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Nathalie Bricon-Souf, Hervé Pingaud. A general model for assessment of change in professional practices while shifting to tele-medicine. Multi Conference on Computer Science and Information Systems, International Conference on e-Health (MCCSIS), Jul 2019, Porto, Portugal. pp.93-100. hal-02942301

HAL Id: hal-02942301

<https://hal.science/hal-02942301>

Submitted on 17 Sep 2020

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To cite this version: Bricon-Souf, Nathalie and Pingaud, Hervé *A general model for assessment of change in professional practiceswhile shifting to tele-medicine*. (2019) In: Multi Conference on Computer Science and Information Systems, International Conference on e-Health (MCCSIS), 17 July 2019 - 19 July 2019 (Porto, Portugal).

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A GENERAL MODEL FOR ASSESSMENT OF CHANGE IN PROFESSIONAL PRACTICES WHILE SHIFTING TO TELE-MEDICINE

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ABSTRACT

Implementing telemedicine in a broad scale requires good practices recommendations. In this paper we are describing an assessment model proposed to assess changes in professional practices while shifting to telemedicine. Two dimensions are explored: the care process and the feelings experienced by the involved actors. We proposed a method based on knowledge framework and providing a qualification of the differences about practices and their impacts. Care process is represented through process modeling and helps analyzing practices *before* and *after* the introduction of telemedicine. A two dimensions matrix (effects/participants) identifies the impacts of such an operation. This work is performed in the context of a secondary care pilot study for elderly people that implements teleexpertise or teleconsultation. Process analyses highlight important variations according to the institutions and their actual organization of care. The introduction of telemedicine modified the involvement of the care team, lightened the travels for patient and needed reentering of data for health professionals. A matrix evaluation was built in order to ask professionals their experiences. The professional assertions analysis lead to propose 12 criteria highlighting the nature and the challenges emerging with this innovation.

KEYWORDS

Telemedicine, Professional Practice, Evaluation

1. INTRODUCTION

Telemedicine (TM) practice increases nowadays due to several important reasons. The technology is mature enough to spread TM in a wide dimension. The legal context has evolved and most of the barriers seem to be removed now. Among many motivations, in particular in some country areas, the lack of caregivers induces remote medical practices that triggers the need of such tools in order to provide effective solutions. Primary-secondary care interfaces are important (Winpenny et al. 2017). Moreover the organization of care in conformity with public savings is becoming sensitive in terms of refunding. Heavy transportation costs should for example be reduced by the use of TM. Before implementing TM in every day medical practice in a major scale it is crucial to detect the positive and negative aspects of such relatively new usage and to give some good practices information/recommendation within existing organizations.

We worked on a public project driven by the Regional Agency of Care in south of France (ARS Occitanie) that aims at developing a pilot study to understand better how the use of TM for secondary care could improve the access to care considering elderly's follow-up and could be considered as a smart innovation for all stakeholders. Picking up on the last point, a special attention was paid to the impacts of telemedicine on the activities and practices of the healthcare practitioners. In a nutshell, our contribution tends to capture real changes and to assess accurately the impacts of TM on the care service. This *a posteriori* evaluation has been performed with a TM field study at the scale of one department (Tarn, 81). According to the latter results TM could be progressing towards new territories in the best conditions.

If TM has often been studied in order to evaluate the benefit for the patient for some precise pathologies, very few papers are dealing with the evaluation of the impact of such tools in the organization of care and in particular referring to healthcare professional practices (PP) (Esterle & Mathieu-Fritz 2013)

We proposed a new method in order to make such an evaluation. At first, we built a specific knowledge framework to objectively catch all features of change in such PP. Secondly, we qualified the differences

within the practices and their impacts before and after the use of TM through direct observations during TM acts and thanks to interviews of practitioners. Hence a data analysis led to choose evaluation criteria reflecting the many facets of changes. The interpretation of their values drew conclusions on whether or not progress has been achieved and to what extent. Each step of this approach implies developing tools or artefacts for the acquisition or interpretation of evaluation criteria. Actually, the aim of this paper is to describe this new approach based on our knowledge framework to assess PP changes induced by healthcare innovation.

The next part of this paper describes the objectives of the performed work, third part describes the materials and methods used, it deals with the medical and technological context of the study, the rationale used to describe and evaluate PP with a specific focus on the use of TM, and the proposed models, fourth part comments the obtained results and a discussion-conclusion ends the paper.

2. OBJECTIVES

The introduction of TM will change the preexisting organization of care (learning and training; new practices acquisition; less partition between specialties; optimization of working time; respect of quality procedures; reduction of transports; planned activity for all the professionals and so on) (HAS report, 2017). The progress expected by this innovation has to be assessed on the field as an integral part of public health policies. However the assessment of the impact of TM can be a bit tricky since on one hand it links different aspects of health services delivery and on the other hand it raises clinical and organizational issues that are often overlapping.

In a regional context of TM innovation in the south of France, the Regional Health Care Agency (ARS Occitanie) has a global strategy to reinforce health care trajectories and to propose an optimization of such trajectories for all the pathologies and populations. One of the main objectives for such a program concerns elderly people and in particular the development of the caring for elderly dependent people living in nursing home. These patients are suffering from geriatrics and psychiatrics pathologies. According to the ARS, introducing new teleconsultation or teleexpertise modes of TM should limit the fragmentation of care trajectory, help the care coordination, limit the professional isolation of the physicians or coordinators and limit trips for elderly people. In this context, a project named PÂSTEL (for Aged People Services TeLehealth) aims at developing the use of TM, complementary to conventional care, in a coordinated care trajectory. A better understanding and an assessment of the impacts of the introduction of telemedicine in professional practices was then needed and therefore grounded the work presented in this paper.

It is important to spot on the aim of our study: it focused only on the *professional* practices which are linked to how the professionals manage the information and the communication in order to build an efficient care trajectory. It was absolutely not an evaluation of the *clinical* practices which are linked to the know-how of the professionals implementing a care strategy. We made the assumption that the purely medical part has the same content with or without TM, which is quite allowable in the case of secondary care. We have been building and using a framework to capture 2 dimensions. From our point of view the two main dimensions that needed to be considered were:

- **the care process** which can highlight factual change *in the organization*,
- **the experience about the execution of the care process** which can be done by capturing *actor's feelings* about aspects of such a new organization (such as positive or negative, easy or difficult).

3. MATERIAL AND METHODS

3.1 Medical and Technological Context

A first experimentation phase of the PÂSTEL project has been performed on the department of Tarn (a French and rural department in Occitanie). It involves 4 requested institutions offering 8 types of specialized advices and 16 requesting units of which 15 are from primary care. In this pilot, 2 TM acts were concerned: teleconsultation and teleexpertise and they are both synchronous. In each case, getting advices on

some patient health status was often needed, hence primary care staff (the requesting physician is the general practitioner) and secondary care staff (the requested specialist is a geriatric or a psychiatric specialist) were brought to cooperate. Two distant sites are connected: the *requesting site* where the patient lives and the *requested site* where the medical secondary care team works. Only health care professionals are having a meeting using TM technologies when teleexpertise whereas during teleconsultation the patient is attending the meeting.

TM is based on a digital technology with a set of functionalities provided by a software provider that will support the TM process execution. Generally, the system performs a connection between remote actors using the available communication network. It operates the display of sounds, images, data, files and medical content that has meaning for any medical act practice. Some information has to be shared for interactivity purpose and stored for traceability. We named “Infra” the level that alludes to all the previous aspects. This “Infra” level cannot be tuned since the TM tool is already installed and is linked to IT performances. However, even if it is an important factor, its evaluation is not in the scope of our study. In the frame of our project, a preliminary work package has selected and validated the adequacy of the applications for the targeted operations. A software (named synapse) is installed to take in charge the communication in synchronous (during the acts of TM) or asynchronous (to prepare or conclude the visit) way. The process manages a workflow which allows a functionality to be used (as soon as the preconditions are fulfilled during process execution), prepares information and publishes it when needed by each health care professional.

The “Infra” level has to be complemented by a “Supra” level. Considering this level, the objectives are to represent the rationale of the different caring steps (for the patient, for the health care professionals or for the administrative professionals) with an explicit vision about what coordination is (when should I work and with who?). The relevance of coordination is facilitated by the workflow implemented with the TM software.

3.2 Rationale

According to the MeSH (Medical Thesaurus provided by the National Library of Medicine) Professional Practice is defined as “*The use of one's knowledge in a particular profession. It includes, in the case of the field of biomedicine, professional activities related to health care and the actual performance of the duties related to the provision of health care.*” PP are concerned with actual activities performed in a given applicative context and by different actors. Knowledge about these performed actions as well as information about the patient management according to the care context are consequently important. Moreover knowledge about PP is often implicit and therefore difficult to capture. The four following aspects illustrate this issue as PP representation should take into account:

1. what is made which is not expressed (because it is not compliant to the prescribed task)
2. what professionals would like to do which is not done (the professional ideal)
3. what professionals do but don't like to
4. what professionals are performing without being conscious of it (subjective unconsciousness or forgetting due to the habit).

Different ways of analyzing PP are then proposed (Boutin 2002) as the supervision of case studies or as the analysis of simulation of actual situations or routine. Cases studies have been used for our work.

The area of teaching habits is one of the well investigated domain. A 7 dimensions model named ECORSET (*Efficacy, Comfort, Organization, Responsibility, Security, Economy and Transmissions*) is commonly used for nursing education as it sums up main features about care professional individual practices that should be currently improved by reflexive attitudes. It refers to quality of care and satisfaction of patient (E and C); communication as part of the team coordination (O and T); regulation and ethics (R); risk evaluation (S) and efficiency for the nurse aid decision process (E). Nevertheless, the medical area has been slightly involved until recently in professional practices studies (Lagadec 2009)

Clinical guidelines for good PP are pillars of the organization of care deliveries. The French HAS (National Authority for Health) for example provides lots of best-practice guidelines to manage optimal care processes. Unfortunately, TM is not yet concerned by such guidelines as being relatively new in care service deliveries. We found some literature reviews on this subject as the one proposed by (Flodgren et al. 2015) onto “*Interactive telemedicine: effects on professional practice and health care outcomes*”. But they mainly concern the forthcoming outcome of TM and they are therefore more dedicated to an *a priori* assessment of the expected effectiveness than to the evaluation of the actual practice. Ethics and deontology are moreover

fixing rules for actual practices and related information is widely disseminated among many sources. PP are more and more subject to consideration within the growing interest for health innovation, the last evolutions of public health system and the new constraints law, on legal practices about caregiving. It is then still prime challenging to propose conceptualization of healthcare PP covering a large range of situations. In order to help care organizations to develop TM, the ANAP French agency (National Agency for the development of the Performance of medical and socio medical facilities) published a guide providing a general approach of the telemedicine domain (ANAP report, 2016) which defined a generic representation of an operating process for a TM medical act as shown in Figure 1.

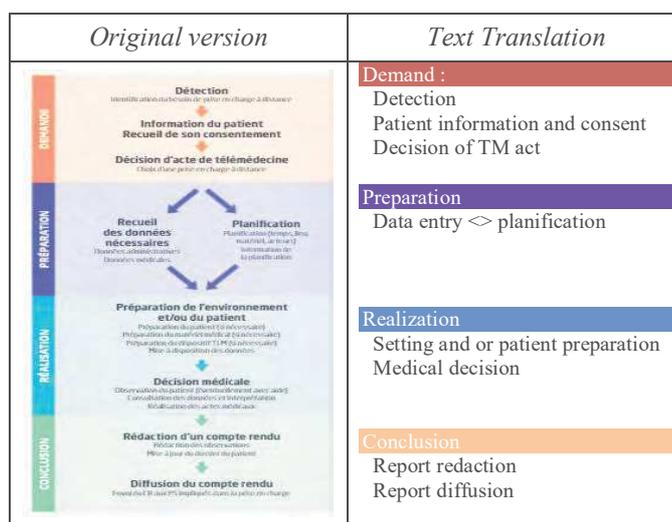


Figure 1. The generic process of TLM act: the original figure is shown on the left and texts are translated on the right

In the very specific range of medical imaging area, the HAS (HAS Report, 2013) defined criteria which should be observed to assess the effects of TM innovation and organized them within a framework defined by a two dimensions matrix. The first dimension splits TM impacts in four categories: (A) Accessibility to care; (B) PPs/organization of care; (C) Quality of care/ security of care; (D) Costs. The second dimension informs on who are the people concerned: (1) Patient / Aids and family; (2) Physicians and allied health professionals; (3) Health facilities; (4) State /Medical insurance/ Collectivities. This precise description helps to focus on the different aspects which are concerned by TM innovation and therefore helps to perform a better estimation of the associated impacts. For example, regarding the (B, 2) cell of the matrix which focused on (PPs/organization of care impacts from the Physician and allied health professionals point of view) some important aspects can be observed: timings used to launch the system (protocols, teaching, meeting and so on), coordination between health care professionals (protocol, quality and security of the transmitted data), time required by TM for the professionals, instructions about the system use, cooperation between health care professionals (delegation, transfer, competence sharing) and optimization of the medical flow management.

Our objective was then to reuse the principle of such a matrix for an evaluation purpose in the area of telemedicine PP changes. To keep in mind the dynamics of change, the reference to a TM care process evolution will be used as a link between past and future. In the particular context of our study we had to derive some precise representations to represent better the two acts of TM complementing the general representation of TM proposed by the ANAP. We used these results to build a new framework facing with this complexity and perform our PP assessment, it could ease any studies on the use of TM tools.

3.3 Proposed Models

We focused on the two dimensions presented above for the evaluation that is to say the care process and the experience about the execution of the care process. A first phase of work was planned, it led to a model of representation for the care process. The second phase of work concerned the experience about the execution of the care process and permitted an evaluation of the impacts on professional practices through the use of an evaluation matrix.

3.3.1 The Framework Model for the Representation of the Care Process

In modeling processes it is very important to understand how, when, and by whom, actions are performed and which resources are used in order to reach a global goal. We are dealing with digital transformation of healthcare and it is important to notice that processes and existing software applications are intricately intertwined. The digital transformation of the practices is our matter of concern in the case of TM.

It is therefore of prime interest to provide a representation of this transformation onto the care process before (“as is”) and after (“to be”) the introduction of such a tool. The way TM will be performed is varying only at the *supra* level as the software workflow has been defined and proposed previously at the *infra* level. The supra level is therefore the right one for the evaluation of PPs. Our objective was to model the supra level of our study while detailing the different activities linked to TM. Such a model is useful to point out what is changing in practice between “as is” and “to be” situations. We paid attention to be compliant with the representation of the TM process proposed by the ANAP as it provides a general framework for definition and assessment of such processes. The “demand”; “preparation”; “realization”; “conclusion” steps of the ANAP representation can be refined further and instantiated to any specific medical acts. We performed indeed such refinements in the case of our study.

Many languages for process representation are known and used effectively in the management science. However the culture of process modelling in healthcare system is still in its infancy. We have chosen to use the well-known Business Process Model (BPM) for care process representation. BPM is fulfilling the requirements of many quality standards and is convenient in our context. We adopted a three level model architecture that allowed a top down representation of an organization with an increasing amount details:

- The upper domain level presents the model area
- The second level is a process mapping level that describes macro processes involved in the domain
- The third level is the activity level. It details how the different activities are tackled and sequenced, while reporting on objects which are transformed by activities (mainly information on patient and the patient him/herself) as well as on resources which are needed and on people who are acting.

Care is modelled as information, domain of the process; patient state; requirement; requested decision; activity or process; role of an actor; risk and event. Actors are modelled as care professionals, requesting doctor, requested specialist; authorized person; assistant. Four levels of granularity are used for the description of activity. For example level0 contains “carry out a TM act”; level1: “practice the act”; level2: “take the decision”; level3: “deliver a prescription”. The nature of the act (teleconsultation or teleexpertise) is mentioned and its implication with the infra level is indicated. Exception could also be represented. We were then able to model the different care processes for the different studied institutions, both before and after the introduction of TM.

Using graphical representations has been nowadays recognized as an efficient mean for sharing knowledge about activities in an organization inside a pool of actors non-specialists of BPM. A graphical representation of the processes was accordingly implemented using the Aris™ software as illustrated in Figure 2.

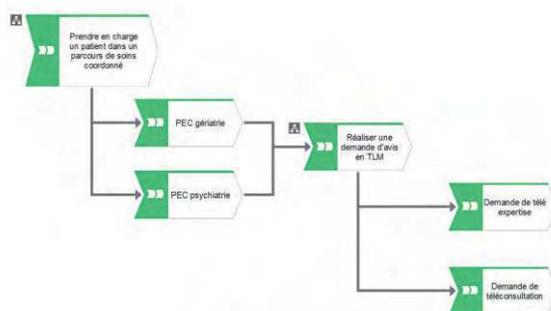


Figure 2. Example of graphical representations of care process

3.3.2 The Evaluation Matrix for the Impacts of Telemedicine according the Experience about the Execution of the Care Process

Three dimensions are proposed for the structuration of the evaluation of the impact of TM on the PP: organization; performance and steering process (see Figure 3a).

The first two dimensions are inspired by the work proposed by the HAS (cf above). (i) The *organization* dimension allows understanding how TM will be practiced. Appropriation of the processes by the different care participants is a main issue for this dimension. It is linked to the representation of the process, explaining the nature and the chaining of different actions. (ii) The *performance* dimension helps to qualify the value of the TM act with two subdimensions reflecting on quality of care and risk control. These two dimensions should at least capture whether or not there is a regression between the practices with or without TM and to determine which developing new services opportunities could be generated while introducing TM.

The *steering process* dimension focuses on the coordinated nature of the care trajectories using TM. Since all the implied people including the patient him/herself have to contribute to build the decision of care, the competency of each actor is insufficient to propose a global efficiency of a care system. Information sharing is needed to help coordination, this is then the fourth point on which we decided to focus.

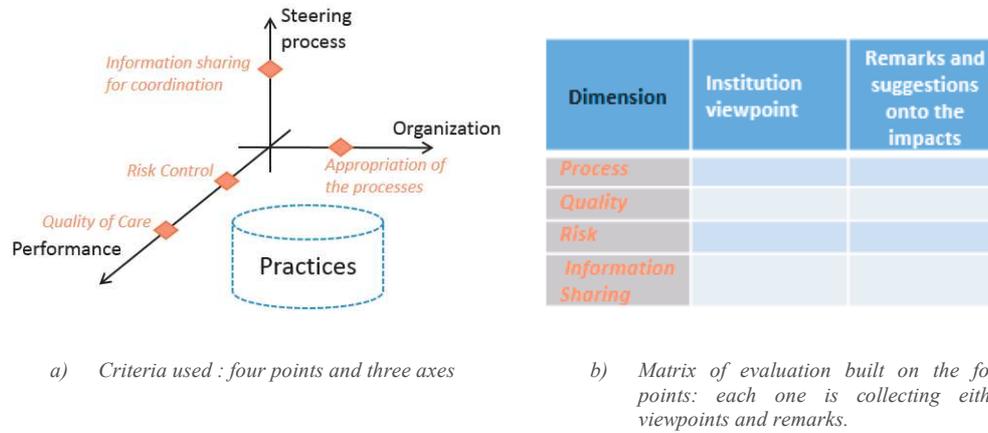


Figure 3. a: Organization of the criteria used for PP measure of impact: the 3 practices representation axes and the 4 studied aspects (in red/italic); b: The associated Matrix

These four criteria were therefore proposed to a panel of care professionals through an evaluation matrix: appropriation of the processes; risks; quality; Information sharing for coordination. Two kinds of advices were requested on each of these four criteria: the first one concerned the specificities which can be highlighted by the professionals regarding this criterion; the second one requested remarks or suggestions on the associated impacts (see Figure 3b).

3.4 Methods

Observations and interviews were used to model the different processes. An observation of the experimental field was conducted on two sites during six months by the authors. A proposition of model was done then and refined during different working brainstorming sessions. Interviews were reported on the management of care with or without TM. Seven sessions of TM were observed concerning both processes of teleconsultation and teleexpertise from two different requesting sites. The observation did not concern the clinical area but was focused on how to build the care process model, reporting for example on from where the information is obtained or on which action is performed by whom. All these materials were then used to model the different processes in a unified view. The resulting model contains four macro processes which are the *consultation demand*, the *preparation of the visit* to the specialist, the *carry out of this visit* and the *conclusion*. Each macro process was then detailed according to if it was performed in a conventional way or it was using TM. All the institutions involved in the project were invited to share their experience and feelings about the execution of the care process. A collective session was organized gathering participants from eleven

institutions involved in the PÂSTEL project: two of them were *requested units* and the others were *requesting sites*. Each institution was represented by one or several participants who were asked to write their comments on the prepared matrix of evaluation. One of the first open questions was targeting the specificities felt for the appropriation of the processes. All this handwritten information was gathered and retyped on a computer. More than 230 assertions were so collected and organized according to the proposed evaluation matrix dimensions.

4. RESULTS

4.1 Processes Analyses Using the Framework Model

In consequence of using the graphical process representations, it was easy to ask practitioners if they validated the representation and to ask them about differences they were feeling between “as is” and “to be” situations. They could comment the care process using this model which was also useful to investigate the other focus points: *quality, risk and information sharing*.

The processes analysis helped us to comfort our understanding of the impact of TM innovation:

- The observed processes of care were compliant with a derivation of the global process proposed by the ANAP.
- At a high level of details some important variations are found according to the institutions and their actual organization of care: the role distribution could be different; the practice of the TM act could be performed in a more or less multidisciplinary dimension of the caring team, the synergy between the general practitioner and the coordinator could differ in intensity.
- Other variations are linked to the change of practice while introducing TM. When a patient stops travelling, it eases the preparation phase for the patient and eludes some stress previously due to the travel. Creation and transfer of medical record for TM are meanwhile inducing some important data (re)entering for the professionals. Yet the preparation phase for TM advice helps to better involve the whole team during the process of requesting advices.

4.2 The Experience of Care through the Evaluation Matrix of Telemedicine Impacts

All the assertions were analyzed and 3 topics have been derived from the annotations concerning each of the 4 dimensions. This led to a set of 12 criteria to overall assess the changes in practices. The evaluation matrix has helped to focus on topics which are important when analyzing the PP. While investigating answers collected from the matrix focusing on organizational dimension for example, three types of opinions could be synthesized: kind of interaction, induction of workload and factors for practice anchoring. Moreover we obtained information about their impacts:

- Kind of interaction between requested/requesting participants: telexpertise organization differs from teleconsultation one.
- Induction of workload: the evaluation of the impact is highly concerned by the difficulties encountered by care professionals in terms of workload.
- Factors for practice anchoring: some specificities could come from the experimental aspect of our pilot study.

We have been completing this work by an assertion analysis. The previous descriptions were enriched by details on the positive or negative evaluation contained in each assertion on each criteria. If the health care professional mentioned an improvement for example then the assertion was marked as a positive one, while if the assertion mentioned a fear, it was marked as a negative one. Cross analyses of each assertions (Topic * Evaluation) have been performed for each matrix dimension, as illustrated in Table 1. By performing such analysis, it was possible to retrieve and explore the opinion of the different participants on the impact of the introduction of TM in their practices.

We can sum up the main ideas provided by this study as follow: TM has a positive impact onto coordinated care trajectory, TM is massively improving the performance of the care in the perimeter of this study, TM is new and there is a high level of risk of a degradation of care unless experience feedbacks and pilot phases have been well conducted and are finished, TM has a good impact on coordination for care trajectory.

Table 1. Qualitative analyses: Example of the “appropriation of the processes” (organizational dimension): the topics for annotations are shown in column1, the counts of negative and positive assertions are shown columns 2 and 3

<i>Assertions Analyses</i>	-	+	Total
Interaction Requested/Requesting	1	16	17 (26.6%)
Workload	13	8	21 (32.8%)
Anchoring	10	16	26 (40.6%)
TOTAL	24 (37.5%)	40 (62.5%)	64

5. CONCLUSION AND DISCUSSION

Nowadays, it is crucial to understand why and how TM could be introduced to efficiently help PP. In this paper we covered a two stages work conducted to analyze TM in the context of secondary care. At first, we have provided a reliable tool to characterize the care process and thereby comparing and expliciting the differences before and after the TM innovation act. Later on, we have proposed an evaluation matrix built as an organized artifact which give the professional actors the opportunity to express themselves in natural language and without constraints. The structured environment proposed by this framework helped to organize the answers. We are already detecting very interesting changes due to the introduction of TM as the one offered by the proximity of all the member of a care team during the TM session. Aid nurses, nurses, doctors can easily integrate the consultation or the expertise and give their specific points of view. It seems to be one of the potential huge improvement of coordination for care trajectory: the so called pluriprofessional way of practices.

The proposed assessment method gave us a rigorous setting to analyze the different remarks and helped us to detect the main topics which are important for health care professionals. Several perspectives of improvement of our evaluation method should be proposed as for example enlarging the number of studied sites, completing the panel of participants by involving patients or improving the interpretation of the natural language assertions by adding some NLP tools.

ACKNOWLEDGEMENT

The authors want to acknowledge the Agence Régionale de Santé Occitanie for its support during this research in the frame of the Pastel project, as well as all project partners for their open minds and real involment in our experiments.

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