2015

Understanding Knowledge Sharing in Health Care System

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UNDERSTANDING KNOWLEDGE SHARING IN HEALTH CARE SYSTEM

Complete Research

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Abstract

To date, healthcare organizations need well-established knowledge to support care quality. Managers invest in motivating medical staff and associated healthcare stakeholders to share their respective knowledge. Additionally, they invest in advanced technology to facilitate sharing process. However, these efforts essentially raise classification and privacy concerns. Technology configuration that does not meet management process requirements may lead to managerial difficulties. In fact, information classification in healthcare systems should respect privacy, yet still be accessible. Using qualitative research, our paper proposes a novel ontological model that extends the Systematized Nomenclature of Medicine Clinical Terms (SNOMED CT) with privacy dimension to enhance access to sensitive patient's data.

Keywords: Knowledge Sharing, Classification, Health Care, Ontology.

1   Introduction

Knowledge sharing plays a determining role in improving organizational performance. Indeed, generating knowledge, and sharing it, provides information that supports care quality and decision-making. It can also engender new ideas, which create business value. Organizations increasingly invest in knowledge sharing systems to capture, circulate, and reuse information resources effectively and efficiently (Nonaka and Takeuchi, 1995; Davenport and Prusak, 1998; Teigland, 2003). This process is very important in the healthcare sector where exchanges of information and knowledge are critical to patient management.

In the health sector, there are wide ranges of data relative to patients, diseases, treatments, analysis results, etc. These data, which occurs quickly in massive quantities, represent a big data. This term describes "large volumes of high velocity, complex and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information." (Gandomi and Haider, 2015, p.138).

Big data in healthcare can play a crucial role with epidemics' prediction, curing diseases, health monitoring, Pharmacovigilance, personalized medicine, and an overall improved quality of life. However, it also poses threats to a patient's privacy, and raises many new privacy concerns. This creates a challenge to make a balance between knowledge and information sharing, allowing for value creation and protection of patient data.

Even though knowledge sharing's impact on decision making and improvement to healthcare services has been discussed in previous research, there are some controversial factors that reduce tendencies to share within healthcare systems. Attitude, culture, privacy concerns, and technologies have all been identified as barriers to the knowledge sharing process (Choi et al., 2008; Witherspoon et al., 2013).

To protect healthcare information and facilitate knowledge sharing processes in this sector, it is critical to define convenient classification principles. However, in France, medical data and information do not have different classifications; they are all confidential and protected by medical secrecy. The Touraine Act (Article 47 of the Health Bill) would enable researchers, associations, and private companies access to billions of types of medical data. Although, classification rules create distinct classes of information based on their levels of sensitivity, as well providing access to qualified information demand a strategic value.

This paper's goal is to provide a data classification framework that enables knowledge sharing within healthcare systems. Our research question is the following: How can we improve data sharing in the healthcare field within big data context?

This paper is organized as follows. We begin by presenting the various present researches about information and knowledge sharing, and then we move on to the current status of big data and the current context of the healthcare sector. Afterwards, we describe the research methodology used to answer our question followed by the presentation of the results. Then we discuss the main findings and propose a structural ontology. We conclude by underlining the limits of our research.

2   Background

Knowledge sharing (KS) is defined as "*the act of making knowledge available to others within the organization. Knowledge sharing between individuals is the process by which knowledge held by an individual is converted into a form that can be understood, absorbed, and used by other individuals*" (Ipe, 2003, p. 341). It is an exchanging process of implicit and explicit knowledge allowing the development of new ideas and subsequently the improvement of decision-making and organizational performance (Nonaka and Takeuchi, 1995; Cummings, 2004).

Knowledge is essentially related to human action (Nonaka and Takeuchi, 1995). Furthermore, it can be distinguished between the tacit and the explicit dimension of knowledge, which presents a way of

articulating knowledge (Baumard, 1999). Recognition of the differences between tactic and explicit knowledge is essential when considering the transferability and knowledge sharing (Boughzala, 2007). The passage of an explicit knowledge into a tacit knowledge is translated by information sharing.

Various factors affect decisions about knowledge sharing among employees and other organizational participants; however, previous research divides these factors into two categories:

- Most previous studies emphasize the role of attitude and behaviors on knowledge sharing because they depend heavily on human choices and tendencies. They have described knowledge sharability, knowledge sharing, and how they correlate within an intra organizational setting (Bock et al., 2005, Wang and Noe, 2010, Chennamaneni et al., 2012, Boughzala and Briggs, 2012). Individual perceptions of knowledge shareability (Cabrera and Cabrera, 2005) have been shown to correlate with a number of factors such as intrinsic and extrinsic motivation (Osterloh and Frey, 2000); awareness of conflicts of interest or vulnerability (Argote et al., 2003); physical capability to share, and certain personality traits including: self-interest and investment and a personal disposition to sharing knowledge (Matzler et al., 2011).

- The ability of information technology to facilitate knowledge sharing processes from storing to generating knowledge is critical as well. Technology empowers the individual, and significantly impresses upon them the attitude of knowledge sharing (Hinds et al., 2003). Cabrera and Cabrera (2005) stress well-designed technologies and user-friendly applications as important factors that simplify tasks, reduce completion time, and the perceptions of cost. Jarvenpaa and Staples (1999) discuss that "*ergonomic technologies influence people's tendencies to engage in knowledge sharing within an electronic information exchange*". Sophisticated tools like groupware, backup databases, communicating networks, knowledge management systems, workflow technology, and more-recently social network-based systems, support the knowledge exchange process (Ruggles, 1998; Kankanhalli et al., 2005; Hung et al., 2013). Although information technology has a considerable impact on developing of knowledge sharing, in many instances presenting new technology has failed because of inadequate attention to existing organizational cultures, insufficient adoption and untrained personnel (Cabrera and Cabrera, 2005).

Organizations face up to massive data flow, which contains potential value. The sharing of these data coming from various sources creates the big data, often characterized by five Vs: volume, variety, velocity, veracity and value. Fosso Wamba et al. (2015, p. 2) defines big data as "*a holistic approach to manage, process and analyze 5 Vs in order to create actionable insights for sustained value delivery, measuring performance and establishing competitive advantages.*" Wang et al. (2015) study the impact of big data on enhancing healthcare services. They find that big data technology in healthcare should contain these attributes: traceability of data, analyzing unstructured data, and qualified analysis for patterns of treatment that support decision-making.

The organizations, which accumulate big data, are going to have to display solutions to manage, analyze and interpret these huge volumes of data but also make sure that these data are preserved in complete safety. Indeed, the privacy issues of medical data worry the patients. The patients do not want that their data to be shared (Perera et al., 2011). However, the sharing of these data is useful. For example, Davis et al. (2014) showed the benefits of sharing psychological electronic records for the care of cancer. The question that arises in this context is "what type of data to share and with whom" (Borgman, 2015). Concerns about privacy are divided into: the type of information stored (e.g., medical, biometric, financial, behavioral, and biographical) and sector would use the shared information (Smith et al., 2011). Other researches have insisted on the weakness of used technology in health sector to handle the issues of privacy (Cabrera et al., 2005; Witherspoon et al., 2013).

Legally, there is no typology permitting for the operation and classification of medical data. However, in the absence of a clear legal list and in the absence of typology of the data, the above, evoked definitions, are only extrapolations. Thus there is a need for text that is susceptible to developing a clear definition that outlines each type of data. By doing this, it would be easier for each party to know the

nature and the significance of the information they have. It could particularly be utilized to create a distinction between the various data at the medical level. This would also permit the application of a different system of access. Certain information, considered more sensitive than others, would not automatically be communicated to certain members of the medical team.

This typology would be conducted more and would then provide a balance between sharable information and privacy issues. The persistence and quality of care would be assured without spoiling the rights of a patient, and continuing to respect their private lives. Ultimately, this would retain the privacy of the information in medical materials.

3 Methodology

According to our literature review, we notice that the concept knowledge sharing and privacy were rarely studied jointly and especially in the healthcare sector. Given that few studies have handled these two themes in a explicit way, a qualitative exploratory research turns out to be useful in this context in order to discover the characteristics and the articulation between these concepts.

For this purpose, we adopted an exploratory approach. It is an inductive approach that consists of exploring a phenomenon by rejecting all the previous knowledge (Thietart et al., 2014). In this work, our purpose is to build a structural ontology.

We led non-directive, face-to-face interviews with physicians working in different hospitals. The guide of interview consists of 3 themes: (1) Knowledge sharing and value, (2) Problems relative to medical information sharing, and (3) Privacy - Classification. It was tested and refined with a physician, a department head of resuscitation and intensive care, who participated in several projects involving the implementation of the Computerized Patient Record.

The appeal of a non-directive interview, answers two essential objectives of the qualitative inquiries: depth and objectivity (Frisch, 1999). This mode of data collection is useful when the object of research is less defined or poorly structured, which is our case (Thietart et al., 2014).

The data analysis was performed by using the qualitative content analysis method (Berelson, 1952) supported by NVivo 10 computer software.

Our sample consists of 4 physicians who were requested to participate in our study from our personal networks. These physicians practice in 4 different hospitals in France. Their experience varies between 20 and 30 years. Their profiles vary from general practitioner, anesthetist - resuscitator, specialist in vascular medicine, and internal medicine. These physicians have participated in implementing of medical record in many hospitals in France.

After the transcription of fourth interviews, we made a content analysis supported by Nvivo, which gave rise to 372 passages of text. These passages were listed according to our four themes.

The coding was separately made by three authors by using the Nvivo software. The purpose was to compare and discuss the results obtained by each until they obtained a consensus. The results were then validated by the senior researcher and translated into English by two native English speakers.

4 Results

This section presents an analysis of the transcriptions in the light of themes.

4.1 Knowledge sharing and value

According to the interviewed physicians, sharing data, information, and medical knowledge in a hospital setting is critical. This sharing of information allows for improvement in the precision of a diagnosis, and care quality.

The first interviewed physician stated the criticality of sharing the medical history of a patient in order to determine whether or not to resuscitate them; "*Let us imagine that I have a patient who is a hemo-*

philiac and that I have no information and that we operate on him without knowing this. It is crucial that this information is disclosed; otherwise the results could be disastrous. The sharing of information is compulsory. We cannot take the necessary decisions if we do not share medical information and knowledge".

The second physician has a similar opinion; *"Yes, we can say it all the same that sharing improves the activity of care".*

The third physician asserted that there is a relation of reciprocity between sharing and quality*; "sharing and improvement are mutually important. One does not go without the other. Naturally, if we want to improve the quality of the care, it is necessary to share".*

For the fourth physician, it is important to permanently share the information and knowledge among a team in order to improve collaboration. The objective of a large amount of information sharing is to improve the quality of the care. *"It is tightly in line with the aim of improving the quality of treatment, the quality of an action, which conveys for me the necessity of having the maximum amount of information, in order to make experienced decisions".*

4.2   Problems relative to medical information sharing

In this part, we present the problems relative to the information sharing at the levels of technology and sharing context.

4.2.1   Technology

Four interviewed physicians explained the obstacles that can surround sharing between medical staff. They expressed the problems bound to a computerized patient file. This tool, in theory, is considered to favor information sharing within hospital organizations. However, according to these physicians, the ignorance and unwillingness to cooperate interrupts the implementation of sharing technology and the incentives to integrate within a collaborative work.

For the first physician, the problem is that the hospital executives bring a very general tool and it does not meet the expectations of professionals; *"it is a big problem because often management provides a very general IT tool but after personalization problems appear for us. And if we do not personalize it, we do not use it properly".* He noted that the information technology program is not successful or optimal enough.

The second one emphasized the same problems with the computerized patient record; *"this computerization of the patient record raises problems rather than solving the previous difficulties."*

For the third physician, following the dematerialization of medical records, he noticed that the practices of the physician staff were standardized and consequently the contents of the patient file were reduced. These files were replaced with simple, basic documents that often limit detail. The computerized patient file, according to him, is not made to make the necessary reflections about a disease or the quality of the treatment of a patient; *"It is true that information is a sort of mechanical data of the individual at the first moment, which makes the patient a summarized concept of biomedical dimensions. Then we share this information by use of computerized patient record. To sum it up, all of the mechanisms simply provide biomedical dimensions".*

The fourth physician noticed that the medical staff is not trained to use the computerized patient file. Thus, they resist this use and this type of sharing. In addition, there are certain medical procedures, which cannot use the software and IT applications; they were not intended to be used for certain medical acts. Some information stays on a paper file and thus the medical data is divided between paper and computerized files. *"The software won't be used as it's not always the most practical. Certain data is missing as we do not manage to include it in the system ... Thus the tool is not adapted enough and the staff is not trained."* He suggests making the software more useful for medical activities by integrating data and statistical studies which can improve the physician's knowledge.

4.2.2   Sharing context

The hospital organization is characterized by very complex activities and is subjected to strong pressures to integrate technological innovations. The interviewed physicians cited some characteristics of this organization, which can occasionally limit sharing, and asked them about the notion of security.

The first physician explained why some medical staffs do not use the computerized patient file and thus do not receive more pertinent and related information. He expressed that this is useful for care giving, "*In the hospital, there are a lot of medical staff who pass-through and sometimes just for temporary missions. So they do not have time to learn how to use software.*" In regards to the security of the data and the information, in theory, the IT organization in terms, depends on every critical structure to put barriers and protect the medical data. However, in practice, it is not easy to set up a system, which allows us to ensure the control of the data; "*actually at the moment it is not very easy to put up protection barriers for data security. How to implement them? According to the profile of each one? That can be made, completely. Because it almost impossible to control medical staff participants, who comes a long time or for a temporary moment, and setting privacy rules is complicated*".

The second physician explained that, in hospitals, security systems are not standardized. Theoretically, the information is not accessible to everyone, but in practice, it is completely the opposite; "*Even when you have security systems with access controls, generally the passwords are hung on the wall, like everywhere. If you want the hospital is the place of '3*8' (shifting work time), there is always a team which comes after the previous one, it is a place where there are temporary employees, it is a place in which the physicians and the interns change all of the time.*"

The third physician works in two organizations, a private clinic and a hospital. At the hospital, he had no training on the use of medical software and he is a just a practitioner for consultations; "*I can't find time to learn the technology or other irrelevant points. Because it seems very complicated to me, and so I continue to use paper.*" He also indicated the problem associated with the security of data in the hospital; "*as the files are computerized, then all the reports would be in computer programs. A physician in another department always has the leisure to read the diverse and varied reports on a patient even if that does not concern him*".

The fourth physician indicated that the communication of medical data can sometimes, damage the private life of some patients, especially if this data is shared with insurances or banks. In regards to the communication of confidential data, the physician sometimes tries to hide the identity of the patient: "*When the patient does not want me to communicate their information, it isn't a fault that I talk with my colleagues without giving their name, it is true that it remains anonymous but it is a partial anonymity…*"

4.3   Privacy - Classification

In regards to the security of confidential data, the four physicians gave very contradictory answers; however, at the same time they consider that medical information is quite confidential. Much like the law has considered it for a long time, and they believe that they have to respect the patient will to avoid their information being broadcasted. However, at the same time, for them, to assure the quality of care, all the information must be shareable between the medical staff. Sometimes for certain legal reasons, information is not marked on the file but rather shared verbally.

According to the first physician, certain data must not be shared or distributed within the organization. He noticed that the IT tool does not propose solutions to protect and classify this type of data; "*when we want to keep information a secret, sometimes we use numbers instead of the names of the patients…This type of information is called confidential. This should be defined as distinct information, but with whom can we share it? Which information is shareable? This would be fine if the technology could state it.*"

He explained also the complexity of sharing sensitive data; "*I remember when I was in 'La Reunion', people were affected by HIV and accessing their file was impossible. This point made a complicated*

situation. For these types of patients, stricter accessibility rules have to be defined for other physicians, moreover, which physicians can access the file should be based off of the patient's agreement. Therefore, more recently we share sensitive information verbally. Because, at the moment this is still not computerized very well."

For the second physician, the decision about classification of medical data returns to the patient, the patient is the owner of his data and only he can define how his data can be shared between the medical staff. *"It is not me, as his physician, it is the patient. Me, I don't care, it is the patient who must choose what is available to the general public and what is not."*

The third physician defined the information, which is not shareable and the people who can share them: *"So, there are confidential things which cannot be shared by everybody. This information relates to personal patient life, for instance, mental elements…because we ask a patient about choosing which information is confidential and which is private. Sometimes we are involved in a huge flood of information, and don't know how much of it should be shared."* In regards to the confidential data of the patient, he does not note them on the computerized file and if necessary he shares it verbally with his colleagues. According to him' *"The professionals share their knowledge. However, there are questions about which knowledge and information should be shared and in which way it should be done?"*

The fourth physician explained that medical staffs may have access to very private and highly confidential information, and should respect professional secrecy. Additionally, he mentioned that some patients may require certain private or confidential information to be omitted from a file. He begins, *"I don't want to note the name of disease at all, because it is so private. And then it can be a demand. Some patients ask me not to note it on their file. This can be, I'll give you some examples, a voluntary interruption of a pregnancy, or this can be sexual assault. Of course it is medical issue, however, it is a personal concern and we can't share it"*. He noted that the patient file sometimes contains information that is not useful or relevant to ensuring the consistency of care, and it is marked by his colleagues.

5   Discussion

The literature review shows the role of knowledge sharing in the improvement of care quality and value creation. Interviewed physicians stressed the problems associated with adapting to a new technology for knowledge sharing, which slows the process down or in some cases, is totally ignored by the medical staff. The lack of skills and knowledge to operate a technology create a dilemma. The medical staff was not trained to use information technologies. Interviewed physicians noticed that the computerized patient file is not adequate to the characteristics of their activities. They underlined that the technology is only a storage place; the studies statistics, the reporting or other elements to improve upon the reflection, are not integrated into this technology.

The other difficulty involving the use of technology is about the massive amount of data recorded which is generally unrelated, confusing, and medical staff have a problem finding meaningful knowledge from computerized records. The participants, in our research, emphasized that without the personalization of shared information in databases, it is not possible to take advantage of recorded files and it just wastes the physicians' time. Expanding on this, finding useful knowledge is another dilemma. The physicians stated that although electronic records shared with them can provide access to various information, without converting it to qualified knowledge and intelligence, technologies do not improve treatment services. In this case, technology causes a reduction in the knowledge sharing attitude.

The security issue is the one of the main concerns that was discussed by participants. Patients have various concerns about their personal data and are sometimes reluctant to share their information. Theoretically, the information is not accessible to everyone, but in practice, it is the complete opposite. Access to these files requires a password, and frequently these passwords are hung on the wall and everyone can access these databases. The professional secrecy principal is not able to cover all privacy

issues in the healthcare system, because in certain cases there is no distinct rule to describe which information is shareable and which is not.

Participators substantially discussed determining which information is shareable. They state that the knowledge and information sharing improve decision-making processes. However, security concerns represent a predicament in determining what should be shared and what should be private. The patients determine decisions about which data are shareable. Currently there are no principles to classify information as confidential, or sensitive, this causes physicians to block access and consequently blocks sharing too. Furthermore, information technology does not propose qualified solutions for considering both privacy issues and shareability processes.

Ontologies represent one technology that can contribute to this goal. Ontologies allow healthcare knowledge sharing through a semantic access to computerized patient record. e.g. by defining clinical terminologies for precise and sharable expressions in patient record entries. Another advantage of ontologies is that their hierarchical structure will result in better control over access and use of personalized medical information addressing privacy issues.

Data come into the big data engine from an increasingly wide variety of sources. The data can be confidential or publicly available; it can be personal data relating to individuals; or being the combination of various issues. The classification is the intermediate step between the big data platform and the business analytics. A combination of the classification principles with big data functions can respond to the patients' security and medical staff concerns at the same time.

To sum up this exploratory study, we propose a novel ontological structure for electronic patient record annotation.

6 Proposal of a structural ontology: OntClassHealth

As the use of computerized records increases, healthcare stakeholders should be expected to make the best possible use of their information.

Our research results reveal that the current structure of the computerized patient records does not allow effective and secure knowledge sharing. This record has been built to solve sharing issues and to improve collaborative work. Yet, we noticed that there is a gap between expectations regarding a computerized patient records and its current use.

Health care domain is gaining more focus in the field of Ontology and Semantic research (Yuwen et al., 2010; Prathima et al., 2011). Ontology provides unique representation of knowledge. It enables unambiguous recording of data in a knowledge base. Medical Ontologies such as Medical Language System (UMLS) (Brut et al., 2011) and SNOMED would improve the access to the electronic patient records privacy.

However, the privacy dimension is not covered in the existing medical ontologies. In this paper, we propose a novel ontological structure that extends the existing medical ontologies with computerized patient record structure with privacy dimension.

Computerized patient records could be accessed through a dual semantic annotation based on medical ontology for representing patient diseases and on computerized patient records structure for representing the information privacy level. The proposed privacy classification levels were defined based on our interviews. Figure 3 (Appendix), presents this ontology called "OntClassHealth". We have adopted a design-based methodology (Isaac, 2005), for building ontology concept hierarchies. Each item of the computerized patient record is annotated as "public", "private" or "confidential" based on the patient record structure (Figure 1) and SNOMED (Figure 2) domain concepts. An annotation example is presented in Figure 3.

7   Conclusion

This study approaches the role of the classification on the knowledge sharing in the healthcare sector. The finding of this qualitative research shows that the decision of classification must be shared with the patient to improve the information sharing. However, one of limitations of this study is that the size of the sample is small. The exploitation of collected data is difficult to act upon, and we cannot generalize our results. Notwithstanding the above, this study proposes ontology based electronic patient record annotation, as it relates to medical data. Experimental research focusing on our proposition would shed further light on its scientific utility.

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Appendix

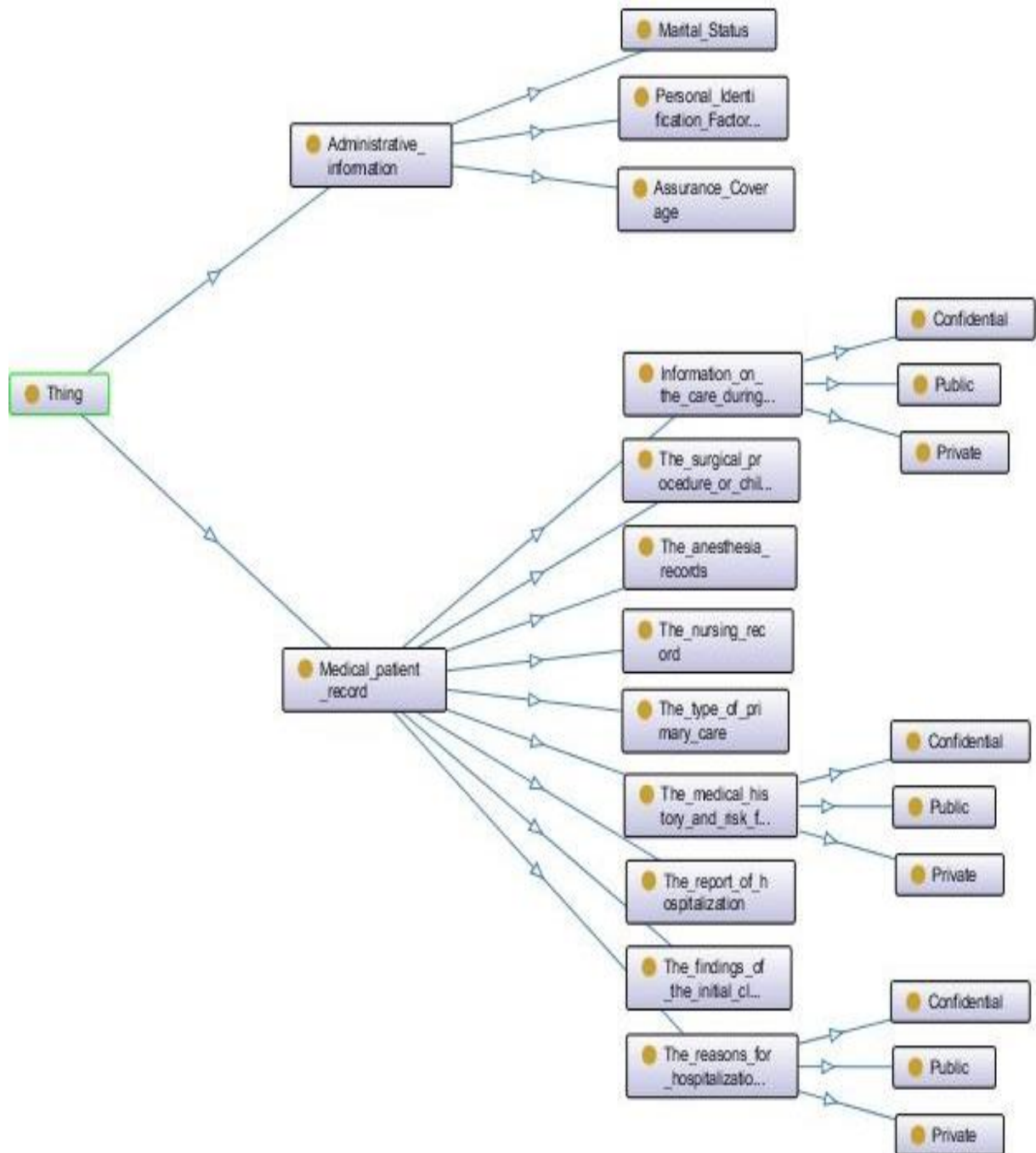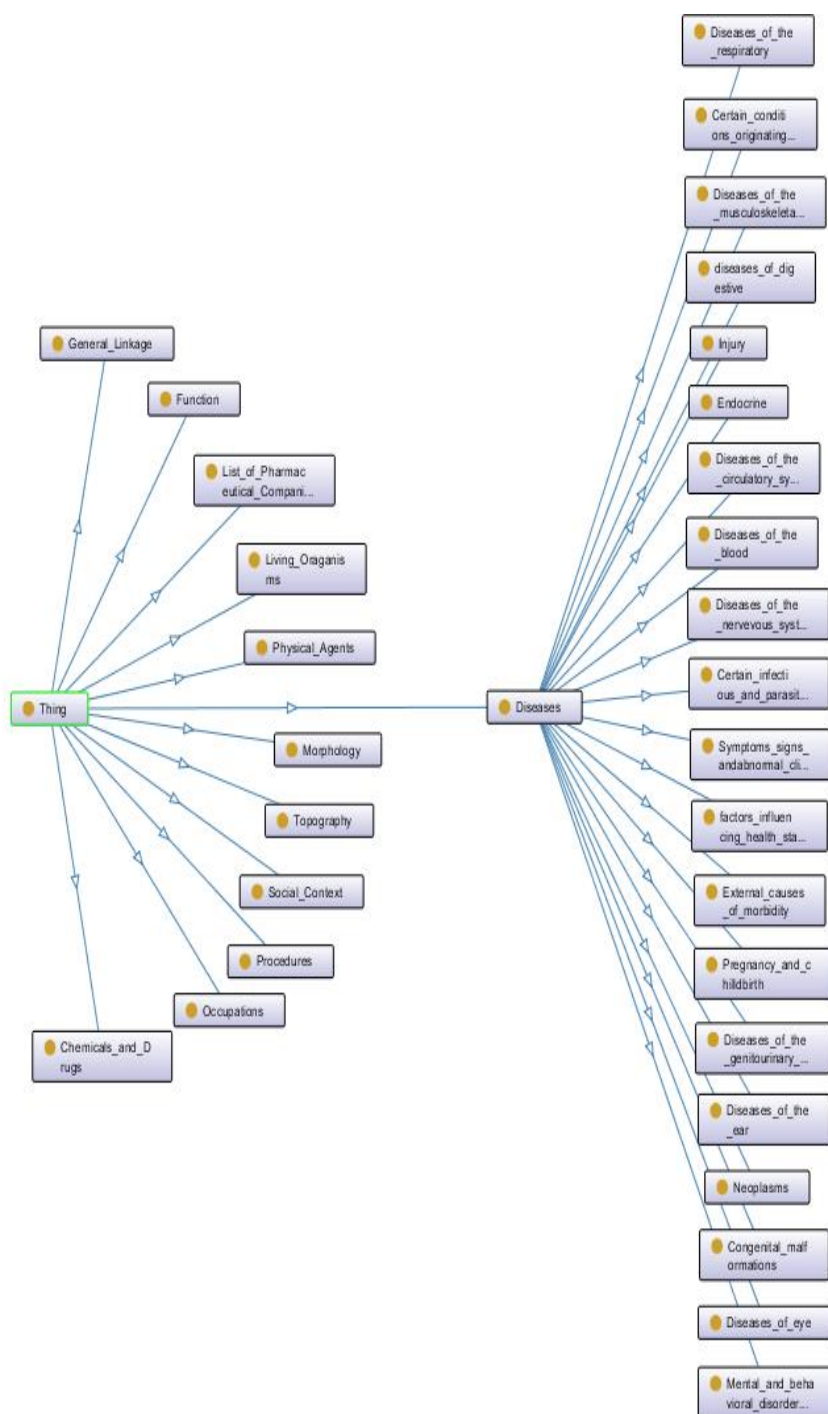*Figure 1.   Computerized patient records structure.*
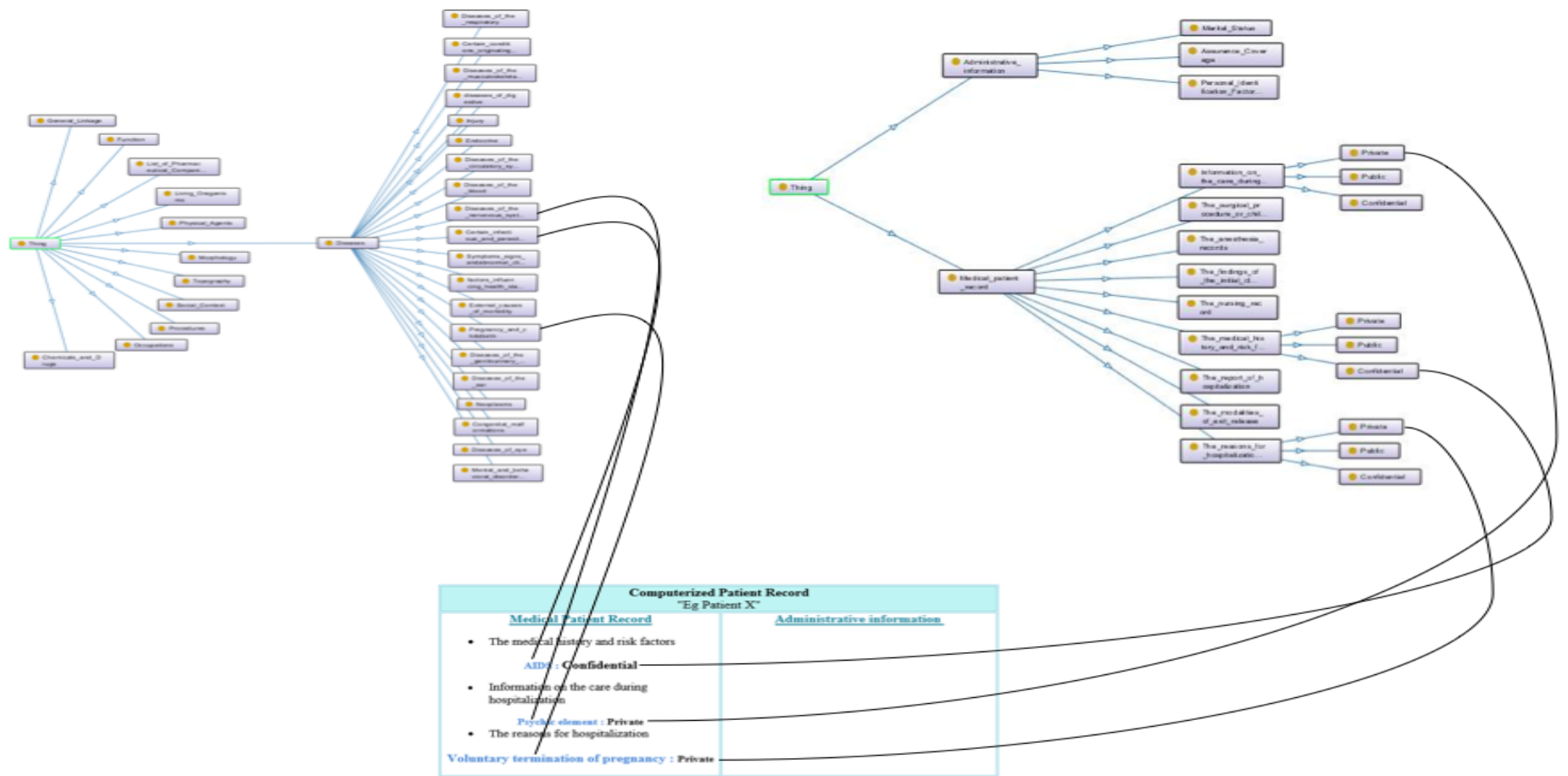
Figure 2.   SNOMED taxonomy.

Figure 3.   Ontology based electronic patient record annotation.