher leading the project.

The project has prompted mixed reactions among doctors. When presenting the project, its promoters (particularly Drs. T and E) emphasized its benefits to clinical practice and the continuity with existing practices. They present this algorithmic prediction as an additional paraclinical element that will equip the decision, "just like a c-reactive protein test value [a marker of inflammation that has great prognostic value for doctors]" Dr. T. says in a document sent to doctors. Nevertheless, doctors expressed their concerns at the general meeting of SOS Médecins, where Doctor E. presented the AI project to his colleagues:

Nov. 25, 2021. 10h. General meeting of SOS Médecins.

Doctor E. takes the floor to present the AI project. As soon as his brief introduction was over, the first question came from the audience: "Are you telling us that we're going to become robots? That we're going to be useless?"

Before Dr. E. had time to respond, another doctor expressed skepticism: "Will AI do us any good? What is its scientific validity?"

(excerpt from fieldnotes)

These concerns echo some of the fears that algorithmic power raises among doctors (Hanemaayer, 2021; Lombi and Rossero, 2024). Doctors introducing AI see AI as a tool that can help prevent medical errors, thereby enhancing medical expertise and power. However, they also express two major fears: that of the automation of medical expertise, and that of being held medico-legally responsible, particularly in the event of a discrepancy between the algorithm's prediction and the doctor's decision. The fear of committing a medical error hangs all the more heavily over the activity of SOS doctors as they intervene alone at the patient's bedside. In addition, they have to decide quickly what to do in the face of non-life-threatening emergencies.

Finally, the adoption of this new tool in clinical practice stalls primarily due to a lack of connection with professional practices. SOS doctors show a limited interest, in terms of the number of users. During the first months of its implementation, between September 2022 and May 2023, doctors rarely consulted the results of the algorithm. Field observations have shown that many doctors are still unaware of the experiment or, caught up in the flow of clinical activity, don't think to look at and analyze the number suggested by the algorithm. In addition, doctors who have tested the algorithm question the relevance of the tool to their practice. In order to assess the uptake of their model, the IT researchers designed a tool so that user physicians could express their opinion by clicking one of two thumbs (thumbs up, thumbs down). In May 2023, they found that out of a total of app. 697,000 queries automatically sent to the algorithm over the previous six months, only 1,556 physicians had clicked one of the thumbs. Of those 1,556, 52% were thumbs up.

Among the doctors we explicitly asked to comment on the score suggested by the algorithm at the end of a patient's visit, many felt it was irrelevant. For Dr. C, a doctor in her thirties who is open to digital innovations: "The scores are not relevant, they are not 'guiding': to be interesting/helpful, the scores would have to be either very low (around 5%) or much higher (around 40-50%)." Thus, the doctors judged the overall performance of the algorithm to be poor. One explanation given by one doctor is that the risk of hospitalization cannot be assessed by statistical reasoning alone, but requires a case-by-case assessment of

medical and social contexts:

“When we enter a patient’s home, we have a lot of information about his or her environment, eating habits and lifestyle (is the room well-ventilated, is the patient a smoker, does he or she live alone, etc.). These elements are difficult to translate into statistical operations (...) Artificial intelligence affects a certain number of specialties, but these are not doctors who are on the front line.”

Interview with Dr. D., Sept. 2022.

Eventually, criticism or non-use of the AI algorithm do not come from a perceived threat to the clinical expertise of these GPs. Rather, they are motivated by a sense of a disconnect between algorithmic reasoning and a professional culture as “front-line doctors”. The doctors who led the innovation remain however optimistic about this experiment, which they see as the first step in a larger dynamic. In the short term, they plan to design an algorithm that would not calculate a risk score but suggest alternative diagnoses (i.e. infrequent but serious diagnoses, with the aim of reducing medical errors), a tool they believe will be better suited to doctors’ needs and more in line with medical practice at SOS Médecins.

5. Discussion and conclusion

In this paper, we analyze how French emergency physicians in private practice introduce digital tools and integrate these technologies over the long-term. We have identified three sequences of digitalization of medical work that have taken place in this professional context: the long-term adoption of digital tools that support mobility and connectivity; the circumstantial use of teleconsultation in the context of the Covid-19 pandemic; and the experimental introduction of an AI-based medical decision support system.

The context of practice and activities of these doctors are quite unique in the French context. However, at a time when the shortage of doctors is blurring the boundaries between general practice and emergency medicine, and when GPs are under strong pressure to digitalize their activities, this case study offers insights into the conditions under which private GPs come to put digital innovation at the service of their practices.

First, we have highlighted an overarching dimension that facilitates the introduction of digital innovation: the organization of these doctors as a coordinated professional which defends digitalization as a means of empowerment, and has the financial resources and control over their work tools to do so. We propose to use the term empowerment to emphasize that these professionals are introducing digital tools to increase their capacity to act and strengthen their position as key actors in the continuity of care and at the forefront of the health system. In the three sequences of digital innovation, it is a small group of doctors who formulate and drive this project of empowerment through digitalization. These doctors are closely involved in the design process of the digital tools and their subsequent adaptation (in particular, the inclusion of new functionalities in their medical software). Our findings are in line with research highlighting the role of practicing physicians in the design of medical innovations, in collaboration with industrial players (Chatterji et al., 2008). In addition, we emphasize the ability of these doctors to work with IT developers to ensure that the technological script embedded in them (in particular the expected uses) (Akrich, 1982) satisfies conceptions of good care.

Secondly, we have found three modes of adoption of digital tools by doctors, depending on the alignment between the expected changes in practice and the professional practices valued in the group. We use the term “domestication” (Pols and Willems, 2011) to describe the widespread, long-term adoption of digital innovations that these doctors see as perfectly aligned with their professional culture, as they facilitate their visits to patients’ homes and inter-professional coordination. These digital innovations strengthen the “continuity of distributed work” in primary care, i.e. work dispersed across space, time, modality and sector

(Ladds et al., 2023) as well as the “continuity of commitment to community” (op. cit.), as they enable examinations at the patients’ bedside. In contrast, teleconsultation was only adopted during the Covid-19 pandemic, with most doctors considering its use only appropriate for facing the crisis. As in other healthcare organizations, the Covid-19 crisis opened a window of opportunity to experiment with the use of new digital devices (Kateb et al., 2022). However, e-consultation gives to some of them a sense of doing “meaningless work” (Hoeyer and Wadmann, 2020); it risks destabilizing a solid and legitimate professional identity to reveal a more ambiguous role, limited to a form of tele-consulting. Finally, if the experimental introduction of an AI algorithm has aroused lukewarm interest among doctors, it’s because the proposed support seems to be based on statistical reasoning that is disconnected from medical practices. Teleconsultation and the experimental development of AI are at this time uncertain, controversial, and a potential source of fragility for this professional group; however, a number of projects are underway to adapt these tools to practices that these physicians consider legitimate and appropriate to their vision of care. This shows that these doctors are collectively working on the symbolic boundaries of the practices of their professional group (Lamont and Molnár, 2002), i.e. seeking to define a perimeter of activities within which digital innovation is considered legitimate.

We suggest two analytical perspectives for the study of how digital tools - in particular, medical softwares - are reconfiguring the professional culture of private GPs. We consider it crucial to advance research in this area, given the importance of independent doctors in the French healthcare system and the paucity of social science research devoted to them. Analyzing the digital transformation of their working practices seems all the more relevant given that independent doctors enjoy a high degree of autonomy in their choice of technological tools and are removed from the control exerted over the French medical profession by university and non-university hospitals (Bloy and Schweyer, 2010). As an essential tool in the digital transformation of healthcare demanded by public authorities, business software has become a crucial issue for these healthcare professionals. On the one hand, we suggest studying the introduction of digital tools in general practice by paying attention to the collective dynamics that are emerging among GPs to maintain professional control over a digitalization that is encouraged by public policies but also driven by digital giants. At a time when these giants are developing particularly aggressive commercial strategies for doctors and are highly visible to patients, GPs fear a possible loss of control over their activities and working tools, as well as a transformation of the patient-doctor relationship. For example, they perceive the widespread use of online appointment platforms as leading to a phenomenon of uberisation, where patients choose practitioners on the basis of their availability rather than their reputation (Habib and Loup, 2019). In this context, doctors are trying to regain control over digital developments and are forming groups (such as the “100,000 Doctors.org” association in France, made up of national unions of independent doctors <https://www.10000medecins.org/>). They want to put pressure on software publishers to get involved in the design and development of new digital tools. We can see here how the increasing digitalization of healthcare is leading doctors to lose control over the technical aspect of their work, a key determinant of their professional autonomy (Freidson, 1984). Faced with the risk of deprofessionalization posed to GPs by their growing dependence on the digital health economy, the dynamics of collective empowerment through digitalization seem to be gaining momentum.

On the other hand, we suggest questioning the adoption of digital tools by GPs from the point of view of the normative tensions that they experience when the expected practices embedded in the technological script do not fully correspond to their professional culture. This research avenue would further explore the idea that digitalization has paradoxical consequences on professional work in healthcare (Ziebland, 2021), such as de- and re-professionalization (Petraiki et al., 2012), the simultaneous gain and loss of autonomy (Mazmanian et al., 2013), and

the current weakening and strengthening of continuity of care (Ladds et al., 2023). Further research could explore how these doctors overcome these normative tensions by changing the meaning they give to their work, which is akin to a form of cognitive job crafting (Wrzesniewski and Dutton, 2001), and redefine their professional activity accordingly.

In conclusion, our study has shown that there are several overlapping temporalities and logics of digitalization in a specific segment of general practice, private emergency medicine. While digitalization has historically been driven by a strong professional project, recent initiatives are more a reaction to the growing influence of economic actors and the increasing importance of economic stakes related to healthcare and health data. This adds uncertainty to the future of digitalization and calls

for research into the transformation of the work of health professionals at the frontline of the health system.

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Marie Ghis Malfilatre: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Séverine Louvel:** Writing – review & editing, Supervision, Formal analysis, Conceptualization.

Appendix 1. Methodology for data collection and analysis

Table 1
Key ethnographic materials used.

Digital innovation	Main empirical material gathered and used for this article
Long-term digitalization of medical activities	<ul style="list-style-type: none"> - Interviews with 18 doctors - Observations of doctors' use of a heterogeneous set of digital devices before, during, and after patient examinations, their experiences with them, and the ways in which these devices inform and transform medical practice.
The introduction of teleconsultation at the time of the Covid 19 pandemic	<ul style="list-style-type: none"> - Repeated interviews with the physician who initiated the introduction of teleconsultation - Interviews with 7 physicians using teleconsultation - Observations of 12 teleconsultations
On-going project to implement an algorithmic medical decision-making tool	<ul style="list-style-type: none"> - Informal discussions, particularly at the association's annual meetings - Repeated interviews with the doctor and the IT specialist leading the project - Interviews with 18 doctors with whom the project is being tested - Observations of the experimental use of the algorithmic tool by physicians during office visits or in patients' homes - Observation of general meetings of the association where the project is presented and discussed.

Table 2
Key analytical steps.

Qualitative data excerpts	Initial categories	Sociological themes and notions
Introduction of digital innovation by the group		
"It makes us more professional to teletransmit mail to the GP. At SOS, we're a bit outside the framework of the GP system. They may have the impression that we're 'uber-doctors'". (Dr. P. February 8, 2022)	Expectations: increased professional recognition	Project of empowerment of the professional group
"With the functionality developed jointly with SOS Infirmiers, you can now book an appointment for nursing care without delay, within the hour, ensuring rapid care and avoiding hospitalization." (Dr. T., SOS doctor, Jan. 2022).	Expectations: increased capacity for action	
"The goal with AI is that the least good of the doctors at SOS Médecins France should still be good, because we're going to give them the tools to do so." (Dr. C., Chairman of the Scientific Committee of SOS Médecins France, Apr. 2022)	Expectations: increased expertise	
"If we don't do teleconsultations, others will." (Dr E., doctor-innovator, Jan. 2022).	Expectations: keep up with competitors	
"Technology is our third largest area of investment". (Dr. F., SOS doctor, Jan. 2023). "The advantage of this software is that you can produce data and process it so that you can increase its value, so that you can work with laboratories and manufacturers." (Dr. R., SOS doctor, Feb. 2022).	Funding	Resources of the professional group
"With its medical regulation centers (6.3 million calls/year handled via its national number 3624), home visits (2.6 million/year), consultations at its fixed points (1.1 million/year), online appointment booking, its applications and soon telemedicine, SOS Médecins offers a collective and diversified practice of medicine that adapts to new needs and usages in a spirit of cooperation and service to the population." https://sosmedecins-france.fr/rejoignez-nous-2/	Identity and common values	
"In the past, blood pressure and temperature were not systematically entered in patient records. We asked for a box to be created in the software and it's simpler for the doctor: when he clicks on it, it opens the numeric keypad on his smartphone and all he has to do is enter two figures, which are inserted in the right place in the patient's file." (Dr J, SOS doctor, Jan. 25, 2022).	Co-design of innovation with IT developers	
"Dematerialisation is designed to offer doctors a carrot, so that they use the tool. If a doctor fills in a prescription directly from MedicNum, the prescription is generated automatically, saving time." (Dr E., doctor-innovator, Jan. 2022) "By integrating the concept of the patient's trajectory into the database and identifying the succession of related health events, we could use artificial intelligence to detect certain	Anticipated uses	Technological script embedded in the digital innovation

(continued on next page)

Table 2 (continued)

Qualitative data excerpts	Initial categories	Sociological themes and notions
pathologies earlier on the basis of these trajectories. Care would be better coordinated.” (Dr T., doctor-innovator, Feb. 2022).		
Adoption of digital innovation by individual practitioners		
“The software can enable us to see whether the person has already visited us and for what reasons. That’s very interesting.” (Dr. D., SOS doctor, Sept. 2022, on the subject of the developments made in the business software enabling them to see the patient’s history).	Emphasis on the benefits of innovation for medical practice	Technological script: alignment with the medical culture of the group
“We are seeking to develop teleconsultation for acute care follow up, for patients already seen in consultation or during a home visit. This can allow, for example, treatment to be adjusted after receiving the results of complementary examinations.” (Dr E., doctor-innovator, Jun. 2023)	Adapting tools to usages	Technological script: search for alignment with the medical culture of the group
“Teleconsultation is sub-medicine. I stopped very quickly. I had the feeling that we were going to end up making the situation worse.” (Dr J., SOS doctor, Jan. 2022).	Criticism and non-use of innovation	Technological script: Normative tension with the medical culture of the group
“The scores are not relevant, they are not ‘guiding’: to be interesting/helpful, the scores would have to be either very low (around 5%) or much higher (around 40–50%).” (Dr A., SOS doctor, Jan. 2023, about AI)	Criticism and non-use of innovation	Technological script: disconnection with the medical culture of the group
“It’s not this score that will give me an argument in court in the event of legal action for malpractice.” (C., medical intern, Grenoble, Jan. 2023, about AI)		

Data availability

The authors do not have permission to share data.

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