Chapter 2

Interaction with Clinical Decision Support Systems: The Challenge of Having a Steak with No Knife

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1. Introduction

Organizations invest in IT systems with the hope of cutting costs, increasing the quality of products or services [1]. But if users do not accept the systems, the organizations can not benefit significantly from the new systems. On the other hand, if users accept new IT systems they become more willing to make use of the new systems [2]. The usage of a newly introduced system can be a sign of the IT system success [3]. Therefore, finding the reasons that motivate people to use or understand the source of resistance to use new IT systems, is important to both system designers and developers [4].

The use of IT in health care practices has increased recently [5]. A variety of IT systems such as clinical information systems, personal digital assistants, electronic patient records and other applications have gradually become established in the healthcare industry. Clinical IT applications in healthcare are regarded as a key element in raising the quality of medical care. However, factors affecting the healthcare professionals' adoption behavior regarding IT systems are not completely clear yet [6,7,8]. The concern of having new clinical IT systems unused is still one of the biggest issues for the clinical IT developers [9,10].

With reference to a study done by Walter and Lopez [8] two types of IT are available in medical care environment. The first one is Electronic Medical Records (EMR) systems which are computer systems that allow users to create, store, and retrieve patient charts on a computer. The second one is Clinical Decision Support (CDS) system that is classified as a decision support system. A CDS System is regarded as an application of Decision Support System (DSS), which takes patient data as input and generates decision- specific advice [11,12]. These systems are referred to as knowledge-based systems that use patient data and series of reasoning techniques to generate diagnostic and treatment options and care

planning. Typically, clinical IT is designed to enhance decision-making in health care environment and in this study the emphasis is on CDS systems.

There is enough evidence to state that healthcare professionals are different from other IT users in terms of accepting technology and may respond differently to clinical IT [13,14]. Their different IT adoption behavior is attributed to their professional characteristics such as specialized training, professional autonomy and professional work context. Healthcare professionals are highly sensitive to changes in their work setting especially they are more concerned about the kind of changes that are perceived as a threat to their professional autonomy [15,16,17,18]. On the other hand, different features of CDS such as guidelines and instructions given by those systems can affect healthcare professional's IT acceptance.

It means that the healthcare professionals' CDS adoption may be affected by their perceived level of interactivity with the CDS system. Therefore, the feature and nature of instructions and guidelines given by IT to healthcare professionals in terms of problem-solving process may be considered as an element that invalidate their professional autonomy [19]. Thus, the antecedent of healthcare professionals' perceived threat to professional autonomy is the rules, instructions and diagnostic options provided by the CDS.

2. Theory of professionals

While a variety of definitions for the term professional have been suggested, this study uses the definition from sociology. According to the classic work of Larson [19], professionals are defined as "members of occupations with special power and prestige based on special competence in esoteric bodies of knowledge linked to central needs and values of the social system". With attention to the study conducted by Sharma [20], members of some professions have been called professionals, in light of their command of focal as well as demanding knowledge that they possess. This list includes the holders of five professions namely financial analysts, lawyers, university professors, accountants and finally physicians.

It should be mentioned that generally, the medical profession has been thought of as the model or symbol of professionals based on the nature of the knowledge owned by physicians compared to the others. According to Watts [21] in all public polls which were taken in the USA in the second half of 20th century, the public selected physicians as the most honored professionals.

3. Types of healthcare professionals

In this study, the focus is on IT adoption behavior of healthcare professionals. Based on a review a literature, different types of medical workers are considered as healthcare professionals. Generally, healthcare professionals or medical professionals are distinguished from others as professionals specialized in serving diagnosis and treatment to patients' medical issues and disease. This group encompasses all physicians such as general practitioners, internists, pediatrics, radiologists, geriatrics, gynecologists, pathologists,

surgeons, and other specialty doctors. For the entire mentioned group, the possibility of working with clinical information systems to deliver proper treatment and health care to patients is reasonable.

4. The unique characteristics of healthcare professionals

Professionals have some distinct and professional characteristics whereby they are viewed different from other non-professionals. Due to the scope of this study, the special characteristics of healthcare professionals are put at the center of attention. Healthcare professionals' professionalism has long been based on a defined set of values. The most important feature is healthcare professional autonomy and the other features are patient sovereignty, physician confidentiality, and habits of learning. According to Raelin [22], professional autonomy is defined as the control that professionals have over the processes and content of their work.

Patient sovereignty is defined as paternalism or the traditional model of doctor-patient relationship that includes official instruction and the patient's values in shared decision-making is not really emphasized in this type of communication [23]. Physician confidentiality is an important issue in the relationship between patients and physicians specifically in the disclosure of a patient's personal health information, medical histories and symptoms to physicians without any distress.

The increasing body of medical knowledge is a main concern to all types of doctors. Their habits of learning are associated with their subjective ability to keep themselves professionally updated on new medical findings. This includes spending time on attending courses/congresses and medical readings [24].

With reference to the findings of an exploratory study conducted by Chau and Hu [25], some unique characteristics are believed to be held by healthcare professionals. Three characteristics have been proposed as the main characteristics of this group. The first one is specialized training that reveals their domination over knowledge which has been obtained during a lengthy period of education. As stated by Watts [21], they devote a considerable portion of their youth preparing for the profession. Their body of knowledge is directly associated with the lives of patients. In this profession even a slight mistake can be fatal. Therefore, the heightened emphasis has been placed on specialized training of healthcare professionals.

The second characteristic is professional autonomy. Based on this characteristic, healthcare professionals proclaim that they are in the best position to drive, organize, and regulate their own practice. They are judged mainly through a peer review process in which professionals evaluate each other. As mentioned by Zuger [26], professional autonomy has clearly been the most important value. This advantage provides healthcare professionals with a sense of pride, and accomplishment. In addition, they take special power, prestige, and authorities, as well as they are put at the top of the hierarchy in the health care profession.

As stated by Watts [21], and Montague et al. [27], the last item is professional work arrangements where healthcare professionals become health care providers, hospitals became health care facilities, and a patient acts as both the product and the client in such a system. Also, in this setting, two other occupational groups (para-professionals and non-professionals) work with healthcare professionals. These two groups, the role they play in healthcare organizations and their relevance to this study is addressed in the following section.

5. Professional autonomy: The central privilege

According to Starr [28] at the start of the second half of the 20th century, healthcare professionals are viewed as the holders of desirable autonomy and respect within the health care industry. In accordance with Abbott [29], being members of a profession is certainly conducive to professional autonomy. Based on a study by Adams [30], professional autonomy is considered as a key factor of the medical profession. Drawing on a recent study by Walter and Lopez [8], professional autonomy is viewed as a precious privilege given to professionals and they do not like to lose it in their workplace. Throughout this research the term professional autonomy is used to refer to having control over the state of affairs, course of actions, practices, or components of their work in relation to their own collective and finally, individual conclusion for applying their profession's body of knowledge and capability [31].

As pointed out by Freidson [32], based on professional autonomy which is granted to professionals, individuals outside the profession (non-professionals) do not know how to evaluate the practices of the professionals due to lack of required knowledge. Relying on professional autonomy, physicians are provided with separate bylaws and arrangement within hospitals [28].

Professional autonomy generates two main expectations of professionals. On the one hand, they are required to practice with extreme conscientiousness and without any direct surveillance. One the other hand, they are trusted to take on the necessary measures in carrying out their tasks [33]. Previous studies have reported that it is very difficult to evaluate the physicians' performance due to the unstructured nature of their practice [34]. This view is supported by Wilson et al. [35] who point out that some usual objective measures like revenue or number of published articles, which are applicable to measure individual outputs in other practices, cannot be used to evaluate professionals especially physicians.

A peer review process is being utilized in professional settings in order to validate the evaluation of professionals based on subjective analysis of objective measures. According to Walter and Lopez [8], one of the most important characteristics of professional autonomy is being analyzed by peers instead of non-professionals who are outside the profession. Therefore, it is becoming increasingly difficult to ignore the importance of professional autonomy that indicates the possession of esoteric body of knowledge which the outsiders are not aware of.

On the basis of having professional autonomy, professionals are given some special rights. First, professionals take advantage of having more access to critical resources than non-professionals. A survey conducted by Freidson [33] shows that as long as professionals are not provided with adequate resources such as equipment and staff, they can claim that their work cannot be accomplished in the best way.

Second, professionals have power over the tasks carried out by non-professionals (ones who do not have professional qualification, skills as well as knowledge and are involved in administrative duties, clerical and office work) and para-professionals (ones who possesses only partial professional skills such as technicians that assist professionals in performing their work) and can control the tasks carried out by them [36].

It should be added that the advantage of having control over subordinate groups is more considerable in those organizations with existing hierarchies among various working groups. A hospital is regarded as an organization in which different work-related groups (physician assistants, nurses, medical technicians, and administration) possess different levels of medical knowledge and among all; physicians are placed at the top of the hierarchy. The following figure (Figure-1) shows the hierarchy of different occupational work groups involved in a hospital, based on their level of medical knowledge.

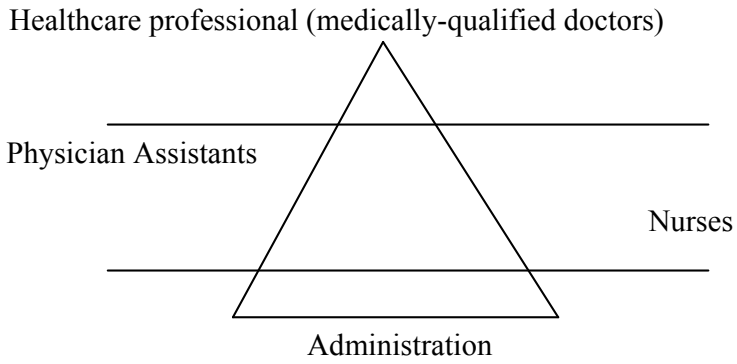

Figure 1. The hierarchy in healthcare organizations based on level of medical knowledge

6. Theory of interactivity

One view toward any new computerized system is that IT can reduce dependence on specific personnel [37]. These rules, procedures, and recommendations designed and embedded in IT can weaken their claim on possession of special competence in problem solving. Moreover, these instructions can invalidate their decision making skills in terms of deciding what to do for treatment of their patients. As stated by Harrison et al. [38], healthcare professionals feel uncomfortable when they face regulations and instructions generated by a clinical decision system that advises them on what to do. This is because they believe that they can treat their patients based on their specialized knowledge,

experience, skills and competence. According to Lowenhaupt [39], healthcare professionals become more anxious when someone or something (such as a computer system, here is CDS) shows he/it has more knowledge than them regarding what to be done with their patients.

Bucy [40] has mentioned that there is a slight difference between interactivity and social interaction in the form of person-to-person conversation or face-to-face communication. On the one hand, interactivity can be viewed as a special sort of mediated social interaction, like online chat, discussion forums, or teleconferencing. On the other hand, it can appear as impersonal interactions with media content or nonhuman agents such as computer game playing, e-commerce transactions, and various other forms of content interactivity. Perceived level of interactivity is largely based on the belief that the interactive nature of the clinical system can assist in creating cooperation between healthcare professionals and clinical IT systems. Perceived level of interactivity with CDS can be divided into three parts. 1. Interactive features of CDS itself. 2. being responsive to customized needs of healthcare professionals. 3. Interaction between healthcare professionals and CDS.

In this study, the effect of level of healthcare professionals' interactivity with a new CDS is examined on the perceived threat to professional autonomy. Based on the interactivity theory which explains human – computer perceived interaction; a high level of interactivity can be demonstrated in simultaneous, reactive and continuous exchange of information [41] that assists in conducting users' tasks. A higher perceived level of interactivity with a system causes higher degree of control that healthcare professionals have during the interaction with an IT system. Higher level of control consequently may result in the less threat perceived from the system to their professional autonomy and in turn they become more prone to use the new IT. This issue indicates that when healthcare professionals perceive low level of control over the health care process due to the function and features of the new CDS, they become less likely to use the system. In other words, if healthcare professionals perceive that the regulations given out by CDS may threaten their professional autonomy and CDS acts as their supervisor directing them what to do without their interference, they perceive this kind of IT (with low level of interactivity) as encroaching on their professional autonomy. Thus, different level of interactivity with CDS system is conducive to different perception toward using that system. For instance, healthcare professionals may perceive a low level of interactivity with the CDS in comparison with the EMR.

As a result, perceived level of interactivity is largely based on the belief that the interactive nature of the clinical system can assist in creating cooperation between the healthcare professionals and the IT system. If healthcare professionals perceive that the nature of new CDS is interactive, they perceive more control and in turn they perceive less threat to their professional autonomy [8]. As a result, we propose that low level of perceived interactivity with CDS leads to low level of involvement in performing activities with the aid of the CDS

system. Therefore, this situation inevitably results in low level of perceived control over processes and procedures of patients' treatment.

Interactivity has been defined in the literature in diverse ways [42]. Based on a review of the literature, interactivity is generally delineated as a property of the technology, the communication setting, or the perceptions of users [43]. In the first part of the definition, features of technology provide the set of interface actions that the systems allow and the degree of interaction changes based on user skills and competencies. The second part of the definition points to the communication setting as the locus of interactivity and specifies that interactive processes can be observed in the form of message exchanges (e.g., [44]). The control that users practice over the content of mediated exchanges is at the core of both message-related and technology-oriented definitions of interactivity.

According to Steuer [45] interactivity is defined as the "extent to which users can participate in modifying the form and content of a mediated environment in real time". Likewise, Neuman [46] stated that interactivity is "characterized by increased control over the communication process by both the sender and receiver". Williams, Rice, and Rogers [47] put forward interactivity as "the degree to which participants in a communication process have control over, and can exchange roles in, their mutual discourse". Based on Jensen [48] interactivity is "a measure of a media's potential ability to let the user exert an influence on the content and/or form of the mediated communication'. In the media literature, interactivity is regarded as a key motive for users' social responses to computers [49].

Stromer-Galley [50] has brought up the matter of categorizing the different types of interactivity into two general dimensions: interactivity as a product and interactivity as a process. The first type is related to interaction with content, dealing with the control that users apply over the selection and presentation of online content, such as text, audiovisuals, multimedia, and other features of the interface [50]. McMillan [43] has mentioned that product interactivity is a type of user-to-system interaction, whereas Stromer-Galley [50] previously used the term media interaction. Also Rafaeli [51] call such interactions as reactive communication. The second type of interactivity addresses person-to-person conversations which are mediated by the technology. Massey and Levy [52] have called this process interpersonal interactivity. McMillan [43] has employed the term user-to-user for this form of interaction while Stromer- Galley [50] referred this to the human interaction.

According to McMillan and Hwang [42], three elements come out commonly in the interactivity literature: direction of communication (responsiveness and exchange), user control (participation and features) and time (timely feedback and time required for retrieving information). Many studies have taken Human-to-Computer Interaction (HCI) into account to explain the ways humans can gain control over computers and other new media, such as video games [53, 54]. Reeves and Nass [49] have stated that with attention to

user control, a group of scholars centers their studies on human perception and another group focuses on computer design. As far as a human focus is concerned, studies examine how individuals interpret computer character [55]. Interactivity acts to provide a human-like signal in the context of human-computer to fill the interface with agency and motivate users to communicate with the computer not only as a medium but also as a source of interaction [56].

Interactivity has some positive consequences in relation to user-system behavior. The level of interactivity might be vital to get users be involved in the online process, hence interactivity may make consumers more alert about information when working online [57]. Based on Bucy [58], the positive benefits of interactivity usually referred to as increased engagement, knowledge gain (or uncertainty reduction), user satisfaction, and efficacy. Other studies have stated that increased interactivity leads to increased feelings of tele-presence [59], greater involvement with the system [44], and creating more positive attitudes toward the system such as higher credibility [60]. As stated by Agarwal and Karahanna, [61] a greater sense of involvement with an IT system reduces the perceived cognitive burden and encourages the user to spend more time experiencing the system.

7. Healthcare professionals' perceived level of interactivity with clinical IT system

The interactivity construct has been initially focused on the context of computers, websites, online advertisements, and web-based mass communication but it has not been tested yet with technologies and IT applications in other fields especially in professional environment. In this study, the concept of interactivity is extended from the context of interaction between customers and websites as well as online advertising to clinical information systems and the healthcare professionals. Therefore, this study is a step forward in defining the concept of interactivity with clinical information systems and extending it to the professional context of healthcare practice. In the context of this study, interactivity can be defined as the amount and quality of two-way communication, reciprocal activity, cooperation and direct relationship between the CDS and healthcare professionals when the CDS asks requirement and disease symptoms to operate based on the built in instructions. One of the antecedents of physicians' perceived threat to professional autonomy is the rules, instructions and diagnostic options provided by the CDS. Function of any new computerized system (such as CDS) can reduce dependence on specific personnel [72]. But the culture of medical practice has always given emphasis to individual physician autonomy [73,74]. Therefore, maintaining the autonomy causes the changes brought by IT systems not to be always well-received by healthcare professionals and becomes one of the biggest challenges for CDS implementation in particular. Also, concerns about overreliance on the device (CDS), makes healthcare professionals become worried on losing their autonomy. According to Lowenhaupt [39], physicians become more anxious when someone or something (such as a computer system) can perform in a way as though he/it knows more than physicians do about their patients. As a result, they feel

their level of control over patient care process, decisions and resource allocation will become less by the presence of the CDS. On the other hand, rules, procedures and recommendations designed and embedded in CDS can be seen as encroaching on the healthcare professionals' professional autonomy. As stated by Harrison et al. [38], physicians feel uncomfortable when they are faced with regulations and instructions produced by CDS advising them what to do because they believe they are able to treat their patients better based on their specialized knowledge, experience and competence. According to the study conducted by Dowswell [14], a majority of general practitioners accepted clinical guidelines as a tool to enhancing healthcare delivery, but when they perceived the encroaching guidelines on their professional autonomy, they started showing negative reaction toward the IT system.

On the one hand, Pain et al. [65] have stated that a computerized prescription system cannot eliminate the power of the doctor, because at the end of the day the doctor has the authority to decide what medicine to be prescribed. On the other hand, as suggested by Walter and Lopez [8], features of a clinical information system may influence perceived threat to professional autonomy. One possible feature is the level of interactivity that may change user perception of control and consequently affect perceived threat to professional autonomy. In the context of healthcare, perceived control can be described as the amount of control that a physician feels she/he has in using a clinical information system. Healthcare professionals' resistance toward using CDS does not always occur because the CDS distributes their abstract knowledge among the subordinate group in a hospital setting. Most of the time the rules and recommendations given by the system make healthcare professionals feel threatened because the system itself invalidates their exclusive knowledge claim. According to Mclaughlin and Webster [66], lab officers and medics perceived rules and recommendations of the IT system as threatening to their professional autonomy. Some respondents in this study declared that they changed the way the system interacted with them in order to save their autonomy.

Therefore, one feature of clinical information systems that influences professionals' perceived control is their level of interactivity. Perceived interaction is characterized as the level of interaction that a user perceives while experiencing the computerized system, and the extent to which the system is perceived to be responsive as well as sensitive to the user's needs. With attention to the medical literature, there are three levels of interactivity with a medical technology [67]. At the first level, healthcare professionals use the technology as a means to generate data so the experts can make a diagnostic decision. Therefore, at this level of interaction the medical IT can be considered as an enabler. At the second level, the technology is more complicated and acts as a partner of professionals. At this level both physicians and technology have the same weight. At the third level, the role of healthcare professionals is demonstrated in supervising the technology. At the third level, the technology takes on decision making process and recommends course of action and users are just responsible to control the process. At this level healthcare professionals are considered as operators. According to Lacramioara and Vasile [68], a factor that plays an important role in the interaction between human and computer for healthcare

applications is the functionality of a simple, responsive and useful user interface. Also as stated by Tung et al. [6], information quality and message prompting have found to be influential factors.

Perceived level of interactivity with CDS can be divided into three parts. 1. Interactive features of CDS itself. 2. being responsive to customized needs of healthcare professionals. 3. Interaction between healthcare professionals and CDS.

1. The features of CDS's information delivery such as quality of information and basic evidence are the most important causes for the effect of CDS on patient safety and quality improvement. A question arises in this area is how much control the user will have in getting access to the CDS information. According to Osheroff [69], the "five rights" of CDS is a good guideline of what is required for having effective delivery. CDS should be designed in a way to give the right information to the right person in the right format through the right channel at the right time (when the information is needed).

The key issues for healthcare professionals to consult with a patient using the CDS are speed and ease of access. Users may be aware of the need for information but if access is too difficult or time-consuming, healthcare professionals may prefer not to use the CDS.

2. The interactive CDS includes both nationally recommended guidelines and customized order sets designed by an individual healthcare professional [69]. Therefore, the interactive CDS is responsive to the needs of healthcare professionals in unique case of a patient and encompasses order sets adapted for particular conditions or types of patients (ideally based on evidence-based guidelines and modified to manifest individual healthcare professionals' preferences).

According to Berner [70], the CDS that is integrated into the workflow and work activities is more likely to be used by healthcare professionals. On the other hand, fitting CDS features (such as timing, structure, and design) into the workflow often necessitates unique customization to local processes and configuring the system for use in the local environment. In some case where the previous clinical processes were inefficient or ineffective, the processes should be changed. According to Miller et al. [71], in some cases, some special features of CDS are ordered to fit into the local context.

3. Healthcare professionals should be involved in entering patient data into the CDS application and also getting relevant information (e.g., lists of possible diagnoses, drug interaction alerts, or preventive care reminders) from the CDS to perceive more control over the care processes. On the other hand, if the CDS's recommendations and notifications are delivered but the healthcare professional does not interact with the system, the effect of timely response is doomed to be a failure [71].

A question related to autonomy is how much control healthcare professionals have over the system and how they respond to the CDS. This aspect of control relates to whether it is mandatory for them to accept the CDS suggestions, whether they can easily not take the suggestions into account, or whether the healthcare professionals take significant effort to

override the CDS advice [71]. Previous theories of CDS gave more emphasis to CDS output and limited healthcare professionals' control, but the new methodology of using CDS states that healthcare professionals can filter, review and finally select the useful and relevant suggestions and override others. With the use of this method a balance between healthcare professionals' desire for autonomy and the CDS suggestions for improving patient safety or decreasing practice costs, is made.

To sum up, the main goal of CDS is to interact with healthcare professionals and assist them in providing care planning and diagnosis analysis. In this human-machine interaction, both the healthcare professional's knowledge and the CDS function are required to better analyze the patients' data rather than relying on either human or CDS to make it on their own. In the interactive relationship between CDS and health care professionals, healthcare professionals input a set of required information and CDS makes a set of suggestions, advice and diagnostic options for the healthcare professionals and they go over the output and select useful one and remove irrelevant suggestions. In this manner, a CDS does not make decisions for healthcare professionals telling them what to do. Also, the process of interaction with CDS can be perceived more interactive when the possibility of adapting and customizing the system is considerable in case of a patient. Therefore, in this way healthcare professionals perceive CDS as an enabler or partner in which the decisions are not directly made by the CDS system.

Perceived level of interactivity is largely based on the belief that the interactive nature of the clinical system can assist in creating cooperation between healthcare professionals and clinical IT systems. According to McMillan and Hwang [72], by improving understanding on perceived interactivity, kind of systems can be developed that effectively make use of interactivity. If healthcare professionals perceive that the nature of new clinical system is more interactive, they perceive more control over process. As a result, the possibility of interaction with the system increases and in turn lowers their perceived threat to the professional autonomy. Psychologists argue that the feeling of being in control of any stimulating event results in approaching behavior, while a lack of that makes anxiety and leads to avoidance behavior [71]. According to Pianesi et al. [73], following the suggestion of Hoffman and Novak [74], it is shown that higher levels of involvement result in a greater feeling of being in control. As stated by Prasad and Prasad [75], employee involvement in interaction with systems can minimize resistance to technological change in organizations.

Thus, different level of interactivity with IT system is conducive to different perception toward using that system. For instance, healthcare professionals may perceive low level of interactivity with the CDS in comparison with the EMR because they think their role in the decision making and treatment gradually becomes less significant while using CDS.

8. Conclusion

As mentioned before, one way to reduce perceived threat to professional autonomy is directly related to organizational environment and human-human relationship such as the

healthcare professionals' relationship with other occupational groups like the subordinate group. The second way to decrease the negative effect of perceived threat to professional autonomy is related to machine-human interaction and the structure, instructions and features of a CDS system [8]. As literature states, a new CDS can reduce dependence on healthcare professionals. Therefore, healthcare professionals are always worried about overreliance on CDS and consequently losing their autonomy. In this regard, the rules, recommendations, instructions and care planning provided by a CDS is another base for healthcare professionals to view CDS as threatening to their professional autonomy and make them believe they are losing their control over the processes, procedures of their practice.

To reduce this negative effect, the study recommends high level of interactivity with the CDS system. Interactivity is characterized by increased control over the relationship between user and system. Higher level of interactivity leads to a higher level of involvement with the system and increase the control over each step of the patient care process [44]. Also, the high level of interactivity encourages the users to spend more time experiencing with the system. In another view, interactive nature of a CDS system can assist healthcare professionals in creating a reciprocal relationship with the system. If healthcare professionals perceive that the nature of a CDS system is interactive, they perceive more control over the process.

This study is one of the first attempts to examine the construct of perceived level of interactivity as a means to reduce the negative effect of perceived threat to professional autonomy among healthcare professionals. The result of this study shows that if healthcare professionals have an interactive relationship with the CDS system, their level of involvement in the process increases and they believe more control over the procedures. Under this situation, instead of showing negative reaction toward new CDS they support the new system in hospital. As a conclusion, the more interactivity perceived by healthcare professionals, the less threat perceived from the new CDS system. This result has a practical implication for IT design. One way to reduce perceived threat to professional autonomy is directly related to user-machine relationship and features of the CDS system. One important aspect of interactivity is rooted in the features and instructions embedded in the CDS system. The interactive features of the system increase interactivity which is perceived by healthcare professionals in the relationship with the system. Based on the findings, IT designers should design the features, rules and instructions of the CDS system more interactive in order to increase the healthcare professionals' level of control over the patient care process.

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