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PRACTICE-CENTERED APPROACH TO DESIGN COOPERATIVE HEALTHCARE INFORMATION SYSTEMS: DATA, ARCHITECTURAL AND ORGANIZATIONAL CHALLENGES

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Abstract. The healthcare sector is a collaborative environment that requires a joint action for delivering care. Health professionals who work in different organizations or settings must assimilate a massive amount of data generated during the patient care journey. Electronic healthcare records offer a starting point for supporting cooperation among healthcare professionals by saving and sharing traces of the patient's medical acts. However, we claim that these records merely store and share data, which disregards how health professionals use this data to understand the patients' situations and make decisions. We argue that focusing on the cooperative practices of managing patients gives designers new insights to design future healthcare information systems supporting cooperation, and we identify challenges related to this design approach.

Keywords: Electronic healthcare record, healthcare information system, cooperation, work practice, patient trajectory

1 INTRODUCTION

The medical arena is a complex environment composed of different clinical (specialized and non-specialized) and non-clinical professionals [1]. Those actors execute different tasks, each according to their specialty and role, and therefore cooperate to accomplish their shared goal of delivering care [2]. The healthcare practitioners are indeed called to work together to achieve a shared mental model to align their joint action [3]. Besides the need for communication, information, and knowledge

sharing [4], care actors also need to understand the role of the other participants in the care journey [5]. This multidisciplinary work escalated with the increased demography of the aging population, with vulnerable patients suffering from multiple illnesses who demand a thoroughness medical care [6]. The literature highlighted the need of each care actor to get an overview of the history, the current events, and the different treatments followed by each patient [7, 8].

With the large areas (pharmaceuticals, health services, ...) covered in the healthcare sector [9], the developed countries, particularly the OECD countries, are depending intriguingly on inter-organizational collaboration (IOC) [10]. Indeed, the fragmentation of the care actors that participate in the care delivery over the different organizations and settings raises the need for inter-organizational collaboration in order to organize the independent actions in one coherent healthcare process [11]. The gain earned from IOC helps to minimize the redundancy of efforts, limit medical errors, and enhance the overall quality of care [12]. IOC aims at reducing the economic burden related to the healthcare services and to improve the quality of the health services [10]. A considerable investment has been made to design inter-organizational systems [13] that are aligned with the legislation calling to promote the collaboration between the different healthcare settings [14].

In parallel, the demand to implement health information systems has constantly increased [15]. Information and communication technologies (ICT) are touted as a solution to respond to the continual need to offer an integrated access to the patients' data, to enhance the professionals' performance, to reduce the healthcare costs, to create a joint action led by a team of healthcare professionals, and to satisfy the demands of the complex and fast-changing health environment [16, 17]. Indeed, with the huge investment in IT for healthcare [15], many solutions have been developed (electronic health records, RFID technologies, context-aware technologies, etc.) that can potentially support cooperation [7].

However, the usual approach for designing healthcare information systems (HIS) focuses on data management, creating giant data containers that healthcare professionals can use during the different phases of the patients' healthcare journey, which is a narrow view of cooperation [18, 19]. Indeed, the observation of healthcare practices has showed that healthcare actors constantly try to make sense of data to overview a patient's situation [8]. They often rely on collective work like multidisciplinary meetings and daily rounds to overview and discuss the information collected by different actors (in the progress notes, the patient records, the rounding lists, etc.) [20]. Studies have also highlighted the importance of time in medical work [21]; seeking and making sense of the data, usually coming from different sources (EMR, mail, notes of other health professionals), is a complicated, time-consuming task.

In this context, we argue for designing information systems that go beyond a pure data container and that engage healthcare professionals in collaborative documentation and communication in order to support cooperation. We claim that shifting the focus from healthcare data management to healthcare professionals' practices [22] offers new insights into how to design systems that support cooperation and raises challenges from a data, an architectural and an organizational point of view.

The remaining parts of this paper are as follows: First, we present a literature review in which we synthesize studies of electronic health records, and healthcare information systems, focusing on the problems leading to their rejection and failure as well as the design recommendations proposed to overcome those problems and to create HIS that promote cooperation among actors working in different settings. We then introduce our proposal for designing HIS supporting cooperation, and the challenges and opportunities related to their implementation. We finally illustrate those challenges through a current project we are leading in France.

2 RELATED WORK

The introduction of new systems in the workplace is always challenging [23], as it may create conflicts, constraints, and new rules on the already existing practices [24]. Moreover, the introduction of IT tends to be even more challenging in the healthcare environment due to the intricacy of medical data, security and confidentiality issues that arise when sharing patients' data [17].

Many pitfalls led to HIS rejection and projects' failures [25, 26]. The assessed benefits were also rarely achieved from a medical point of view [27]. Moreover, the fragmentation of data through the different IT systems used by the different organizations leads to disconnected documentation and no data sharing, which induces the isolated care activities where each professional acts upon their perspective [28], which impedes cooperation among the care actors.

Besides the many ergonomic problems [19, 29], hardware and technical issues [19, 30], the literature unveiled many other reasons that may steer to the failure and the rejection of HIS. We chose to categorize those reasons into two classes:

- Reasons related to the integration with the workplace practices;
- Reasons related to the cooperative nature of healthcare work.

2.1 Integration in Workplace Practices

Many studies in the CSCW and Health Informatics communities highlighted how the non-respect of the workplace practices while piloting new technological projects lead to the rejection and the failure of the system.

The medical field by nature is a knotted environment where care occurs in episodes with frequent contingencies, the data is compound and its security and confidentiality is a steady preoccupation [31]. Those characteristics make the task of designing and implementing a medical information system a very tough task. However, developed systems generally tend to ignore the actual way the work is done (documentation, ordering, ...) and redesign the workflow [32, 33, 34, 35]. Those attempts changed the familiar activity flows which exacerbated the workloads of the healthcare professionals and created a time-consuming action [26, 30, 32]. Also, they decreased clinicians' productivity, caused communication breakdowns,

and damaged the interaction between healthcare providers [32, 33, 36]. Over and above, the introduction of IT destroyed synchronization of the activities and the exchange of feedback on which those activities may relay [36] and changed the overall relationship between actors and the culture of the organization [34]. In addition, many researchers argued that the proposed process in those systems is linear with the sequential order of activities, but the actual medical work is a dynamic process where actors rearrange their actions according to the actual situations [30, 37].

Moreover, researchers argued that system providers give less assessment to the existing reality while designing and implementing medical information systems, which leads to a reality-design gap. This reality-design gap is fostered mainly by the providing of inadequate information that the end-user may request and by the work procedures that do not match the actual workflows [18, 38].

Beyond that, nowadays, governments are promoting the National wide system in order to organize healthcare system procedures. Yet, this Standardization of workflows ignores the customized practices of each organization which leads to the system's rejection [39]. In the same context, healthcare professionals are not familiar with using IT and are not aware of the benefits that they may have from employing them in their daily practice [40]. Plus, often, they are not invited to be involved in the project's creation as experts who can best describe the work practices, workflows, and explicit expectations [18, 41]. At the same time, the lack of training and technological change process during the deployment phase seems a crucial reason that leads to the system defeat [39].

2.2 Cooperative Nature of Healthcare Work

Healthcare is a highly collaborative system where communication and coordination underpin the process of decision-making between all the stakeholders and enhance the relationship between patients and providers [42]. However, the introduction of new technologies in many cases imply changes in workflows, task division, and participants roles as it may alter the work organization by impacting the way actors are collaborating [43].

The Computer-Supported Cooperative Work community worked since its inception to study IT solutions that tailor the organization's way of work and which respect the collaborative aspect. According to Schmidt and Bannon [44], to support cooperative work through technology, developed tools must address the main issues of the cooperative work:

- Supporting the articulation of work [45]: defined as a list of tasks that need to be coordinated. This articulation includes programming and reprogramming the sub-tasks, getting over the emerged errors and gathering resources. HIS must support the articulation of work as those tools must permit the health care actors working in a very contingent environment to self-organize their procedures;

- Ensuring the common information space (CIS) [46]: defined as the physical container of information as well as the sense attributed to that information by the different users. Therefore, the HIS must encompass a shared information space that contains all the artifacts that support the cooperative work with clear details about the information generators;
- Creating the social-technical system [47]: which is a characteristic of all the systems that contain a social sub-system alongside the technical sub-system. In CSCW, the concept promotes the acknowledgment of both subsystems in organizations during the introduction of new technologies as it may affect the social aspect of work. Thus, the HIS must respect the social-technical system character of the medical field.

However, researchers raised awareness about the problem of ambiguity of the information writer (prescriptions originator) in the shared EHR that leads to fogginess about the source of the instruction and required extra efforts from the medical team to do in order to verify whether the data available in the systems are reliable before executing the orders [36, 48]. Plus, in many cases providers asserted that finding the right information in the systems is a tough task due to the data overflow and the long printouts [15, 19, 41]. Also, the data are often not complete (e.g. the lack of information about the radiological test process including the conditions and the action of the preparation that may be required for a certain type of patient) [49]. Healthcare actors complained from the fact that in many instances they were not able to sort and prioritize those data according to their need [50] and those problems proliferated the time-consuming documentation and data retrieval.

Additionally, different researchers highlighted how the introduced systems frequently ignored the necessity to respect the prerequisite to allow users to align their tasks with their co-actors to permit them to articulate their tasks and coordinate their work trajectories while ensuring continuity of care. [29, 30, 36]. Worse than that, IT entails cross-boundaries breakdowns due to the improvident in Physician Order Entry Process, the insufficiency of the shared information, the unsuccessful interactivity, and inefficacy of artifacts [32, 49, 51]

Furthermore, the discard of the social aspect of work was a salient cause of the system's disapproval [52] as system providers focused on the technical feature on behalf of the social side [53]. Many writers argued how the creation of an IT system for healthcare is not just a technical process as the healthcare field is a collaborative environment where all the actors – including the top management, stakeholders, clinicians, ... – need to interact and cooperate to deliver the best service [39].

To summarize, when reviewing the studies related to the design and deployment of HIS, we identified the pitfalls leading to their rejection, which is helping us to identify principles that should be applied when designing HIS to support inter-organizational collaboration. The main argument in the literature is the need to rely on the work practices as the pillar that supports the design.

3 A PRACTICE-CENTERED APPROACH TO DESIGN COOPERATIVE HEALTHCARE INFORMATION SYSTEMS

In this section we present our approach to design cooperative health information systems. This approach focuses on the practices where HIS must evolve from a simple data container where medical information is stored to a scalable social-technical system. Thus, it is crucial to collect the social-technical requirement based on the day-to-day practice in order to fit with the reality [56]. Indeed, the creation of new technologies need to give a significant amount of consideration to the workflows, teamwork, and the other central medical practice [54].

Moreover, as indicated in the introduction, we are interested in a developing phenomenon, which is the inter-organizational healthcare practice. Indeed, this way of working, taking care of the trajectory of patients, whereas they are hospitalized, in a nursing home or back at home, is becoming the norm, at least in OECD countries. In this configuration, new forms of collective efforts emerge, like knotworking which describes that actors usually loosely connected work together to solve a problem despite the boundaries of the contributors involved [57]. Recent work has even suggested design guidelines for information systems to support this knotworking [31]. The design principals aim to assist HIS developers to create new technologies that furnish flexible access to data, provide information for the different changing and evolving actors, and enable synchronous and asynchronous communication between them.

Taking into consideration this existing work, we suggest that a practice-centered approach to design cooperative HIS should provide three main requirements: support the awareness, integrate with the ecology of artifacts around the users, and enhance the data presentation. In the coming sections we present the details of each requirement.

3.1 Supporting Awareness

Awareness is one of the central concept of CSCW, it is defined as a commitment by its percipient to engage in a prolonged activity of seeking attention of the activities occurring around him as well as regenerating information [58]. Being aware about the overall patient situation is a core requirement of the medical work where healthcare professionals need to work constantly to acheive the overview of the patient state and act upon it to deliver the coherent care. Therefore, we argue that an HIS need to ensure that the users stay conscious about the urgent and imperious cases to which they need to respond quickly. Highlighting the urgent information, dedicating special views to contingencies, and offering a notification service is tremendously important to ensure this awareness's level [15, 35].

Moreover, we argue that the system needs to ensure the temporal awareness [7], which allows one to have an overview about the past, the present, and the future predictive actions that are significant to that person. Thus, the system needs to enable the care actors to locate their activities as well as the generated medical

data in time, as time is a crucial resource that guides the actions in the healthcare work.

Also, we claim that its system needs to guarantee social awareness [7], which enables the person to be aware of other persons around them by knowing their place, their activities as well as the different information about them. Consequently, the systems need to ease the task of identification of correspondents. Likewise, the system needs to facilitate reaching out for the different actors participating in the care journey in order to seek more information. Moreover, it works to enable the users to collectively make sense of the medical conversation they are engaged in, taking into account that healthcare professionals use their documentation to identify their future activities and those of their colleagues through time and place [3].

We insist that offering the healthcare actors the opportunity to be aware both socially and temporally of the different activities occurring around them and the different actors participating in those activities will facilitate their work. This transparency will allow the emergence of conversations about the patient, will foster the medical care and will ensure the coherent service.

3.2 Considering the Ecology of Artifacts

The ecology of artifacts [59] is defined as the ensemble of all the physical material that each person may possess, use, and can access. This ecology evolves around each user according to its appropriation and uses in time (e.g. introduction of new tools...). Literature debated the effect of the spatial configuration and the way information is inscribed inside those artifacts on cooperation between the different actors working through the different workplaces [60]. Therefore, we debate that our system that works to ensure cooperation between health cares actors need to take into consideration the different ecologies of artifacts around the future users as they represent the actual way the work is done. In addition, we claim the necessity to reflect on the way those artifacts evolve in time and how they are shared in the cooperative arrangements.

3.3 Enhancing the Data Representation

Data and medical information are the core component of medical work [16, 21], therefore, further focus is needed to accommodate the data to the cooperative practices. For instance, our proposal focuses on offering multiple views on patients' data based on the user's profile and their involvement in the patient journey. These multiple representations will allow the users to stay aware of the actions carried out around them and coordinate their tasks adequately [56]. Also, it will point to offer a gradual level of visualization in order to permit healthcare professionals to access data according to their experience and knowledge of the cases [8].

To summarize, our proposal aims to support the design of systems that enable healthcare professionals – that may not belong to the same organization – to cooperate. Thus, we propose that a HIS cooperation system should increase health professionals' awareness of other health actors' activities, integrate the current ecology of artifacts, and enable the care actors to enhance their understanding of their patient's medical data. This proposal is in line with a large body of research demonstrating the need to consider work practices before designing systems that support cooperation [18, 43, 54, 55]. In this context, we are debating the data visualization techniques as a key to support actors making sense of the medical data and cooperating to take care of their patients.

4 CHALLENGES AND OPPORTUNITIES

A practice-centered approach to support the design of cooperative HIS raises challenges related to three dimensions of healthcare systems: a data model that allows representing the pertinent information, an effective architecture that supports continual communication and personalized data sharing, and an organizational basis that promotes cooperation among the different stakeholders.

4.1 Data Challenges

Medical data privacy is one of the most prevailing concerns that arose with electronic health records as they include highly confidential data about a patient's life [48]. Thus, it is essential to implement a very tight access control system allowing each participant to visualize only the necessary information. Therefore, identifying the data that can be visualized by each profile represents a challenge by itself. Moreover, the responsibilities of each care actor may evolve, so access rights have to evolve accordingly.

Besides, it is also challenging to consider the huge amount of data to present and which evolves rapidly in time due to the pace of changes in the priorities in the care trajectory [49].

Finally, with the existence of the multiple ecologies of artifacts that differ from an organization to another, the balance between standardization and customization while creating information systems that consider the different ecologies of artifacts is a real challenge.

4.2 Architectural Challenges

As indicated above, in order to promote the cooperation among healthcare professionals, we must ensure that the HIS evolves from a data container to a sociotechnical network that allows information exchange and permits patient monitoring, alerting options, and offers a solid cognitive support [18, 19]. Moreover, this network has to be integrated in the existing constellation of artifacts [50] of the care actors.

Thus, the data that has to be retrieved from each system used by the care actors has to be identified as a mechanism that permits the integration of the fragmented data into one system.

However, the work to replace all the existing system with a new one is not realistic, because it alters the work practices and may create conflicts. Therefore, the work to create a tool that supports cooperation by offering a (virtual) place where healthcare professionals can communicate and share data coming from their systems is a tough challenge to overcome.

4.3 Organizational Challenges

As already mentioned, the identification of the care actors who participate in the different care journeys is needed [51]. Moreover, many problems occur due to the lack of communication about the temporal priorities of actions and the lack of data transferred between the different parties [41]. Increasing the motivation of the healthcare professionals is one of the main challenges to ensure their commitment in a willful cooperation.

To recapitulate, despite the challenges to overcome, we argue that supplying healthcare professionals with a cooperative HIS will allow them to get an overview of the different events occurring in the patients' care journey and will enable them to identify and get in touch with the various actors with whom they may have to interact to reach a common goal.

Also, communicating with the other stakeholders from the different organizations will enable the health professionals to build a shared mental model and develop reciprocal respect, which should enable trustful relationships [5]. Therefore, the use of a cooperative HIS should positively impact the patient's care delivery as it will prevent the medical errors that may arise from miscommunication during the transfer of patients from one care setting to another [52].

5 ILLUSTRATION

Here, we present an empirical case of a project at a regional level aiming at supporting IOC in healthcare. The system that is put in place offers an example that is partially aligned on our proposal, so following its configuration and deployment should deepen our understanding of the complexities related to the implementation of IOC in healthcare.

5.1 French Context

In 2018, the French government launched their National Health Strategy aiming at establishing a five-year term policy for the healthcare system. The goal of this strategy is to modernize the healthcare system, to act against social and geographical inequalities when accessing care, to promote good practices that maximize

the prevention, as well as to ensure safe, relevant, and high-quality care for patients.[1]

In order to implement this National Health Strategy, several measures have been put in place; in particular, a Healthcare System Transformation Strategy (STSS) has been defined. It encourages the creation of organizations promoting cooperation between healthcare professionals with a private practice, and those exercising in hospitals. Digital tools have a central role in this strategy as they are presented as solutions that should allow various care actors to work around a patient (seen as the core of the healthcare system) to ensure a good quality of care.[2]

Three main technologies are being promoted[3]:

- **A digital health space for all the French citizens by 2022** which represents the shared medical record that encompasses all the information about the patients, the care they had, the reimbursement of their care as well as their trusted relatives who can consult their personal data in emergencies cases.
- **Telemedicine tools** which aims to enable the different health care professionals to deliver care online. Those solutions aim to provide more access to regions that suffer from the medical desert
- **Health Data Hub** that organizes and makes available data from the national health data system for research projects deployed for the public interest.

Moreover, besides the promotion of technological adoption, the french government calls for the creation of the Communities of territorial health professionals (CPTS) that aim to organize the care offers delivered in the city. The work of the CPTS is to regroup the healthcare professionals working liberally, using the data provided by health insurance establishments, around the care projects that best meet the needs of the population.

5.2 Care-0: A System Supporting Cooperative Work

To cope with the new directives of the health system transformation strategy, each region of France identified public/private organizations in charge of the development of e-health services. Their role consists in applying the national strategy at a regional level, which means selecting, configuring, deploying and maintaining the healthcare infrastructure, and systems that are pertinent for their region.

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[2] Centre de documentation de l'Irdes, 2019, La loi Relative à l'Organisation et la Transformation du Système de Santé, https://www.irdes.fr/documentation/syntheses/pro-jet-de-loi-relatif-a-l-organisation-et-a-la-transformation-du-systeme-de-sante.pdf

[3] https://www.ars.sante.fr/system/files/2019-07/2019-07-10-Masante2022-adoption-PJL.pdf

As our research deals with cooperative HIS, we contacted the organization that has been put in place in the region of our university, the Grand East region, in order to be involved in the customization and the deployment of Care-O (name has been changed) to support cooperation between the local hospitals and the private city-based care actors, with which we collaborate for several years already.

Care-O is a new system that is available on web and mobile devices to assist the coordination support plans. It offers the professionals working over the different settings a coordinated treatment path where they can share and exchange data and information about patients and make decisions to establish a personalized care plan for each case (Figure 1 presents an overview of the interface that allows the adjustment of the personalized health plan according to the patient state and care circle). Based on the data provided by the local Primary health insurance fund organization (CPAM de l'aube), the first care project to be mounted on Care-O in our region is used for the management of diabetic patients.

Care-O offers a multitude of communication tools like instant messaging app, which is available in the two version of the tool, liaison notebooks, alerts, and notifications. Also, it enables professionals to identify the other professionals taking care of a patient, allowing them to exchange rapidly and to collectively follow the progress of the patient in order to be able to coordinate during complex situations.

Moreover, it offers cooperation tools such as a shared agenda where professionals can visualize the different programmed events and a lifeline visualization (Figure 2 presents the list of documents added on Care-O on temporal scale to facilitate their identification in time) where they can browse the patients' timelines to see the different added documents (lab results, medical reports, ...) as well as the different booked appointments. Care-O also offers the professionals the ability to create a personalized care plan according to a patient's situation.

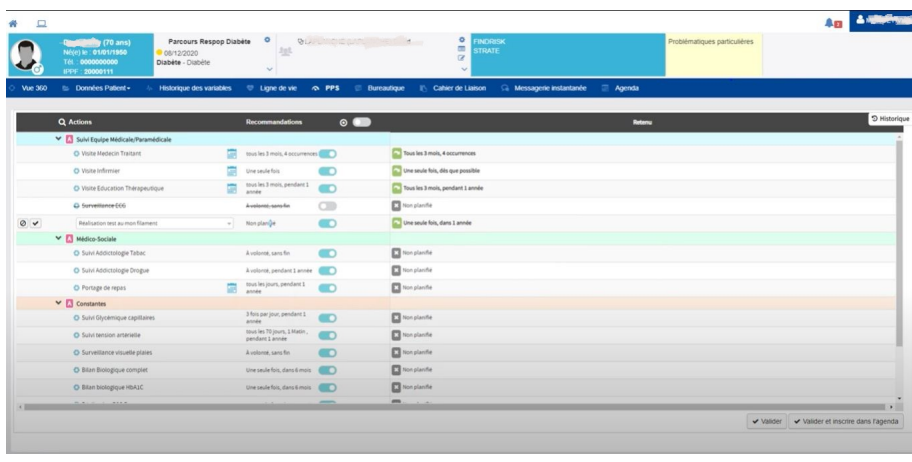

Figure 1. The interface that allows the adjustment of the personalized health plan according to the patient stratum and his overall situation

Over and above, Care-O is connected to an Identity Reconciliation Server, which presents a database of all the citizens, that facilitates the verification of the identity of each patient and fluidizes the task of their inclusion (Figure 3 presents the first page where actors fill the information needed to pre-include the patient in the Care-O journey) by the different healthcare professionals that may launch the treatment journey.

Also, acting as the automatic fallout of the various documents generated by the various health professionals (Figure 4 presents an overview of the page allowing to visualise the different added documents as well as the different actors that may manipulate them) makes Care-O the go-to of the different health care actors looking for further information about the patient. To optimize this automatic fallout of documents, the project proposes the deployment of data modules on the different computers used by the different care actors that act like connectors that bridge the documents from their sources in the EMRs used by the care actors to Care-O.

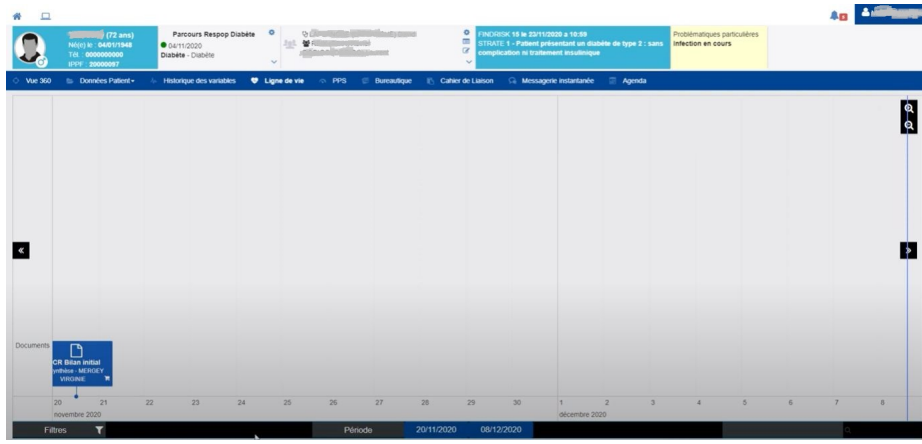

Figure 2. The lifeline visualisation permitting the positioning of added document on a temporal scale

From this presentation, we argue that Care-O presents a good example of a cooperative HIS that works to ensure awareness and that works to integrate within the ecology of artifacts used by the different users. Therefore, Care-O offers a good case to deepen our understanding of the challenges related to the design and deployment of systems supporting cooperation. Also, it will open our eyes to the possible ways to overcome those challenges.

5.3 Challenges

To deepen our understanding of the tool, the potential users, and the proposed processes, we enrolled in three meetings with the project leaders in the Champagne-

Sud Hospitals, two presentations by the regional grouping leading the project in the Grand East region, and one demo session with the project manager. During those sessions, we noted the main functionalities, we were able to see the platform and ask questions about the different processes considered for the inclusion of patients and healthcare professionals as well as the scenarios of uses.

At the same time, we were able to collect a list of contact of different healthcare professionals that participated in the different presentations of Care-O and were willing to participate in the first user groups. We used this list to plan our field study to investigate the cooperative work practices, the different artifacts used as well as the expectations regarding collaborative information systems.

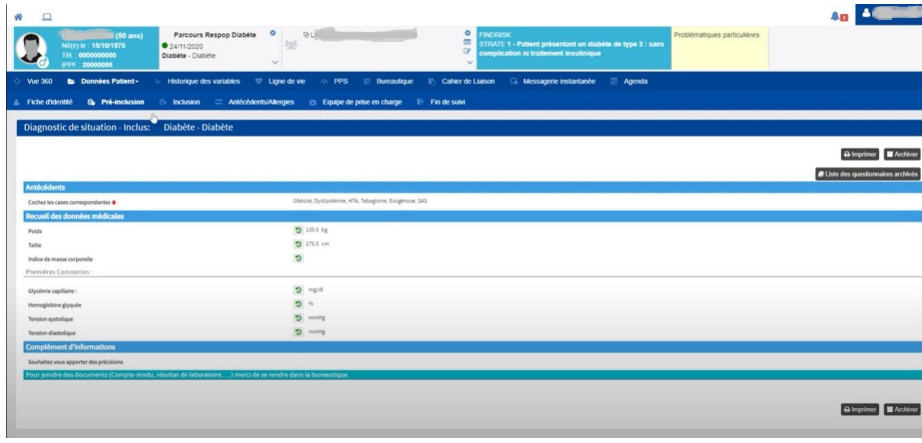

Figure 3. The interface permitting the filling in the information for the pre-inclusion of the patient in the Care-O journey

Through the analysis of the information we collected during the different sessions, we observed a challenge of identifying the data to be presented to the different care actors. The care process of diabetic patients includes both healthcare professionals (doctors, nurses), paramedical professionals (dieticians, physiotherapists, etc.), and social actors (social workers). However, Care-O allows the creation of three types of profiles only; health professional, patient, and patient's entourage. It allows the assignment of three types of roles; user, coordinators, and transverse. The coordinators are the managers of the care pathways. Therefore, they manage the shared agenda, the booking of consultation appointments and the patient follow-up. At the same time, they are the person in charge of defining the defaults data access rights for other healthcare professionals. However, it is not clear yet which health actor from the patient care circle will be assigned to this role. Thus, they are still discussing the choice between treating physicians (GP) and the new emerging medical professions that are being created such as the advanced practice nurses (IPA).

> "It is part of all these new professions which are in the process of being set up, such as IPAs, which are those professions where nurses are starting to take up duties, a little more coordination around the patient and we can clearly see that the IPAs do a lot between town and hospital."
>
> DL, The Project Porter

Besides, as the enrollment of the health professionals into the tool is based on the shared directory of healthcare professionals number (RPPS), the other types of profiles that normally participate in the patient care journey and who do not have an RPPS number are ignored.

At the same time, Care-O allows the users to precise the documents readers while uploading their document on the platform. Yet, the inclusion of health professionals in the care path depends on their colleagues who are already included and who are in charge of defining the care circle of each patient. Hence, we question if healthcare professionals will show enthusiasm to use one extra tool to upload the documents and to follow the evolvement of the care circle.

To investigate the architectural challenge, we are interested in analyzing how Care-O goes beyond a data container by enabling different actors to identify their correspondents for a patient, and to launch professional conversations and discussions around the treated patients. However, despite the fact that Care-O offers communication functionalities between healthcare professionals via integrated secure messaging with the other functionalities of the shared agenda and the liaison book, especially when the tool is generally promoted just as a WhatsApp.

> "It's a professional WhatsApp. That is all. The advantage, however, is that it is secure messaging and is compatible with the secure health messaging."
>
> DL, The Project Porter

Moreover, it is considered just as an automatic fallout of the documents in the same platform. Thus, although Care-O tends to fluidize the exchange between the healthcare actors around the patient, its principal objective is to store the generated documents about the patient in one tool.

> "The objective is to make things more fluid in order to ultimately have a direct fallout of all the information within a common platform."
>
> DL, The Project Porter

In addition, Care-O is described as a solution to improve the link between the city and the hospital. However, the projected process deny the actual work practices where many healthcare professional working in the hospital participate in the care journey of the patient and restrict their use of the tool to the functionality of adding documents about the patients following their hospitalization.

> ""What we know is that from; we will say, from the beginning of the last quarter of the year, we will be able, for example, to put together all the documents produced at the hospital in the patient record in Care-O. So all the hospital reports, biology results, radio results, will be uploaded there."
>
> DL, The Project Porter

Therefore, we are interested in analyzing the ability of Care-O to enhance the awareness of the professionals about the other actors' activities and help them gain insight into those activities through the shared information that is available in the shared calendar, the patient lifeline, and the liaison notebook.

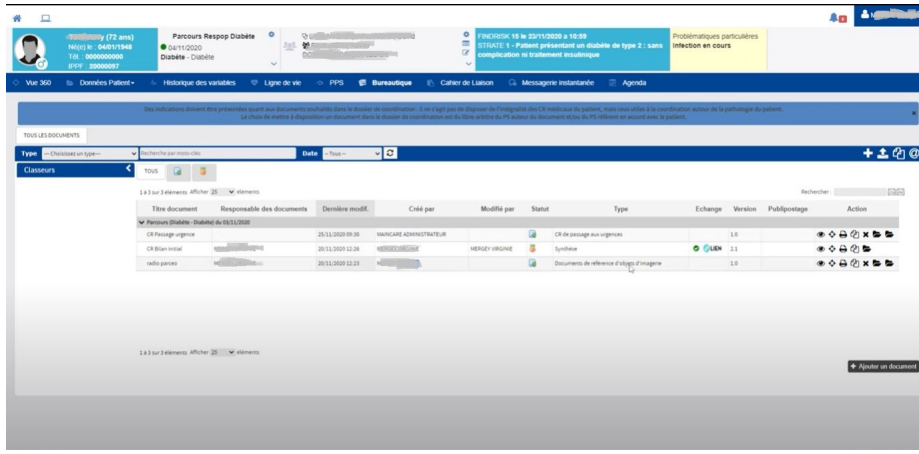

Figure 4. Actions permitting to manipulate the added documents and define the potential readers and modifiers

Finally, as the treatment of a diabetic patient evolves over time, the care actors, as well as their role, may evolve respectively. This evolving organization is challenging for a system as it means that this system should enable the unpredictable evolution of roles over time (according to the patient's situation).

To summarize, we believe that this case study will allow us to perceive how cooperative practices emerge and develop when they are supported; it is an opportunity to observe how challenges related to systems aiming at supporting cooperation are addressed.

6 CONCLUSION

In this paper, we presented issues and recommendations made by previous researchers for designing cooperative healthcare information systems. We identified as core advice the need to consider work practices as a starting point to design such systems. We then discussed our proposal to design a practice-centered system that support cooperation in healthcare, in particular by allowing the possibility for care actors to identify each other and to reach out to get medical data and get a collective insight into it. We then identified the challenges to overcome when adopting a practice-centered approach to design a cooperative HIS. We finally illustrated these challenges with a project led in France that aims at implementing and

deploying a national healthcare strategy fostering cooperation among care actors across different settings.

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