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Professional facing coercive work formalization: vicious circle of the Electronic Medical Record (EMR) implementation and appropriation

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Abstract

This paper shows that, according to many studies, the implementation of the Electronic Medical Record (EMR) does not cause efficient uses as expected in hospitals. Authors suggest explanatory factors, including both generic factors related to the implementation of ERP and specific factors related to health sector, in particular to professional bureaucracies (professional autonomy, divergence of goals, lack of coordination). The paper highlights the risk of a vicious circle of clinical process computerization, similar to bureaucratic vicious circle described by Crozier (Crozier 1965). Specifically, the convergence of two information systems, the clinical one and the administrative one inside the EMR, is a source of conflict between two logics, one focused on the professional to manage the care of a given patient, and the other focused on the resources management for all patients. The dominance of the administrative logic, consisting in monitoring and promoting coercive formalization, is likely to reduce the professional adjustment and autonomy, to cause their resistance and, consequently, the absence of effective uses, which lead back a strengthening of the control logic. The author shows interest to consider this conflict to reverse the situation by enabling approach, using professional autonomy as lever.

Keywords
professional autonomy, electronic medical record, professional bureaucracies, hospital information system, appropriation

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Introduction

Information technologies are more and more used in healthcare to follow up hospital activities, physical flows (as patients and drugs) and information flows related to patient care process(Flower 2003). Among these technologies, Electronic Medical Records (EMR) allow monitoring patient data (such as vital signs, laboratory data, radiology, patient care notes) provided by various sources and incorporating these data into a template that facilitate medical reasoning and reporting (consultation, hospitalization and medical consultation summaries) and order entry for treatments, examinations and appointments. EMR provide also administrative data for billing and management of all available resources such as beds, human resources, pharmaceutics or technical products, technical and operating room. On the medical or administrative side, EMR integrate additional functionalities as alerts, decision support, balanced scorecard and best practices guidelines.

EMR directly support both clinicians' current practices inside a hospital, and thus need to fit real-time medical work processes (Aarts, Doorewaard et al. 2004), and functional activities as accountability.

Our theoretical paper highlights that coercive EMR implementation, as experienced in France, can be a threat for professional autonomy and physicians' medical dominance and, thus, negatively impact EMR effective use. We argue that management of the EMR has to avoid vicious circle of coercive implementation, driving to physicians' resistance, causing back more coercive implementation. We suggest management has to deal with a subtle mix of coercive

and enabling logic to realize and assess fundamental objectives like quality of care and efficient clinical practices.

In France, EMR for hospitals are designed on the model of Enterprise Resource Planning (ERP), related to a unique data base of patients' identifiers. As for ERP, EMR is expected to decrease risk of errors related to double entries and redundancy among different specific software (designed for each specialty or each organizational function).

The stated objectives of integrated software are various(Poba-Nzaou, Uwizeyemungu et al. 2014) as follows: providing reliable data, accuracy of patients' identification, preventing duplicate data entry and related errors, improving traceability of acts and drugs, optimizing care management by facilitating availability of patient records for caregivers. Nevertheless, the complexity of the implementation of EMR is obvious in literature and resistance of clinical staff, particularly of physicians, is considered as a major barrier to EMR implementation. Several authors consider hospital does not adequately drive organizational changes to facilitate physicians technology acceptance and to get all benefits related to EMR (Bates, Ebell et al. 2003).

Our hypothesis is integration of clinical information system for clinical staff covering administrative functions (billing, patients and resources schedules) blurs the medical and the administrative boundaries, driving to a conflict between professional and bureaucratic logics (Mintzberg 1979), between control and autonomy.

Our paper is organized as follows: in section 2 we highlight the difference between effective use and implementation. In section 3 we describe the hospital as professional bureaucracy, whose characteristics affect EMR implementation and prevent effective use or meaningful use" (Blumenthal 2010). Section 4 is focused on the conflict between enabling and coercive logics, viewed as the conflict between professional and administrative logics, which are highlighted in the EMR design and implementation. We emphasize the risk of vicious circle of coercive implementation, increasing professionals' resistance and decreasing effective uses.

Relevance of an EMR: its use and data quality

Many positive goals explain why the Organization for Economic Co-operation and Development (OECD) consider IT as one of the most important pathway to improve healthcare : decrease medication errors rate, financial gains, better quality of care, improved performance and greater safety. However, EMR implementation is still considered as high-risk failure (Littlejohns, Wyatt et al. 2003). Furthermore, implementation of EMR has led sometimes to

unintended consequences (Park, Lee et al. 2012), as increased time dedicated to the prescription and prescription errors (Koppel, Metlay et al. 2005) (Han, Carcillo et al. 2005, Koppel, Metlay et al. 2005, Nebeker, Hoffman et al. 2005, Koppel, Leonard et al. 2008) and dangerous workarounds (Saleem, Russ et al. 2011) (Saleem, Russ et al. 2011, Park, Lee et al. 2012). Total EMR implementation failures have been described (Littlejohns, Wyatt et al. 2003). Data from several studies have suggested that the mere adoption of EMR does not necessarily improve the quality of care and this does not change over time despite a number of years of use (Zhou, Soran et al. 2009). However, since recently, US developed an injunction of EMR adoption for US hospitals focused on "meaningful use" (Blumenthal 2010),with an incentive on well-defined criteria to improve safety, quality and efficiency of care (Blumenthal 2010). Demonstrating that the use of these criteria leads to the expected benefits remains to be determined for some authors (Classen and Bates 2011) and seems certain to others (Xiao, Sharman et al. 2012). A recent review from 179 studies published between 2004 and 2007, mostly in North America, on the costs and benefits of information technology and health communication, shows that less than 10 % of the studies detail the factors success, financial background of the project and sustainability of the system evaluated (Goldzweig, Towfigh et al. 2009). Moreover, the failure of health information technology, data loss, misuses and bypass the elements That helped to turn a failure into success are probably underreported in the literature (Kaplan and Harris-Salamone 2009). As in other sectors, IT failures are neglected, resulting in a repetition of mistakes. Without ignoring the importance of these technical problems, there is an emerging consensus that the most important problems has sociological, cultural and financial explanations, and thus are more managerial than technical (Kaplan and Harris-Salamone 2009). Understanding the complexity of computerization requires to distinguish between having a technology, the fact that this technology is used and the fact that this technology is used effectively according to different goals of the organization (Markus 2004), namely that this use enables users to be more efficient in patients management care. Cooper & Zmud (Cooper and Zmud 1990) identified six stages of the implementation process on an information technology (initiation, adoption, adaptation, acceptance, routinization and infusion), but these steps were very little developed in the literature thereafter, and attention has been focused mainly on the adoption decision and the implementation project. However , adoption is not appropriation, because adoption does not reflect the full interaction between a technology and an actor, especially for complex technologies such as clinical information systems that require the active participation of the user (Ologeanu-Taddei, Gauche et al. 2015). We propose a simple definition

of appropriation of the EMR by choosing the users point of view : the fact that this technology is used effectively by professionals, i.e they consider that the EMR is useful to do their work, that EMR enables them to improve quality of care and that they want to use it.

The integration of technology in an organization requires specific knowledge of its users and an the use assessment. As Berg assumes, "whether an information system is successful or not is decided on the workplace" (Berg 2001). The choice of technology and its availability are not sufficient for the right or meaningful use (Orlikowski 2000). The importance of the points of view of the different actors in an organization is considered capital to move from the implementation of technology to the appropriation (Mantzana, Themistocleous et al. 2007, Ologeanu-Taddei, Gauche et al. 2015). When users are convinced of the value of innovation, they are ready to generate themselves changes in their practices, often for technologies they already use in non- professional uses.

Previous research showed technologies exist only in use, as technology-in-practice (Orlikowski 2000). Furthermore, information technologies required proactive use and accurate data (Markus and Keil 1994), which are necessary conditions for effective or meaningful use. This means that information recorded in an EMR is relevant for a care giver in management care process only if it is available and accurate (for example, real time information related to prescribed and administrated drugs). The assessment of the information relevance may be different for different caregivers and for administrative employees. Medical information in the electronic records must be reliable, exhaustive and unique; thus, missing data cannot be accepted for critical steps as anesthesiology process. Both care managers and accountability departments need data on prescription and administration drugs but not at the same time limit. Care staff need real-time data because of the sequential interdependence (Thompson 1967) of care management process. Besides, accurate and real-time data are not compatible with workarounds and insufficient adoption as stated by previous literature.

Yet to date, research have not demonstrated rigorously the ability of EMR to drive down costs of clinical or administrative processes, at most a slight improvement in the quality (Himmelstein, Wright et al. 2010). In the next section, we will propose to summarize the different factors negatively impacting the appropriation of the EMR, especially those specific to hospitals setting as professional bureaucracies.

Characteristics of professional organization impacting EMR implementation and appropriation

Research on EMR pointed out same problems already highlighted for ERP (Entreprise Resource Planning) implementation (Paré 2002, Nohr, Andersen et al. 2005, Strong and Volkoff 2010, Park, Lee et al. 2012). We propose first to classify these elements from the grid of Pettigrew (Pettigrew 1987) to differentiate the elements related to the context from those related to software used and finally to the implementation process (Pettigrew 1987). In terms of content, that is to say, the software itself, the most commonly reported factors include the poor ergonomics and ease of use, but also the perceived non-adaptation to daily work, the lack of flexibility of the system, the lack of compatibility with the work processes, especially because of time constraints or role conflicts, and finally the lack of interoperability (Ash, Berg et al. 2004, Thompson, Duling et al. 2005, Ash, Sittig et al. 2007, Ludwick and Doucette 2009, Gagnon, Desmartis et al. 2012, Bossen, Jensen et al. 2013, Cresswell, Bates et al. 2013). The implementation process includes inadequate training, insufficient support for change, lack of user involvement, lack of recognition by the top management of the key actors, the workload during the implementation phase and of the consultation of the actors, lack of time dedicated to users training, insufficient strategic alignment between the administration and the main medical leaders, the lack of effective internal communication strategy and the lack of collectively anticipation of technological risks (business interruption, software failure) (Gagnon, Desmartis et al. 2012, Cresswell and Sheikh 2013, Cresswell, Bates et al. 2013). Moreover, the importance of the "champions" and "boundary spanners" as proactive key users, able to ensure training and mediation between peers and decision-making is often highlighted as a key success factor of implementation (Greenhalgh, Robert et al. 2004, Cresswell and Sheikh 2013). Most of these factors are not specific of the health sector, thus we propose to separate in Table 1 the common factors from those related to professionals and to develop in next sections why these elements are crucial for appropriation.

Table 1. Main factors impacting negatively EMR implementation and meaningful use

	Common with others IT implementation	Specific to professional bureaucracies

Context	• **Failure perceived utility** *Gagnon, Desmartis et al. 2012* *Bossen, Jensen et al. 2013* *Cresswell, Bates et al. 2013* *Boonstra, Versluis et al. 2014* • **Ambiguity of objectives** *Cresswell, Bates et al. 2013* • **Lack of « champions »** *Gagnon, Desmartis et al. 2012* *Cresswell, Bates et al. 2013* *Boonstra, Versluis et al. 2014* *Rivard, Lapointe et al 2011* • **Lack of previous experience** *Gagnon, Desmartis et al. 2012* *Ludwick, Doucette 2009* *Cresswell, Bates et al. 2013*	• **Multiplicity of objectives and divergence of goals** *Cresswell, Bates et al. 2013* *Poba-Nzaou, Uwizyeyemengu et al. 2014* • **Extreme variability of process** *Gagnon, Desmartis et al. 2012* *Poon et al. 2004* *Ash, Gorman et al. 2003* • **Professional autonomy** *Walter Ash, Sittig et al. 2007* *Gagnon, Desmartis et al. 2012* *Boonstra, Versluis et al. 2014* *Rivard, Lapointe et al 2011* • **Limits of process standardization** *Ash, Sittig et al. 2007* *Ludwick, Doucette 2009* *Rivard, Lapointe et al 2011* • **Conflicts between professional culture and organizational culture** *Gagnon, Desmartis et al. 2012* *Ash, Gorman et al. 2003* • **Conflicts in professional bureaucraties** *Boonstra, Versluis et al. 2014*

Content	• **Lack of design, poor ergonomics** *Gagnon, Desmartis et al. 2012* *Cresswell, Bates et al. 2013* *Boonstra, Versluis et al. 2014* • **Lack of data fiability** *Boonstra, Versluis et al. 2014* • **Insufficient ease of use** *Gagnon, Desmartis et al. 2012* *Cresswell, Bates et al. 2013* • **Lack of interoperability** *Gagnon, Desmartis et al. 2012* *Cresswell, Bates et al. 2013* • **Non-adaptation to daily work** *Gagnon, Desmartis et al. 2012* *Ash, Gorman et al. 2003* *Ash, Sittig et al.2007* *Cresswell, Bates et al. 2013* • **Lack of customization** *Gagnon, Desmartis et al. 2012* *Cresswell, Bates et al. 2013*	• **Influence of EMR on care relationship** *Ludwick, Doucette 2009* • **Privacy** *Boonstra, Versluis et al. 2014* *Houser and Johnson 2008* • **Highly intensive customization** *Ash, Gorman et al. 2003*

P r o c e s s	• **Lack of user involvement in the implementation strategy** *Gagnon, Desmartis et al. 2012* *Boonstra, Versluis et al. 2014* • **Insufficient training and support** *Ash, Sittig et al. 2007* *Bossen, Jensen et al 2013* *Ludwick, Doucette 2009* *Boonstra, Versluis et al. 2014* *Rivard, Lapointe et al 2011* • **Inadequate change management** *Gagnon, Desmartis et al. 2012* *Ludwick, Doucette 2009* *Cresswell, Bates et al. 2013* *Boonstra, Versluis et al. 2014* *Rivard, Lapointe et al 2011* • **Top management involvment lack** *Gagnon, Desmartis et al. 2012* *Ludwick, Doucette 2009* *Rivard, Lapointe et al 2011*	• **Lack of physician involvement in IT project** *Cresswell, Bates et al. 2013* *Gagnon, Desmartis et al. 2012* *Boonstra, Versluis et al. 2014* *Ash, Gorman et al. 2003*

1. Professional autonomy

Mantzana et al. insist on the high importance of "the actors' views since their actions can have a great impact on Hospital Information Systems adoption"(Mantzana, Themistocleous et al. 2007). Moreover, physicians are professionals having control over the conditions, processes, procedures, or content of their work according to their own collective and, ultimately, individual judgment in the application of their profession's body of knowledge and expertise" (Walter and Lopez 2008). They control, monitor and define the norms of the their activity. According to Adler & Kwon professional autonomy allows professionals to have a considerable influence on the diffusion of innovation ; thus, the independence from commercial pressures allows physicians to adopt a technology based on specific values and not economic considerations : the physicians' adoption decisions of innovation reflect their individual preferences rather than the preferences of others (Adler and Kwon 2013). They take the example of a director of a hospital, who has sufficient authority to require the replacement of obsolete equipment , but cannot require doctors to adopt Computer Physicians Order Entry,

although their interest has been demonstrated (Adler and Kwon 2013). According to Walter & Lopez, there is a strong correlation for physicians between the perception of the usefulness of clinical decision support systems and EMR and the perceived threat of such technologies on their professional autonomy (Walter and Lopez 2008). For the medical profession, sophisticated information technology cannot be adopted if it does not fit the physician's workflow or can be perceived as a threat to its ability of mutual adjustment. The results of the telemedicine experience observations made by the team of Hu et al. reinforce this finding, showing that the autonomy of practice and ongoing adaptation of work are the specific characteristics of the medical community and the perception of the reliability of the system is a fundamental element for the adoption as ease of use or the perceived usefulness (Hu and Chau 1999).

Degrees of professional physicians' autonomy can vary. For example in France, even if the non-university hospital physicians are autonomous in managing the care of patients, there is nevertheless a hierarchical relationship informal with professor or formal with the head of a medical department (Baszanger 1981). Accumulated missions of teaching, research, and organization of clinical activity, generates an even greater autonomy, particularly because of multiple affiliation (hospital, university, research laboratory).

Many reservations about the effectiveness of professional bureaucracies related to professional autonomy were made by Mintzberg in 1979 (Mintzberg 1979): apart from self-regulation by peers, there is no control over the work and no how to correct deficiencies accepted by professionals (Mintzberg 1979). The autonomy of professionals in itself tends to encourage people to misunderstand the goals of the organization for which they work. For many of them the organization is accessory, as just a convenient place to practice. Professionals consider themselves being loyal to the profession but do not necessarily feel part of their institution and are not necessarily involved in organizing. Conversely, autonomy preserves a capacity adjustment and management of essential unpredictable due to the nature of medical practice. Walter and Lopez showed that for physician users, a sophisticated system would not be adopted if the system does not follow the workflow, or if it can be perceived by the physician user as threatening to his or her professional autonomy. Their results were similar for Clinical Decision System support and EMR. Culture of healthcare givers as end-users may be described by four values, meaning quality of care, efficiency of clinical practices, physicians' medical dominance, professional status and autonomy. These values explain the level of difficulty of a clinical information system implementation (Rivard, Lapointe et al. 2011). Physicians differ from other types of IT users investigated in the literature (Paul and McDaniel Jr 2004)

2. *Mutual adjustment and difficulties to standardize patients care flows and management*

Patients care management consists on very heterogeneous care workflows in a complex continuum. Some workflows may be standardized (i.g, cataract surgery), while others on the contrary justify a very high level of customization (overall treatment of an elderly with multiple comorbidities) (Lamothe 1999). Usually, the patient care management is not based on a single process, but on a combination of sub processes (Pascal 2003) whose referent physician is similar to a bandmaster. His or her expertise allows mutual adjustment among different players (others physicians or radiologists or biologists) based on limited resources (availability of technical equipment, or of beds), emergency degree (prioritization of resources by each unit manager) and especially unpredictable events. If each sub process can be modeled (i.g. performing a lumbar puncture), the whole journey of a patient can be extremely complex to be modeled depending on the occurrence of adverse effects and multiple pathologies, or human factors (as refusal or misunderstanding of care by the patient, information and communication to family). Patients care modeling required for EMR design is possible for a small number of patients and thus often constitutes the exception and not the norm. A physician can manage simple situations that matches to care process formalized in the EMR, whereas singular and complex clinical situation cannot be modeled (Minvielle 1996). Lamothe highlights the ineffectiveness of control measures aiming to strongly standardize practices, since they are based on mutual adjustment and the development of an ideology shared by professionals (Lamothe 1999).

3. *Challenge of intra and inter-professionals coordination*

The complexity of the organizational functioning of the hospital comes under three main features: the diversity of activities, configuration of power relations and the dynamics of evolution marked by profound changes (Nobre and Haouet 2011). The high diversity of an hospital activities comes from the multiplicity of partitioned services (clinical, medical-technical, logistical and administrative tasks) and of the related skills and occupations , which limits the coordination of actors and projects.

For Mintzberg (Mintzberg 1979, Glouberman and Mintzberg 2001) professionals tend to overlook the essential problems of coordination, control and organizational innovation ; the standardization of qualifications is not sufficient to solve coordination problems between professionals and logistic support functions or especially between the professionals themselves.

The division of medical knowledge and skills make it even more complex phenomenon. If each specialist control a source of uncertainty related to his or her specialty, interdependencies create a new source of uncertainty and exacerbate competition and informal professional rivalry. The different groups in an organization seeking to differentiate themselves by their cultural objects and values, which in the hospital reinforces the rivalry and competition between groups (Davies, Nutley et al. 2000) and the "tribal" organization (Kaplan and Harris-Salamone 2009). Over time, not only physicians but many health care givers organized themselves as professional occupation (physiotherapists, occupational therapists, psychologists, radiographers, radiologists, social workers, dietitians, health managers ...) and has complicated the patients care workflow under the medical domination. All implicit rules to enable coordination of all these different professionals under medical control leads to the formation of an inter- hierarchy. This informal and flexible structure allows flexibility and adaptability, as a fundamental and protective interlayer between the care units and administrative decision process (Lamothe 1999). The confrontational balancing between groups helps to stabilize the system by defining the prerogatives of each. For example, the medical group fighting to preserve the unpredictable characteristics of the activity which he or she is responsible : it opposes the rationalization of its own domain, while fighting for the rationalization of other domains (Lamothe 1999). Users of an EMR in a hospital are not a homogeneous group of people and interests and one of the main factors of appropriation concerns the perceived adaptation of care processes. Figure 1 provides a schematic representation of the different homogeneous interest group of EMR users . This allows to distinguish between professional specialties that are not in directly at bedsides (eg, microbiologists, pathologists) or very occasionally as support (eg radiologists , anesthesiologists) of those who manages all the patient's care process in everyday life (eg internists, geriatricians, pediatricians) or are highly specialized on smaller areas (eg ophthalmologists, cardiologists) .

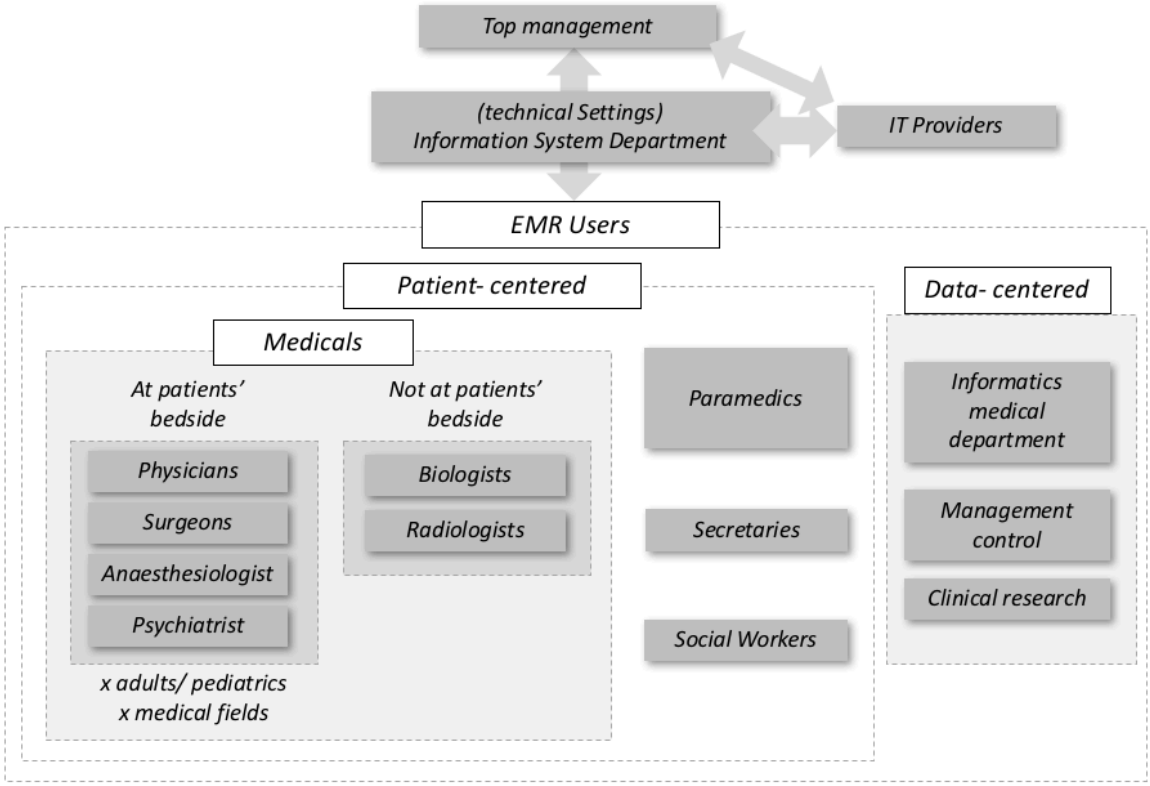

Figure 1 — Schematic representation of electronic medical record (EMR) actors. Each part could have separate point of view and interest for EMR settings.

The various specialties may have very different setting goals: for example, laboratory certification procedures require that the biologist masters how are viewed the results of laboratory blood tests by clinicians, while the latter prefer to compare datas in tables or graphics. Physicians specialized in medical informatics are interested in processing information from the medical record to enable repayment of the activity by medical assurance or epidemiological monitoring. Pediatricians do not have the same expectations on the management of data associated with the weight and size of the patient as a plastic surgeon. Additional examinations providers may request the seizure or postponement of a number of clinical information on the request for review, so that prescribers may consider that this information is already available in another part of the EMR .

Inside the same specialty, academic logic may object to the clinic, for example for structuring data in clinical research folder referred to bringing no benefit to the realization of care. Ash et al. showed the crucial nature of the customization including adapting the EMR for drug prescription: more technology is flexible more it is possible to create "customizations" and thus to led to acceptation by different medical specialties (Ash Gorman et al. 2003).

In contrast, the Information Systems Department could not to set EMR for different teams or individuals, for reasons of resources or maintenance (Guillemette and Paré 2011). The

management of the institution may require prioritizing the elements that increase the completeness of information useful for hospital's manager or facilitating the reporting form of various indicators requested by different national or regional stakeholders.

Prioritization settings, such as input interfaces and visualization of information, specific developments or the integration of new features, version update or interfaces with other non-integrated software are therefore an extremely strong challenge because it can substantially change the EMR workflow for users and therefore their perceptions and uses.

In a complex situation characterized by professional autonomy, diversity of professions, difficulty of consultation and coordination, complex hierarchies and power conflicts, the decision-making for EMR setting and customization is a key issue.

EMR on the razor's edge of enabling and coercive logic

4. The workflow formalization induced by technology can be coercive or enabling

On the one side, workflow formalization can trigger decreasing commitment and job satisfaction, deskilling, alienation and brakes to innovation. On the other side, workflow formalization can increase autonomy, reduce role conflicts and stress at work (Adler and Borys 1996) and facilitate innovation when it allows learning from experience and it facilitates coordination for the implementation of important projects (Craig 1995). Technology design and implementation cannot be neutral, because it is based on algorithms design, codes and thus a representation of workflows. Various authors distinguish between coercive and enabling technologies: the one is designed to enhance deskilling and is focused on the technology features while the other is based on the users' skills and capabilities (Zuboff 1988, Adler and Borys 1996).

Table 2.Opposition of Coercive and Enabling formalization of information technology applied to Electronic Medical Record (EMR), adapted from Adler and Borys, 1996.

	Coercitive EMR	Enabling EMR
Architecture of EMR	Design of the EMR focus on the technical features	Design focus on usability EMR browsing is obvious for users and fit the care process practice
	Deskilling logic: technology design is left to the technical experts.	Skilling logic: facilitate responses to real work contingencies. Physician, paramedics, secretaries can modify specific settings and adapt the EMR to work process.

Table 2.Opposition of Coercive and Enabling formalization of information technology applied to Electronic Medical Record (EMR), adapted from Adler and Borys, 1996.

	Coercitive EMR	Enabling EMR
	No involvement of the professionals in the design of the EMR	Involvement of the professionals in the design : -Test of successive new functionalities with caregivers; -The EMR design allows improvement suggestions by members at every level.
Repair	Technology is designed to reduce the possibility of shirking. - Design should need no revisions after implementation -When unexpected breakdowns happen, production employees need to call a specialized technician. - Difficult to correct - No help facilities, the user is forced to interrupt the flow of clinical activities to consult a manual or a supervisor - Low consideration for the suggestions of physicians who notice opportunities for improvement.	- The goal of design is to ensure that operator can intervene effectively to rectify problems. Focus on the ease with which caregivers can repair the process themselves - Errors (prescription, posology, schedule) are easy to correct - "help" facilities - Enabling users to regain control if break down happens or if users make mistakes - If the system can be improved, designers enable users to formulate and evaluate suggestions for improvement. - Hotline is optimized to fit with 24h 7d medical work
Internal transparency	Technology is black-boxed. - Technology information is presented only in the event of machine malfunction; it is presented in a language familiar to the technical staff but not the caregiver - Care givers are expected to follow explicit instructions (What they have to do). - Users information overload (alarm system failure)	EMR is glass-box design -Caregivers are provided with all the information necessary for the task. -Users' manual helps users to do their work more effective (how they have to do) -EMR is presented in a way that is intelligible to the operator, and the operator can use the information to rectify errors. -EMR do not overload the user with unnecessary system information. -EMR design takes into account that users will be confronted with unforeseen contingencies and will therefore need to interact creatively with the technology - Users are aware of the different settings possibilities

Table 2.Opposition of Coercive and Enabling formalization of information technology applied to Electronic Medical Record (EMR), adapted from Adler and Borys, 1996.		
	Coercitive EMR	Enabling EMR
Global Transparency	**No global transparency** (which refers to the intelligibility for the users of the system) : asymmetry of information	**Global transparency**: EMR is designed to provide caregivers with extensive information on global care coordination of the patient. - Physicians have full access on quality data of patients care management in their department - Caregivers' understanding of the entire care process is considered as a valuable resource in their efforts to optimize the performance of their work and to identify local and system wide opportunities for improvement.
Flexibility	**No flexibility**: - The deskilling logic results in technologies that are designed to minimize reliance on caregivers' skill and discretion. The machine takes the controlling decisions after the operator has entered the required data. (automating logic) - The coercive procedure manual defines in detail the specific sequence of steps to be followed in the care process.	**Flexibility**: - Technologies are programmed to give advice and make suggestions, and users take the controlling decisions after the system displays the requisite data. Users can choose to retain control or can hand off control to the machine. - Several information input modes are possible. - The organization allows continuous setting of input interfaces. - The system allows the construction of new channels of information (screening clinical situations, specific alerts and follow up, collaborative work). - The organization can adapt to unpredictable situations (new user, reassignment, etc.). - An enabling procedure manual assumes that deviations are not only risks but also learning opportunities.

This distinction may be related to the technology design or to the implementation (Ologeanu-Taddei, Gauche et al. 2015). When technologies are designed for automating decisions, whose aims are fool-proofing and deskilling rationale, they are coercive (Perrow 1983, Adler and Borys 1996).The rationale is that "user is a problem to be eliminated" and a source of error (Adler and Borys 1996). When managers fear the opportunism of employees and they do not trust employees, they adopt a deskilling approach (Adler and Borys 1996). On the opposite, technologies are enabling when they are designed to enhance users' capabilities and skills. In other words, technology is thus designed for empowerment and not for enslavement (Davison and Martinsons 2002), according to the rationale that user is "a source of skill and intelligence to be supported" (Adler and Borys 1996). We summarize in the table 2 using the grid from

Adler and Borys (Adler and Borys 1996) the opposition between coercive and enabling formalization of information technology applied to Electronic Medical Record (EMR).
We argue in the next section that coercive design and implementation is driven according to administrative logic, related to unclearness between administrative and medical boundaries inside the EMR.

5. Design of EMR: medical or administrative logic?

Computerization of medical records has constrained physicians to replace their own clinical information system.
To elaborate diagnosis, a physician draws his or her information system through his or her representation of patients and their diseases. For this, he or she assesses medical observation, meaning patient symptoms, clinical signs and laboratory tests, prioritizes and selects relevant information for medical decision-making and asks for advice to peers if necessary. Even if this information is partly medical routine, the way they are is represented and put together is often specific to each specialty and even every physician. Organizing these elements is the core of medical reasoning. Related to type of design and implementation, enabling EMR may assist physicians to elaborate a convenient representation of a medical situation, while coercive EMR misfits medical and care management workflows, according to the standardization of medical and care management process as drawn by administrative logic.
When a therapeutic is decided, information system must provide all the information related to medication, isolation precautions or further investigations to all the caregivers. A physician may adapt medical decision only if he or she can follow back relevant information and monitor the effects of his or her decisions, taking into account evolution of patient's disease (current administration of the treatment, test results, vital signs).
The Electronic Medical Records which allows to acquire and store useful medical information for a given patient, to store, organize, process and communicate it, can be considered at the individual level (physicians who uses the patient's folder to manage a clinical situation), at the collective level because many people (different specialists, paramedics, secretariat) use the same system, and at the organizational level, since all the datas from different patient are made available for the different medical departments, and finally at the inter-organizational level, since the communication of medical information between institutions are necessary to the continuity of care. The EMR can be the backbone of the collaborative care and can increase or conversely decrease for the physician his capability to master and manage medical decisions

related to patient's care process. Transposition or computing model of care process is related to the formalization of medical work. If the system does not enable physician to act as a bandmaster, it may be perceived as coercive and as a threat to professional autonomy.

6. Electronic Medical records (EMR) embedded in the Hospital Information System (HIS)

Frontiers between the different subsystems of the information system used in hospitals are unclear. The term "electronic medical record " (EMR) is generally used to designate the information system used by all the actors in care delivering. EMR cover all major functions of medical practice by capturing, storing and indexing of medical and paramedical notes and reports (consultation, hospitalization, consultation meeting with other medical specialists), but also the complete process of the drug delivering and administration, planning exams and appointments.

From the perspective of the staff providing a management function within the hospital (administrative staff, medical department manager, nurses managers), EMR enables the centralization and processing of data for monitoring and tracking of resources such as beds, drug stocks, consumables, technical platforms, operating theaters or human resources. It also helps to assess "cost based" reimbursement based on a specific system of classification, namely Diagnosis-Related Group (DRG) (Lenay and Moisdon 2003). The hospital information system (HIS) support the monitoring of physical flows or data associated with the production of care, such as medication management (orders, stock and delivery in care units), but also all the consumables necessary to technical support, to the management of the hostelry, of the staff and of the billing process. Enhanced by the implementation of the pricing activity (T2A) in 2005, the DRG constitutes the core of the hospital remuneration system and becomes the main tool for hospital management (Lenay and Moisdon 2003). This system is based primarily on the information processing for each patient, from the EMR; thus, it is dependent on the quality and availability of this information.

The EMR is thus a clinical information system (CIS) as a part of the information flow related to patients care but also to the management of the hospital. Computerization has accelerated the convergence of management of patients care tools with administrative tools for managing the hospital. We propose in Figure 2 a schematic representation of the subsystems of the hospital information system and the connection between the administrative logic (hospital management) and the medical logic (patients care management).

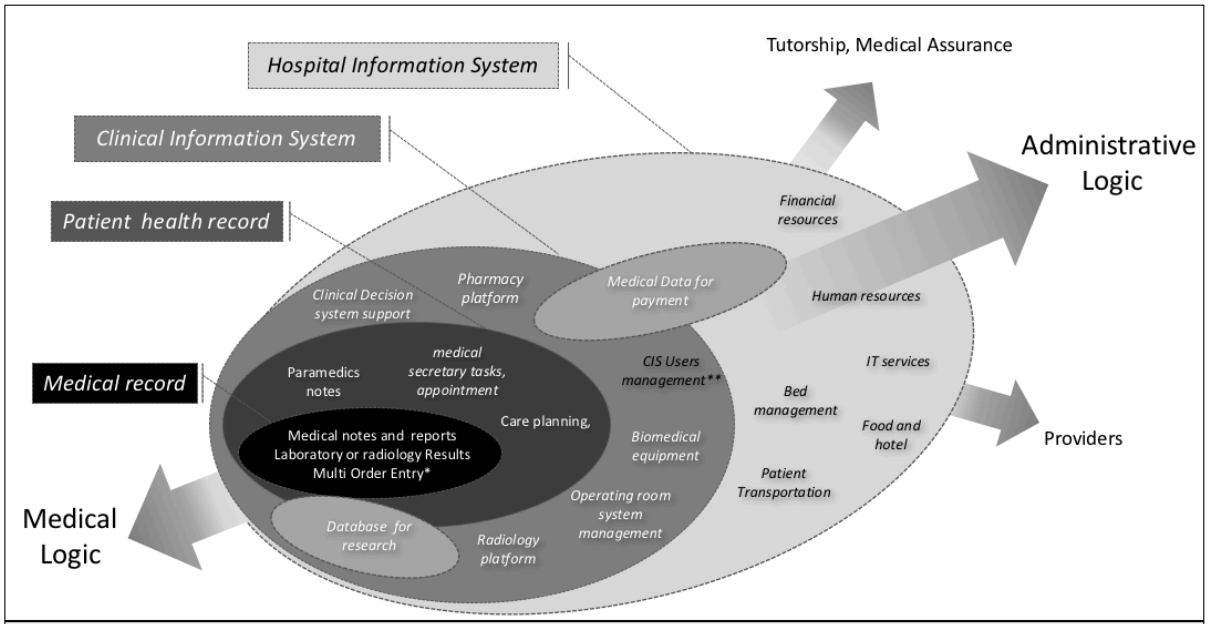

Figure 2 — Proposal from the author for schematic representation of Hospital Information System, Clinical Information System, Patient Health Record, Medical Record. Functions are not exhaustive. **Multi order entry : medication, medical test and care computer order entry. ** CIS Users Management : access and identity for clinical information system.*

7. Risk of vicious circle

Existent literature shows EMR adoption and effective use require preventing physicians' autonomy, which is a concern for EMR design for each specialty. A clinical information system, involving all the medical and care occupations, requires intra and inter-professional coordination. Furthermore, administrative and top management need accountability of available resources (as beds, human resources, pharmaceutics or technical products, technical and operating room) and measure of quality and efficiency indicators, which may be rejected by physicians. For these reasons, implementation management tends to be coercive. Doing this, it misfits medical and care workflows and can cause physicians resistance and negative unintended consequences as exposed by literature. Administrative managers then react by strengthening formalization and process standardization and, thus, increase the gap between the required enabling design and implementation and the effective clinical information systems. This is a vicious circle, similar to bureaucratic circle described by Crozier [30] that may be broken by change management of practices focused on coordination.

More precisely, Crozier showed the characteristics of bureaucratic organization (development of impersonal rules, centralization of decisions, isolating each hierarchical category and development of parallel power relationships) tend to the development of new pressures that reinforce the climate of depersonalization and centralization and lead to a vicious circle. We

suggest that the lack of effective uses of EMR is likely to result in a strengthening of the control logic, justified by arguments of economic performance, which is likely to enhance the resistance in return for users and to maintain a situation of 'inefficient uses. More so, when the finding of the mismatch between promises of technology and actual use is effective, it can be tempting for the decision maker to believe, as a form of magical thinking, that the implementation of a new technology suffice to overcome this phenomenon without trying to understand the cause. We propose a schematic description of the different stages of this phenomena concerning the EMR adoption, implementation and appropriation in figure 3.

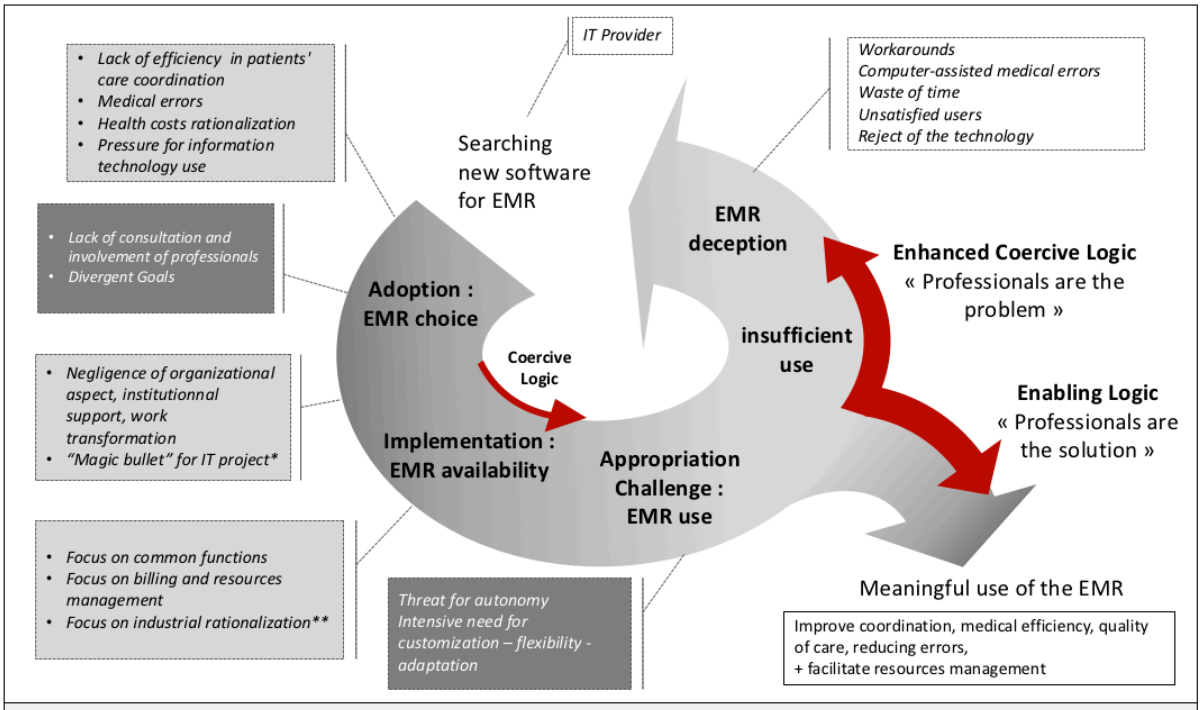

Figure 3 — Schematic representation the potential vicious circle of the Electronic Medical Record. *(*"Magic Bullet" refers to L.Markus, 2004 ; Industrial Rationalization refers to J.Gadrey, 1994)*

Gadrey (Gadrey 1994) shows that there is a confusion between industrial rationalization and professional rationalization of work especially in hospitals. For this author, industrial rationalization, using massively new information technologies, aims to design and organize the production of professional services as "quasi-products", to standardize as much as possible professional work, by searching to measure productivity (Gadrey 1994). This is opposed to the professional rationalization which consist in making more accurate and systematic typifying cases. Professional formalization consists in dividing care process in routines to improve the efficacy defined as both time saving and quality of care of professional work procedures (Gadrey 1994). This distinction helps to qualify the contrast between bureaucratic logic and professional autonomy: autonomy is not opposed to formalization, but the professional vision of formalization differs from the bureaucratic vision. Design and implementation of EMR,

functional setting and support functions are based on a techno-economic logic or industrial rationalization, to the detriment of the consequences for the caregivers. This may be explained by the difficulty of consultation of professionals and their tendency to neglect the essential problems of coordination, control and organizational innovation (Mintzberg 1979).

Conclusion

We have shown in this paper that the implementation of EMR is based on the principle of integrated software as in other economic sectors. EMR makes coexist features corresponding to different logics: one bureaucratic or managerial control, and another professional (clinical). Thus, the EMR crystallizes the very functioning of professional bureaucracies, characterized by the opposition between these two logics. But the inherent formalization caused by computerization (in terms of design or functional setting post-implementation) requires defining the processes and procedures to be formalized, with clear objectives. Another characteristic of bureaucracies, namely the chaos associated with the divergence of goals defined by Hodson & Martin (Hodson, Martin et al. 2012), reinforces this phenomenon, with the risk of a lack of adoption of EMR by professionals and therefore not appropriation. Yet only appropriation by professionals, and thus the development of what we call "effective use" is likely to cause an improvement in both the hospital organization and working conditions for each professional involved in the realization of care.

The main contribution of this paper is theoretical. It links the literature on the factors of failure (and success) of EMR and the literature on professional bureaucracies, in order to highlight the most important aspects to promote appropriation, which goes beyond the implementation of the technology. The design and effective implementation of technology focused on professional autonomy constitutes the most crucial point for appropriation and EMR benefits. Furthermore, we based our argumentation on the approach of Adler & Borys, in favor of enabling formalization process (Adler and Borys 1996). We argued that only this approach would get out of a vicious circle that currently strengthen the bureaucratic logic to force appropriation, resulting in return professional resistance, and therefore not associated to EMR efficient uses. Thus, our theoretical contribution is completed by managerial recommendations, since we propose another approach to define, implement and enable the development of EMR.

In future research, we want to provide empirical examples to support our assumptions, through case studies in French hospitals.

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