Understanding variation in departmental adoption of Electronic Health Records: an embedded case study

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Abstract

Background: Electronic Health Records (EHR) are integrated software applications used by healthcare providers to create, share, retrieve, and archive patients' health status information. Especially for large healthcare organizations, implementing Electronic Health Records organization-wide is a complex endeavour. The EHR literature generally suggests that contextual factors play a major role in adoption. We demonstrate how the work context influences adoption at the departmental level in a situation where each department has its own medical specialty or patient stream, clinical authority, and accountability. Here, the achievement of full adoption by all departments is not self-evident. Drawing on EHR implementation in a Dutch hospital, this study explores how the clinical departments' work context characteristics contribute to their pre-implementation intended adoption and their post-implementation EHR uptake.

Methods: This embedded case study allowed us to examine the EHR adoption of eight diverse clinical departments in terms of their work and socio-political context. Data collection entailed semi-structured interviews, observing meetings, document analysis, and feedback sessions to check our interpretations. We examined the context and adoption intentions before implementation and the adoption level approximately half a year after the Go Live. The comparative case analysis iterated between holistic department-level descriptions and structured data displays based on inductive and deductive coding.

Results: We identified three departmental types that varied both in adoption intention and post-implementation uptake: (1) departments oriented towards the organization with an enthusiastic or compliant adoption; (2) internal-oriented departments with a selective or conditional adoption; and (3) externally oriented departments with no or low adoption with workarounds.

Conclusions: We conclude that work context characteristics contribute to individual departments' adoption of an EHR. By acknowledging departmental types that will vary in adoption intention, and especially the underlying explanatory mechanisms, we recommend that implementers acknowledge these departmental types and differentiate their strategies towards clinical departments accordingly based on their observable work context characteristics. Based on these findings, we develop propositions that contribute to the development of a department-level EHR adoption theory.

Background

Healthcare is in an era of digital transformation in the quest to deliver better quality of care at lower costs. For hospitals, having a well-functioning Electronic Health Record (EHR) is key to this transformation. The main promises of these systems are integrated applications, a uniform data model, and shared patient data that result in improved patient service, quality, and healthcare safety [1] and contribute to cost effectiveness due to efficient patient data flows [2]. The EHR systems are repositories in which digitalized healthcare process information is organized in a way that enables clinical departments to register, process, retrieve, archive and, importantly, share patients' data on both the individual patient level within the daily workflow as well as on the aggregated level (e.g. for quality monitoring, teaching, and research purposes). As such, EHRs were also meant to facilitate clinicians to base their decision-making and research on an all-encompassing view of patient data. In practice, the promises are not fully met due to reported low adoption or fragmented use caused by low interoperability and unintended adverse consequences such as information overload, incessant box checking, laborious documentation, and designs based on overly rationalist, linear models [3-8]. This paper explores the contextual factors underlying differences in realized adoption between clinical departments in a hospital.

The adoption of Electronic Health Records

For hospitals in particular, the successful adoption of an EHR depends on the compliance of all its clinical departments. In the embedded case study reported in the current paper, one surgeon stated: *"we [the department] are very much in favor of this new integrated health record, we are looking forward to it"*, whereas a specialist from another department argued, *"we don't see many advantages for our department, rather we foresee problems"*. However, only through widespread adoption by all departments, an EHR can reap its benefits and fulfil the high performance expectations in terms of empowering health professionals to efficiently and transparently provide better continuity and higher quality care [9]. As clinical departments are heterogeneous and powerful units, each with its own goals, medical specialty developments, and interests, the achievement of any hospital-wide adoption is a complex endeavor [10-13]. In this embedded case study, we explore how clinical departments' diverse contexts may contribute to differences in their adoption of an hospital-wide Electronic Health Record. Thus far, the departmental or clinical subunit level has barely been taken into account in EHR adoption studies. Such studies have mostly focused on either the individual [e.g. 14] or the organizational level [e.g. 15].

Still, some results suggest that hospital-wide EHRs suit some clinical departments better than they do others [e.g. 4]. A meta-review [10] concluded that small EHRs may be more efficient and effective than larger ones. A reason for this finding could be that the large diversity in clinical processes across specialties and their specific information requirements prevent standardization, and that the extent of customization required renders a large EHR inefficient. A qualitative study also showed how paper- and EHR-based practices within one network organization had different priorities for implementing a new EHR [16]. On their turn, Park et al. [17] compared the adoption of EHR by Canadian ophthalmologists with physicians from other surgical specialties. Compared with other surgeons, the ophthalmologists felt that EHRs were not suitable for their practice, and too time consuming. This was attributed to unique features of their field, including a heavy reliance on hand-drawn figures in documentation and high patient volumes. Park et al. consequently called for more research to explain differences in EHR adoption and identify implementation strategies to mitigate discipline and clinical department-related barriers. This call is in line with an earlier review of the impact of emergency department features on EHR adoption, which led to a call for examining diversity in needs and expectations across departments [18].

Research aim

We took a focus on the clinical department level for three interlocking reasons. First, differences in views on adoption among clinical departments are critical for EHR implementers and technicians who require their cooperation in aligning the system and departments' clinical processes [17]. Clinical departments have their own distinct specialist responsibilities, and legal and budgetary accountabilities, and this grants their boards a level of discretion when it comes to adopting an EHR [19]. Second, the staff of a clinical department share working goals and practices with which the information system will have to be integrated if it is to be effectively used [20]. For nationwide EHR systems in primary care, whether the EHR enables or constrains micro-level care delivery depends on the realized alignment of goals and resources [21]. The same may be true for hospitals, making the department a highly relevant level of analysis [22, 23]. Third, evidence suggests that healthcare organizations that are divided into semi-autonomous departments, with decentralized decision-making structures, assimilate innovations more readily [24]. However, given that EHRs are aimed at organization-wide integration of data, applications and work processes across departments, it is possible that contextual differences among these semi-autonomous clinical departments complicate this readiness. The literature, however, offers little insight into the nature of the relevant clinical departments' contextual characteristics. Such insights would be highly valuable for implementers negotiating EHR adoption and adaptation.

The stake in these negotiations is high since adoption outcomes such as non-use, partial use with workarounds [4, 25, 26], and fragmented or neglectful use, even if by only one clinical department, could jeopardize effective use by other departments and for the hospital as a whole. In such situations, the EHR will fail to deliver the promised data overview and seamless integration of operations [25].

The paper is organized as follows. First, we describe the methods employed in our embedded case study of eight departments within a hospital and present the results. These departments are compared in terms of both work and socio-political context, pre-implementation adoption intention, and realized adoption. Based on within-case analyses, we first develop a categorized overview of the contextual characteristics that were perceived by department board members and leading representatives to affect the departmental intention to adopt the EHR. A post-implementation analysis demonstrates that the departments' realized adoption was in line with their earlier adoption intentions. The cross-case analysis shows three departmental adoption types that are directly related to differences in their work context and less so to their socio-political context. Based on these outcomes, we develop a model and propositions for further research. Implementers could use the knowledge of a department's work context at an early stage of the implementation process to guide the required collaboration with the department members.

Methods

Research site and department selection

To explore how the particular contexts of clinical departments affect the adoption of organization-wide EHR, we conducted an embedded case study within a large hospital in the Netherlands. A case-study approach allowed us to study departmental adoption in its natural setting and so understand its nature and the complexities involved [27, p. 78].

The Dutch healthcare system is in transition from a supply-side oriented, government-regulated approach towards managed competition [28]. The Netherlands has 77 hospitals [29]. Since 2006, hospitals have increasingly been allowed to negotiate with health insurers over treatment prices and quantities. The number of negotiable treatments has risen from 20% in 2008 to 70% in 2018. Increasing pressure from insurance companies to lower prices has resulted in competition between hospitals [30]. In order to lower prices while maintaining quality, hospitals are increasingly specializing, which requires negotiations between hospitals and specialties. Partly as a consequence of this specialization, hospitals are still expected to collaborate with each other in networks to maintain accessibility and increase the quality of care [31]. This development is enabled through demands for transparency in terms of price and quality imposed by government, insurers, and patients, a process that represents a strong push towards EHR use. In many hospitals in the Netherlands, clinical departments enjoy a fair degree of autonomy if only because the medical specialty is professionally accountable for the patient care delivered. Often, medical specialties are organized in legally separate entities that negotiate with the hospital management. The focal hospital of our research had initiated a program directed at purchasing and then implementing an organization-wide EHR to improve cross-departmental workflows, patient safety, and efficiency of care. Top management had decided to implement, through a big-bang approach, a uniform system, with hospital-wide functionality, that left little room for customization. The focus was on internal hospital processes and reimbursement for services rather than on information exchange with external actors. The system was expected to replace numerous stand-alone applications and integrate all the existing paper-based and electronic records.

The case study in this paper covers the pre-implementation stage that lasted 2.5 years (Autumn 2012 – Spring 2015) and the subsequent uptake between December 2017 and Spring 2018, complemented with a snapshot of the realized adoption for each department a year later. The pre-implementation stage was divided into two phases, in each of which we gathered data. Phase 1 focused on project preparation, requirements specification, the tendering procedure, and vendor selection. Phase 2 involved the subsequent system design, system integration, training, and testing. The implementation strategy from December 2017 onwards was plateau-oriented and is still in progress. The level of customization will be increased at each successive plateau. The analysis of the realized adoption concerned the implementation of the first plateau.

Given our study's comparative nature [32], eight departments were selected to allow theoretical replication [33]. The departments (coded A - H) were selected in consultation with the EHR's project management to ensure variation on three selection criteria: (1) the department's existing patient administration and handling (largely digitalized versus largely paper-based); (2) department staff level (small:< 75fte, medium:75-150fte, large >150fte); and (3) the grouping logic underlying the medical specialty (see Table 1).

Table 1. Selection criteria for the clinical departments sampled

<i>Department</i>	<i>Pre-implementation patient record digitalization level</i>	<i>Staffing level (small:< 75fte, medium:75-150fte, large >150fte).</i>	<i>Medical specialty based on</i>
A	High	Small (outpatient clinic, no ward)	Life stage
B	Moderate	Small (outpatient clinic, shared ward with other department)	Life stage
C	Low	Medium (large outpatient clinic, no ward)	Organ/body system
D	High	Medium (outpatient clinic, own ward)	Organ/body system
E	Moderate	Large (multiple wards)	Treatment stage
F	Moderate	Small (outpatient clinic with a few short-stay beds)	Treatment stage
G	Moderate	Large (outpatient clinic, own ward)	Condition/illness
H	Low	Small (outpatient clinic, shared ward with other department)	Organ/body system

Data collection

Data collection methods comprised a variety of document searches, interviews, meetings, and informal communications. For example, in the study's initial phase, two project managers set up a document in which all clinical departments had been given a preliminary score on a number of characteristics to support our sampling. During the pre-implementation period, after having gained formal approval from the department boards, we conducted 44 core interviews: 36 within the sampled departments and 8 with project managers. The authors were involved in the interview protocol design and in conducting most of the interviews, the latter either individually or as a dyad, often assisted by students. Interviews were taped and transcribed. During Phase 1 of the pre-implementation, in 2013, 24 interviews were conducted with department board members and leading user representatives (i.e. physicians, nurses, and administrators) from each department [34]. At the end of Phase 2, in 2015, 12 of them were re-interviewed. Each time, the outcomes were discussed with project management representatives for validation purposes. Finally, a year after Plateau 1 implementation, a leading hospital manager was interviewed about realized adoption in each department sampled. This post-implementation interview was complemented by interviews in five departments (A, B, C, D, and H) and informal, personal communications concerning the others between Spring 2018 and Winter 2018-2019. These were aimed at better understanding what happened after the big bang and to evaluate the current state of departmental adoption. In addition, during the Plateau 1 implementation and the period thereafter, meetings with one or two project management representatives continued, albeit on a less frequent basis than in the pre-implementation phase.

The pre-implementation interviews were semi-structured, lasting between 60 and 90 minutes. To explore why and how specific characteristics affected a department's adoption intentions, the protocol included not only questions about the interviewees' departments (e.g. *What are the main characteristics of your department? Are there any specific department features that put a special demand on the EHR? Which ones, and why?*), but also about the department's involvement in the EHR project (e.g. *Is your department represented within the program or within any of its projects? How?*), the expected future impact of the system (e.g. *Looking to the future, in your view, what effects will the EHR have on your department?*), plus the department's initial intentions concerning future use of the system (e.g. *When did you first hear about the new system? What was, generally speaking, the initial reaction in your department? And yours personally?*). The post-implementation interviews were short and focused on recording departmental adoption, any customized extras delivered, emergence of workarounds, and overall reaction after the big-bang of Plateau 1. This allowed a comparison between the intended and the realized adoption approximately one year after implementation: is the EHR being used on a regular basis as the department's patient data recording and management system, with full compliance in terms of no extra customized modules and no local workarounds.

To contextualize the data and ensure construct validity [35, 36], we held a meeting every six weeks during the pre-implementation stage with between two and four project management representatives. Given our aim to examine the department level, we also held four feedback sessions with interviewees and some of their colleagues to share and discuss interpretations. We ensured that two of the authors were present at all these meetings and minutes were

taken. The meetings and additional data sources, including newsletters, written reports, and policy plans, enabled us to better contextualize and verify the relevant departmental characteristics and how these characteristics impacted adoption [32].

Data reading, coding, and analysis

Since each department was different in terms of the clustering of its main context characteristics, they were each treated as a separate embedded case [37]. The following six steps were conducted and the results from each step were discussed in the research team as a whole.

First, for each department, we developed a holistic storyline, based on our reading of the available materials, to enable an initial understanding of their voiced adoption intentions. In discussing these initial storylines, and tentatively mapping emerging differences between them, we noted that, in all the clinical departments surveyed, the views of the board members and leading representatives on EHR adoption were built around their department's specific work context. The specifics of the work context were prominent in interviewees' reasoning about future (non-)adoption of the EHR.

Second, following this preliminary finding, we provisionally split up all the relevant quotes in the data as relating to either work context or socio-political context. To more in-depth unravel the dominant work context characteristics, we returned to the literature and selected a framework that distinguishes three elements in the work context: Technology, Organization, and Environment (TOE) [38]. Two authors then individually coded the pre-implementation data using deductive TOE-based and complementary inductive codes. These codings were compared and combined, systematizing and refining the context characteristics' codes as required.

Third, for each department, the same two authors discussed all the quotes that directly referred to departmental adoption intentions, leading to a short description of each department varying between firmly declared intentions to use and stated strong likelihood of non-use. On a few occasions, we had to go back to the transcripts for clarification and to minutes and notes of meetings to verify the convergence in the interviewees' views. We concentrated on the expressed views regarding the likelihood that the department would show compliance in using the system on a regular basis after the 'organization-wide' go-live. In our conceptualization and coding, we kept the departmental intention to use well apart from the more general departmental support for or resistance towards the implementation process [39].

Fourth, we went back to the transcripts, and earlier generated data displays, to deepen our understanding of the different reasons behind the departmental adoption intentions and again further refined the code definitions for the contextual characteristics (see data structure in additional file 1 and codebook in additional file 2). These iterations led to a department-based list of voiced reasons behind the adoption intention. Each voiced reason could be grouped into either work context or socio-political context characteristics.

Fifth, we subsequently cross-analyzed these lists to arrive at a tree of perceived contextual characteristics and we carefully identified the direction of each characteristic's influence based on the interviewees' accounts (see below in Table 3, 2nd column; see also the data structure in Additional file 1). The elaborated tree with context characteristics, whose preparation again included additional data checks, enabled us to distinguish, for each department, between dominant characteristics and complementary characteristics that further strengthened or weakened the department's adoption intention. After comparing these eight departmental patterns, we arrived at three department types in terms of adoption intentions and the contextual characteristics underlying these intentions.

Finally, we examined what happened in the period between 0.5 to 1.5 years after the EHR go-live, and compared the realized adoption after approximately one year with the departments' earlier voiced adoption intentions.

Results

Within-case analyses

Table 2 summarizes the departments' contextual characteristics as voiced by the interviewees to explain their department's position vis-a-vis the implementation process including their reasons for the departmental adoption intention. The final column specifies the realized Plateau 1 adoption. In the next section, based on a cross-case analysis of the resulting patterns, the individual departments will be grouped into three types. To help interpret the chain of evidence leading to this typology, Table 2 already includes each department's type. For each of the three types, this section further presents one representative department: Department A represents organization-oriented departments (Type I); C those with an internal orientation, i.e. a department-oriented department (Type II); and G an external environment-oriented department (Type III). Descriptions of the other departments are included in Additional file 3.

[Insert Table 2 about here]

Example of an organization-oriented department

Pre-implementation. Department A is a generic small subunit staffed by six medical staff members and one psychologist. The department is responsible for a small outpatient clinic (with three nurses). There is already a high degree of digitalization of patient records. Exceptionally in this hospital, the nurses at the outpatient clinic were already working with digitalized records. The interviewees emphasized their multidisciplinary patient focus, expressed by one of the doctors as follows: *"We are one of the very few departments that focus on our patients and not so much on diseases"* (A1). The department does

not have its own nursing ward so patients who need hospitalization are admitted to wards belonging to various other departments. The clinicians from Department A will visit their patients in these wards. As such, their working practices are highly reliant on cooperation with other departments. Moreover, data are exchanged with care providers outside the hospital, particularly when patients are referred to the hospital by these providers and vice versa. Perhaps as a consequence, the interviewees welcomed the idea of a hospital-wide EHR and expressed no doubts about adopting the EHR as a department. While they voiced some concerns about whether it would match their own distinctive, holistic logic of patient record keeping, they saw no active role for their department. The interviewees admitted that given the department's small size, and other developments requiring their attention, the new EHR was not their key priority. They thus seemed to be opting for a wait-and-see role. Nevertheless, the department clearly intended to comply, and indicated that their operations would benefit from a single shared patient record across departments and across professions. In short, they did not shy away from digitalization: *"We are a forerunner in working in a digital way"* (A2).

Realized adoption. Although the department's members were slightly concerned that their specific multidisciplinary approach may be in jeopardy because of the system, they complied with adopting the system as implemented in Plateau 1 without demanding customized extras. The two interviewed users were happy with the progress in digitalizing patient-related data, as noted by one of them *"...we catch up now, and I'm happy with it [the EHR]"* (A4).

Example of a department-oriented department

Pre-implementation. Department C is a medium-sized mono-disciplinary subunit, consisting of doctors (14 specialists and 13 residents), nurses, paramedics, and technical support staff (approximately 120 fte in total). Although the department provides consultations for other departments' patients, it works largely in a stand-alone manner. The department's key activities are related to service delivery within a large outpatient clinic. They use advanced equipment that is fully integrated into the department's care processes. They treat approximately 300 patients per day and for each there is a strict and limited timeslot available. The care processes are organized in such a way that the patients, depending on their diseases, complete a number of steps of this process. In the past, Department C had put great effort into designing efficient work processes. Given their existing tailored care processes, they only envisaged minor benefits from the new EHR. The department's manager expressed this as: *"it can save some time in routing the patient records from the depot through the process...but we are particularly concerned that the system is able to follow a patient through our process, that is how we have organized it logistically"* (C3). As such, the department was worried that the new EHR might create more problems than benefits. During the pre-implementation phase, it was uncertain whether the new EHR could be aligned with the department's existing work processes that were integrated with the technological equipment in use.

Realized adoption. Plateau 1 was implemented without any customized extras for Department C. Due to the high volume of patients each day, it was crucial that the department could quickly retrieve concise specialty-related medical histories of their patients. The system could not meet this requirement. Therefore, the department's board decided to create a workaround, which all its specialists were obliged to use: *"...it is not even allowed to use it in a different way; these are firm arrangements within our department"* (C4). They acknowledge that their view conflicts with having a unified organization-wide EHR: *"Our way of working goes against agreements"* (C5).

Example of an external environment-oriented department

Pre-implementation. Department G is a large subunit (230fte) that has its own ward and outpatient clinic. Here, new patients are filed digitally, while existing patients still have paper-based records (internal documents). This department is not located in the main building and their care processes have little work dependencies with other departments. One manager explained: *"Some departments operate in a very isolated way within the organization. We are very isolated... our information systems differ considerably from the other information systems...we don't collaborate that much"* (G2). Nevertheless, they showed themselves to be highly committed to helping the change take place and the interviewees did see benefits in the new system for their department: *"People are intending to use the new system...they can hardly wait, because we are faced with the limitations of [the current information system]"* (G2). They also saw it as a way to become better connected to the other departments. The interviewees did not worry about task-technology fit: *"...business as usual, with another information system"* (G2) and *"this is about finance and bureaucracy for the most part, the way we provide care will not change that much"* (G1). Despite the seemingly enthusiastic support, the department board's intention to adopt was clearly conditional: *"We really want one [generic] information system. We are true proponents! However, it has to go our way...we will still have to comply with our own [external] rules and legislation"* (G4). It was uncertain whether the new system would facilitate these requirements.

Realized adoption. Despite the department's supportive attitude towards implementing the EHR, the EHR proved incapable of supporting the production registration system demanded by the insurers. Implementation was, therefore, suspended until further notice.

Cross-case analysis

The descriptions of Departments A, C, and G show different emphases in their work context orientations: towards the hospital (A), towards the department itself (C), and towards the external environment (G). These work-context-based orientations not only play a role in the adoption intentions, but are similarly reflected in the Plateau 1 realized adoption: Department A achieves a rather unproblematic adoption, in Department C we observe the collective creation of workarounds and, in Department G, the EHR was not adopted. In this section, we present the cross-case analysis leading to these distinct types.

Context characteristics and related adoption

The context characteristics that interviewees used to explain their department's adoption intention are provided in the second column of Table 3. Based on our interpretation of the shared elements in their narratives, as summarized in the within-case summaries above and in Additional file 3, the final column specifies the direction (positive +; negative -; or ambivalent +/-) and dominance (in **bold**) of the characteristic's influence. The table shows that the dominant characteristics relate especially to work context and less so to the socio-political context.

First, the accounts from five departments point to the relevance of a fit between the new technology and the existing material and human technical capabilities. In three departments (D, F, G), the existing IT expertise seemed to positively influence the adoption intention while, in two other departments (C, E), the local IT expertise, as well as the existing or envisioned technology, had a negative effect. Department E had started to independently develop its own IT: *"At E we now have a patient management data system [...] which we will keep using. Thus, we will not fully adopt the EHR"* (E3). They expressed strong doubts as to whether this system could even be connected to the organization-wide EHR. The key actors in Department C voiced similar concerns about the possible integration of, or interfacing with, the numerous and advanced technologies employed in their efficiently organized work processes, leading to strong reservations towards EHR adoption. In terms of the material technical capabilities, two departments (B and G) explained that they expected better connections or integration of their systems.

[Insert Table 3 about here]

Second, the work context points to a perceived fit between the EHR and the departments' tasks and current work designs. The table's third column presents a range of characteristics related to task-technology fit that were voiced during the interviews. Clearly, perceiving the existing administration as inefficient, unreliable, or fragmented is a driving force for EHR adoption, and this perception was mentioned by all departments except Department C. Expecting current practices to benefit from the uniformity that the new EHR system imposes was also a positive stimulus for intended adoption (D, E, and F). Department C demonstrated how having a well-designed, but vulnerable to change, workflow makes departments suspicious of a new system that will cause disruption.

Third, the interviews exposed how a department's environment plays two counteracting roles determined by (1) a department's dependencies on other departments within the hospital (intra-organizational) and (2) its dependencies on the hospital's environment (extra-organizational). For six departments, their dependencies on other departments can be seen as a major reason for their intended adoption: they deliver either multidisciplinary care or share patients with other departments. These departments expect greater benefits from a hospital-wide EHR system than departments that operate in a relatively 'stand-alone' fashion, such as Departments C and G. When it comes to extra-organizational dependencies, the picture is less straightforward. Interviewees from four departments voiced the relevance of extra-organizational dependencies (B, D, F, and G), with those from D and F perceiving opportunities to improve their dealings with supply chain partners or in complying with legal requirements. However, Department B was highly ambivalent regarding the system's potential to facilitate external information flows. Moreover, Departments B and G did not see how this new EHR could possibly support them in meeting externally imposed information requirements.

Regarding the socio-political context, the interviewees' narratives did not reveal any dominant role of these characteristics: as Table 3 indicates, our findings provided no indications of a direct relationship between these characteristics and a departments' adoption intentions.

Pattern identification: three department types

By examining the interplay between the contextual characteristics and then relating the identified patterns to the department's adoption intention, we were able to determine the dominant factor(s) for each department (shown in Table 3 by the department letters in bold). For example, Table 3 shows that the material technical capabilities of Departments C and E, critical resources for delivering their specialty's patient care, had the most impact on their adoption intention. Although these departments were supportive of the change direction, they had developed conditional, or limited, adoption intentions (Table 4; see also Table 2). For these two departments, their existing, highly advanced, technical capabilities had a negative influence on their adoption intention. The representatives voiced this aspect as dominating their ultimate adoption intention: *"[The existing technologies] are an incredibly huge investment that [Department C] has made, so imagine that you have just adopted these and then they get thrown out once the EHR is implemented, then you end up totally suckered"*. For these departments, this aspect was perceived as more critical than other influences (such as department E's references to 'IT expertise and vision for the future').

In contrast, the low technical capabilities of Departments B and G had a positive influence on their adoption intentions. Department B's interviewees mentioned that greater integration between applications and a long-desired connection with a specific technology were expected to be realized through the EHR implementation. However, their serious concern was that this positive influence would be outweighed by the negative effect of this department's dominant factor: its extra-organizational dependencies related to national laws and specialty regulations, and the integrated workflows with external partners: *"We have many referrals from a large region, and the doctors from our specialty are also based in almost all the hospitals in the region"* (B1). Despite the espoused support for the organization-wide EHR implementation, these characteristics led to reservations about their own adoption in the pre-implementation stage.

The pattern identification process resulted in three department types that varied in their adoption intentions: (I) organization oriented, (II) department oriented, and (III) external environment oriented (Table 4). The first type with an *organization orientation* (A, D, F, and H) had many intra-organizational dependencies. These were in the form of workflow dependencies with other departments because they deliver multidisciplinary care and/or

treat patients from other departments. Such departments are relatively more dependent on inter-departmental information flows than are other departments, and A, D, F and H were clearly dissatisfied with their current systems. Their expectation was that the EHR would enable high quality information exchange with other departments, and voiced this as the dominant reason for their intended adoption of the system. In these departments, the data show relatively unproblematic realized adoption, although the efficiency of the use was sometimes a little lower [estimation of program management for D and H].

The second type had a *department orientation* (Departments C and E) and characterized themselves as having relatively stand-alone work processes with few reciprocal dependencies with other departments. These departments had serious doubts as to whether their current technologies-in-use could be safeguarded or further developed under the new standardized systems and therefore only intended to adopt the EHR in a limited or selective way. Both departments were rather satisfied with their existing technologies (some under development), and their relative independence or even isolation had allowed them to carefully integrate these into their well-designed work processes. This strengthened their reservations. In the end, these departments had nevertheless to implement Plateau 1. In Department C, a collective workaround was determined to secure their own throughput efficiency until a customized module was provided. In Department E, many of the analytical functionalities of their highly customized patient data management system were lost. This was, however, partly compensated for by a medical specialist who managed to acquire high EHR expertise and so build customized flowcharts for their clinical processes and specific order sets, and also generate the required data analyses “*deep within*” the EHR itself. Finally, halfway through 2018, both departments were provided with a ‘physician builder’ – a physician responsible for maintaining and updating their own EHR configuration.

Representing the third type, with an *external environment orientation*, were Departments B and G that had significant extra-organizational dependencies through regional or (inter-)national collaborations, or through laws and insurance regulations. These departments were highly supportive of implementing an EHR, but said they could only adopt the new system to the extent that it would not hinder them in fulfilling their external requirements. Their fears in this respect showed in pre-implementation reservations. The post implementation data show that it was negotiated that Department G, facing externally imposed production registration requirements that went against the EHR logic, did not adopt the system. A customized module was developed for Department B to enable it to meet its external demands. Moreover, a third system that the physicians worked with, alongside the two applications replaced by the EHR, would be integrated in the EHR for Department B. The latter customization was, however, ultimately postponed to Plateau 2 by the supplier. Consequently, both a medical specialist and the project manager acknowledged that the outcome was perceived as complicated to work with, leading to individual physicians using workarounds.

[Insert Table 4 about here]

Discussion

Department-level adoption model and propositions

We have explored how contextual characteristics may explain a clinical department’s adoption of a hospital-wide Electronic Health Record. Our findings demonstrate how departmental adoption was closely linked to the departments’ work context characteristics. Below we discuss these findings and take the first step towards a department-level adoption theory for organization-wide EHR that can complement individual- and organization-level EHR adoption theories. For implementers, clinical departments are salient stakeholders as they constitute a countervailing power to hospital management [23].

In the hospital studied, the EHR was initiated in a top-down manner, with the implication that management expected the system to be fully adopted. However, our data suggest that certain work context characteristics decrease the likelihood that a department will adopt the system as anticipated. In particular, some departments have specialized, local technologies that the EHR cannot be integrated or connected with, others have an advanced and vulnerable workflow design that would need to be adapted, and others have binding requirements imposed by their extra-organizational environment. Other influential work and socio-political contextual characteristics were also identified, but played a more modest role in the view of the interviewees.

Our finding that departments’ workflow and resource dependencies influence EHR adoption accords with classic sociological research that recognizes these factors as critical contingencies for work design at the department level [40, 41]. The patterns we reveal add to a systematic eHealth review [42], which shows that a crucial fail factor is not understanding the workflow(s) that the eHealth will support and the clinical processes involved. Many clinical processes are still specialty based and (coalitions of) departments are in the lead when designing workflow. Combining the patterns identified in departments’ contextual characteristics with their intended and realized adoption, we deduce three generic department orientations that underlie the variation in adoption of an organization-wide EHR: (I) organizational orientation, (II) departmental orientation, and (III) external environment orientation. Further, taking both the dominant and the additional reasons for (non-)adoption into account, we now develop seven propositions for future research represented by the relations depicted in Figure 2.

Departments with a hospital orientation (Type I) experience their work processes as having reciprocal dependencies with other departments that require intensive and reliable two-way information flows (compare [40]). Since EHR targets the hospital-wide integration of data and work processes, Type I departments expect an EHR to be especially useful [compare 43], leading to intended and realized adoption of the hospital-wide EHR. In our study, they showed themselves also relatively resilient to negative socio-political contextual issues. Finally, their adoption intention was strengthened when the department negatively evaluated the fit between their workflow design and the existing IT systems that supported them before the implementation. These arguments lead to the first two propositions for further research.

Proposition 1A: Intra-organizational dependencies positively influence a clinical department's adoption of organization-wide Electronic Health Records.

Proposition 1B: A low existing task-technology fit strengthens the positive effect (1A) of intra-organizational dependencies on a clinical department's adoption of organization-wide Electronic Health Records.

In contrast, a department orientation (Type II) reflects a department that operates relatively independently, the orientation is inward, and management may in this respect even feel or portray it is 'isolated'. In terms of Thompson [40] the dominant work dependencies are sequential. Given that these departments tend to focus on optimizing their internal processes, they may have developed or acquired localized, highly customized, and advanced applications, hardware, and other digital equipment. The Type II departments in our study had also developed their own IT vision and knowledge. We saw that, when such departments are satisfied with their tailored IT systems (realized or under development), their adoption intention is lower since the improved integration with other departments that the EHR offers is of limited value. Consequently, these departments only intended to adopt the EHR if it was compatible with their current IT vision, systems, and other equipment. In other words, their adoption was conditional. Further, their adoption intention tended to be selective in that only the prospect of previously unavailable or improved functionality that would render their operations more efficient would lead to the EHR being embraced. As Greenhalgh et al. [10] suggested that small EHRs may be more efficient than larger ones; for Type II departments an organization-wide EHR may not be able to beat their local dedicated digital systems. Our theoretical interpretation of these observations leads to three propositions.

Proposition 2A: Existing material technical capabilities that are critical to their patient care negatively influence a clinical department's adoption of organization-wide Electronic Health Records.

Proposition 2B: An existing task-technology fit strengthens the negative influence (2A) of current material technical capabilities on a clinical department's adoption of organization-wide Electronic Health Records.

Proposition 2C: Intra-organizational dependencies with other departments weaken the negative influence (2A) of current material technical capabilities on a clinical department's adoption of organization-wide Electronic Health Records.

Externally oriented departments (Type III) tend to have externally imposed data requirements from stakeholders they are reliant on for their legitimation or resources [41], such as government or financiers, that lead to more decentral decision-making [44]. They often have or require customized IT-supported interfaces with the outside world, such as suppliers, customers, and partner organizations. These departments feel a need to optimize their external relationships through dedicated technological interfaces, or at least compatible systems that allow (future) digital data exchange. Further, our study suggests that a department's evaluation of its current task-technology fit may affect the influence of extra-organizational dependencies on a department's adoption intention. If the current fit is experienced as low, and hampers performance, departments seem more open to the new EHR. Therefore, we propose the following:

Proposition 3A: Extra-organizational dependencies negatively influence a clinical department's adoption of organization-wide Electronic Health Records.

Proposition 3B: An existing task technology fit strengthens the negative influence (3A) of extra-organizational dependencies on a clinical department's adoption of organization-wide Electronic Health Records.

The model in Figure 1 summarizes the propositions developed above based on our interpretation of the results summarized in Table 4.

Figure 1. Model of work context influences on a department's adoption of a hospital-wide EHR

Implications for research

Our study and the propositions that follow from our findings build on the social-psychological nature of behavioral intentions [45]. For the departments studied, we find that the interviewees' perceptions of the dominant work context characteristics affected their adoption intentions [37, 46]. Second, our proposed model (Figure 1) includes fit variables related to the existing technology and organization of the clinical departmental work. That is, the nature of an EHR embraces the logic that intra-organizational dependencies will be served by the standardization of the internal data model and information flows. This logic aligns with the interests of those departments that have intra-organizational work dependencies, but is less relevant for departments that operate relatively independently and for those whose critical operations are interwoven with external partners, whose output is tied up with external networks, or who have to conform with medical professional associations. This 'fit' aspect of the proposed relationships accords with the explanatory mechanisms in adoption studies on the organizational level [47] and especially with enterprise system alignment studies [48, 49]. Indeed, a system can prescribe the mode, the content, and the temporal aspects of clinical work [19], and these prescriptions may not align with critical characteristics of a department's work context.

Our study focused on contextual differences between departments, and we expected differences in the socio-political context, existing or arising during the organizational change process [e.g. 50, 51], to operate at the department level. We, therefore, looked at these characteristics separately, and in

combination with work context characteristics, for alternative explanations for departmental adoption intentions and subsequent EHR uptake, but failed to identify any. For example, in socio-political terms, Departments C and H both saw themselves as having no or little influence although they were actively supportive of the change process, yet both their intended and realized adoption differed. Departments C and G showed that such subunits can actively support an organizational implementation process without having a high adoption intention. Our reading of the socio-political context and process data is thus complementary to, rather than competing with, the developed propositions. For example, we saw how a clinician acting as a local project champion (a change process characteristic) can strengthen a department's adoption intention and how frustrations about a lack of communication (another change process characteristic) reinforced reservations about the system.

We argue that contextual characteristics are a reality that has to be dealt with. That is, although socio-political and organizational change process factors may influence how contextual characteristics are dealt with, and the weight they are given, the former are unlikely to change the direction of the contextual influences. It follows that these should be analyzed separately, and therefore that any quantitative follow-up research aimed at testing the proposed model should control for socio-political and change process factors.

Another avenue for future research would be to study the extent to which the constellation of department types within an organization influences successful adoption at the organization level. To the extent that department management has a formal say in the local adoption decision, and that a 'big bang' is not imposed, the order in which clinical departments adopt an EHR over time is also relevant. Rogers [52] showed that early adopters pave the way for subsequent adoption by other actors. It is therefore relevant to examine if there are any sequential effects on departments where contextual rather than psychosocial factors underlie their adoption intentions. Another question is whether and how the constellation of department types is related to the hospital's implementation strategy. For example, are exceptions inevitable when a 'big-bang' transition has been selected? This indeed proved to be the case in the hospital we studied. It follows that a related question concerns the ways in which hospitals should address the different intentions of the department types, especially those that are department oriented (II) and external environment oriented (III), in their overall implementation strategy. Should they make exceptions, do they force compliance, do they facilitate modifications, and at what cost?

A final direction for future research relates to the question of how departments respond when an imposed hospital-wide system does not seem to fit with the departments' work context. This study indicates that departments can: (1) be coerced to use, which may result in resisting users [39]; (2) negotiate customized extras; or (3) instigate various types of workarounds [26]. Related research may provide implementers with fresh insights into how to deal with various types of department level support or resistance.

Limitations

We argue that, within the time horizon of a project, the characteristics of the work context are more stable and accessible than those of the socio-political context and, for this reason, are a relevant focus for implementers. Nevertheless, one might still ask how permanent work context characteristics are across the adoption stages in long-term projects. It has even been shown that the implementation process can affect a department's characteristics [53], which may need to change because deploying an organization-wide system does not in itself create integrated and seamless processes [48]. Moreover, different contextual characteristics might be relevant in different stages of departmental adoption, as has been shown to be the case at the individual level [54].

Due to our focus on the clinical department level, we acknowledge that we may have overlooked factors on the hospital and individual levels that might co-determine departmental adoption intention. However, direct influences from these other levels did not come to the fore during this study's interviews and meetings. For example, the generally shared feeling in the hospital that the organization-wide implementation should not fail, did not necessarily mean that department board members and leading user representatives were optimistic about the uptake by their own department. While it was recognized in our interviews and plenary meetings that physicians would have to invest more time in digital administration and that some older physicians and nurses were really hesitant about the switch, such individual readiness or acceptance issues were not cited as decisive in determining the departmental adoption intention. We therefore think that our study complements existing literature on individual- and organization-level EHR adoption by investigating, within the boundaries of clinical departments, the implementation of hospital-wide EHRs. Further research is required on the proposed model to evaluate the generalizability to other, for example politically less critical, EHR adoption contexts and stages.

Implications for practitioners

Our findings can help implementers to understand and, based on a diagnosis of their work contexts, predict the a-priori adoption intentions of clinical departments towards a new EHR. Such a diagnosis could be used to inform department-tailored communication and adaptation strategies. For example, implementers could try to identify and form a coalition of hospital-oriented departments (Type I) that could then be deployed either as first movers in an incremental implementation strategy, or as pilots to demonstrate and learn about the effectiveness of integrated information systems in a big-bang implementation [24, 55]. Given that our findings show how the intended adoption can be legitimately constrained by certain work contexts, and that implementation will then be inherently more complex, implementers might want to pay particular attention to the concerns expressed by department

oriented and external environment oriented clinical departments (Types II and III). Tailor-made solutions may have to be negotiated, or purposeful workarounds collaboratively designed in a way that the system is accepted and not misused.

Greenhalgh et al.'s [10] meta-review of EHR studies concluded that many of them raise questions about the scalability and the transferability of such systems, especially of commercially developed ones. Given that our paper addresses adoption of a commercial EHR in a hospital context, our study can feed into the practitioners' debate on trade-offs: when can clinical departments be asked to adopt an organization-wide EHR, and when might such a demand be problematic or even 'unreasonable' from the outset?

Conclusions

Our research question was whether, and how, contextual characteristics contribute to a department's intention to adopt an EHR. The 'how' question is answered in the form of propositions and a developed model. The typology that emerged led to propositions that can be tested and refined in future research. This offers an initial step towards a departmental level theory of EHR adoption. Most IT adoption studies address either the individual level [43, 56] or the organization level [52, 57, 58]. This is also true for studies that focus on EHRs [e.g. 59]. While these studies explain why individuals or healthcare organizations adopt EHRs, they overlook the reality that other adoption mechanisms are in play on the clinical department level that may override individual-level factors in the adoption of an organization-wide system. Here, we add preliminary evidence to the EHR adoption literature that the department-level warrants inclusion in adoption studies. Our study indicates how characteristics of the work context of clinical departments can hinder or stimulate the adoption of hospital-wide information systems.

Declarations

Additional files

Additional file 1: Data Structure.

Additional file 2: Codebook.

Additional file 3: Case descriptions. In addition to the three cases described in the main text (departments A, C and G), this file includes descriptions of the remaining departments in the sample: organization-oriented ones (Type I; D, F and H), department-oriented ones (Type II; E), and another external-environment oriented department (Type III; B).

Abbreviation

EHR: Electronic Health Record

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Authors' contributions

MO, AB and JV jointly developed the study design and its underlying conceptual framing. They equally contributed to the data gathering and analysis. The three authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

As this study did not involve research on patients or human subjects, no Medical Ethical Committee approval was required under Dutch law. Neither the Dutch Medical Research Involving human subjects Act (WMO), Wet Medisch-Wetenschappelijk onderzoek met mensen, nor the University required ethics approval for the type of work conducted in this research. This study is based on interviews, observations, closed meetings of hospital working groups and documentary research. All participants were staff members of the hospital who voluntarily orally agreed to participate in this study. They allowed us and to use the data they provided, including the use of quotes, under the condition of confidentiality.

Consent for publication

The management of the hospital granted access to interviewees, committee meetings and documents, and consented publication under the condition of confidentiality of the hospital, the departments involved and the individual interviewees. Those who attended meetings were informed about the research and consented presence during meetings. All interviewees participated on a voluntary basis and were granted confidentiality. Further, in feedback sessions to the project and to single departments, our reported data and interpretations were checked by interviewees and project managers. We obtained oral permission from interviewees and from the organization's management to use the data, including quotations from the interviews, for scientific publication purposes.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 2. Overview of departments’ context characteristics, pre-implementation intended and post-implementation realized adoption

Work context						Socio-political context			Pre-	Post-
	<i>Material technical capabilities</i>	<i>Human technical capabilities</i>	<i>Task-technology fit</i>	<i>Intra-organizational dependencies (within hospital)</i>	<i>Extra-org. dependencies (outside hospital)</i>	<i>Trust in organization-wide implementation</i>	<i>Involvement in implementation.</i>	<i>Perceived dep. influence</i>	<i>Intended Adoption (Type)</i>	<i>Realized Adoption</i>
A	Not voiced as a major issue.	Instrumental attitude towards IT, no IT staff.	Current administration inefficient / unreliable; misfit - diversity of current systems; misfit with new EHR.	High: hospital-wide dependencies because of multi-disciplinary care.	Moderate, but this is not a key focus.	Wait-and-see; attention elsewhere	Passive	No influence	Compliant acceptance (Type I)	Yes, compliance without customized extras. Happy with the progress in digitalization.
B	A few interfaces with existing less-advanced technologies.	Limited, no IT staff.	Current administration inefficient / unreliable.	Moderate: multi-disciplinary care, collaborates with a few other departments.	High: through requirements on data reporting and role in region's patient care.	Wait-and-see	Passive	No influence	Conditional acceptance (Type III)	Yes, with customized extras, one system not integrated at Plateau 1; workarounds by individual physicians emerge.
C	Will require many interfaces with their advanced digital equipment.	Local IT expert, IT-minded department.	Vulnerable, detailed work design; misfit with new system.	Low: mono-disciplinary care, independent work processes.	Low.	Worried	Proactive	No influence	Conditional acceptance to non-adoption (Type II)	Yes, but problematic by constraining the workflow design; collective departmental workaround; customized module will be added later.
D	Some interfaces with less advanced technologies.	Vision for the use of IT for specialty; expertise available.	Current administration inefficient / unreliable; interest in uniformity; misfit with current systems.	Moderate: multi-disciplinary care, collaboration with other departments.	Moderate: through requirements on data reporting.	Optimistic	Proactive, has a champion	Feel heard	Enthusiastic acceptance (Type I)	Yes, compliance without customized extras, although not as satisfied as expected (neutral) with Plateau 1.
E	Many interfaces with complex technologies required.	Some local expertise on IT use; own IT vision and IS under development.	Current administration inefficient / unreliable; interest in uniformity.	Moderate: because of patient referrals to and from other departments.	Low: because it constitutes a transitional stage in care.	Not voiced; attention directed elsewhere	Re-active	Feel heard	Limited acceptance (Type II)	Yes, late compliance without customized extras, but one member is trained to "go deep into" the EHR to generate customized patient data analyses, partly making up for the lost functionalities (neutral).
F	A few stand-alone systems; expecting a	Vision on the use of IT for specialty.	Current administration inefficient /	Moderate: data exchange with various	Moderate: department has central	Some concerns; especially with regard to	Re-active	Little influence	Compliant acceptance (Type I)	Yes, with customized module.

	better fit in terms of better-connected systems.		unreliable; interest in uniformity; misfit with current systems.	other departments.	position in regional healthcare.	damage control during implementation				Internal employees satisfied.
G	'Band-aid' applications with few functionalities. Expects a better fit in the sense of more integrated functionalities.	Vision on the use of IT for specialty; a clinician with IT knowledge.	Current administration inefficient / unreliable.	Low: mono-disciplinary care; independent work processes.	High: through requirements on data reporting.	High expectations	Proactive, high drive for participation	Feel heard	Disappointed non-adoption (Type III)	No, not adopted. Future developments unclear.
H	Work is in steps becoming increasingly paperless, the EHR is the next (big) step.	Limited, no IT staff.	Current administration inefficient / unreliable.	Moderate: intensive collaboration with a few related specialties.	Low.	Single system is desirable. Trust that it will come. But it will take a long time and no longer "utopic" expectations.	Proactive, gathering information for internal preparations, but priority lies with patient care	Very little influence that they did, however, use	Compliance: it is no issue; it will come. (Type I)	Yes, compliance without extra customization although not as satisfied as expected (neutral) with Plateau 1.

Table 3. Contextual characteristics voiced to explain departmental adoption intention during pre-implementation

<i>Context characteristics*</i>	<i>Reasons for departmental adoption intention voiced by interviewees:</i>	<i>Direction (+; -; +/-) and dominance (bold) of influence on departmental adoption intention:</i>
Work context		
Material technical capabilities	Local advanced, complex technologies requiring interfaces or integration.	B ⁺ G ⁺ C ⁻ E ⁻
Human technical capabilities	Local IS expertise and vision aligned with EHR.	D ⁺ F ⁺ G ⁺
	Local IS expertise and IS vision for the future, not aligned with EHR.	
	Limited local IS expertise	C ⁻ E ⁻
		A ⁺ +/-, B ⁺ +/-, H ⁺ +/-
Task-technology fit	Current patient administration inefficient/unreliable/fragmented.	A ⁺ B ⁺ D ⁺ E ⁺ F ⁺ G ⁺ H ⁺
	Current IS fails to sufficiently support the work processes.	A ⁺ B ⁺ D ⁺ F ⁺ G ⁺
	Work processes will benefit from EHR through greater uniformity.	D ⁺ E ⁺ F ⁺
	Current customized workflow is a well-balanced design, vulnerable to changes.	C ⁻
	Expect the EHR to not match own workflows or work methods.	A ⁻ C ⁻
Intra-organizational dependencies	Yes, involved in multidisciplinary patient care streams.	A ⁺ B ⁺ D ⁺ H ⁺
	Yes, treating patients of other departments.	A ⁺ E ⁺ F ⁺
	No, pre-dominantly monodisciplinary care, independent workflows, EHR use less relevant.	C ⁻ G ⁻
Extra-organizational dependencies	Yes, in the supply chain or cooperation in professional networks.	D ⁺ F ⁺ B ⁺ / -
	Yes, through laws and regulations.	D ⁺ B ⁻ G ⁻
Socio-political context		
Trust in organization-wide implementation, informed by past change history, current change leaders, or other hospitals' achievements	Optimistic, high expectations	D ⁺ G ⁺ H ⁺ / -
	Wait-and-see; neutral, attention elsewhere	A ⁺ / - B ⁺ / - E ⁺ / -
	Some worries or even low trust	C ⁻ F ⁻
	Proactive	C ⁺ D ⁺ G ⁺ H ⁺
Department supportive involvement in implementation	Somewhat active	E ⁺ / - F ⁺ / -
	Passive	A ⁻ B ⁻
Perceived departmental influence on implementation, inferred from size or own status.	Feel heard	D ⁺ E ⁺ G ⁺
	Afraid of having little influence	A ⁻ B ⁻ C ⁻ F ⁻ H ⁻
*The findings do not indicate a direct relationship between a department's socio-political contextual characteristics and its adoption intention, or with its realized adoption a year after implementation.		

Table 4. Department types based on identified patterns in their work and socio-political context

Grouping based on patterns	Adoption intention (pre- implementation)	Dominant context characteristics voiced	Additional influences on departmental adoption intention		
			Strengthening adoption intention	Weakening adoption intention	Resulting Department type
A, D, F, H.	High to moderate.	<i>Intra-organizational workflow dependencies</i> are critical.	Current systems are inefficient or inadequate (A, D, F, H). Strong implementation support (D). Proactive involvement (D, H).	Passive involvement (A). Some concerns about organization-wide implementation success (F).	I Organization orientation
C, E.	Intended use highly selective (E) or conditional (C).	Independent or sequential dependencies in workflows (<i>task-technology fit</i>). Many interfaces with advanced local technologies (<i>material technical capabilities</i>).	Proactive involvement (C).	Local technologies (under development in E) fit department's IS vision (C, E).	II Department orientation
B, G.	Low (to not use or only in a highly selective way).	<i>Extra-organizational dependencies</i> are critical, such as legal or insurance requirements or work interdependencies on alliance, regional or (inter)national levels.	Current systems are inefficient or inadequate (B, G). Proactive involvement and strong implementation support (G).	Passive involvement (B).	III External environment orientation

Figures

Figure 1. Model of work context influences on a department's adoption of a hospital-wide EHR

Figure 1

Model of work context influences on a department's adoption of a hospital-wide EHR

Supplementary Files

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