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Department of Marketing, Informatics and Statistics

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Index

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– Based on a Means-End Chain Approach

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Abstract

This paper is an integrated part of a PhD study on healthcare professionals' perception of Electronic Patient Record (EPR) implementations within Danish hospitals. The objective of the paper is to examine how nurse professionals perceive the EPR implementation process in a department of Cardio-Thoracic Surgery based on a Means-End Chain (MEC) approach. Qualitative interviews have been conducted to identify the perceptions among nurses most significant to the implementation process with regard to three levels of abstraction: Attributes, consequences and values. The findings reveal that there is a hierarchy and direct relations between the means and ends sought by the nurses when it comes to the EPR implementation. The content analysis is centered on five areas of interest: Support, user training, EPR workstations, integration between EPR and other systems, and information activities. Although explorative in nature, this study serves as introductory to consider the potentials for applying the MEC approach and its methodology to the area of EPR implementations. Similarly, the approach offers knowledge for future research in this area, and it serves as a practical tool for project managers interested in developing strategies to improve future EPR implementations at Danish hospitals. The paper includes arguments for further investigation. Additional empirical studies may show whether other healthcare professionals, such as doctors, have similar perceptions of the EPR implementation. Further examination may also explore whether it is possible to extend the findings from this study to other hospitals also implementing EPR systems.

Keywords: Electronic Patient Record, Implementation Process, Means-End Chain Approach, Danish Hospitals.

1. Introduction

1.1 Information Technology within Danish Hospitals

In recent years, there has been an increased demand for a full exploitation of the possibilities of information technology (IT) within Danish hospitals. Hospital managers perceive IT (also termed as health informatics) as the key tool for handling the increased need for better services and for complying with the political objectives regarding high quality, better information flow, and patient participation (Indenrigs- and Sundhedsministeriet 2003, p. 3). The Electronic Patient Record (EPR) is considered to be the main system in achieving these objectives and the Danish Ministry of Health has brought forward a motion with the objective to implement the EPR on all Danish hospitals before the year 2006 or as soon as possible from that date (Indenrigs- and Sundhedsministeriet 2003; Amtsrådsforeningen, Indenrigs- og Sundhedsministeriet et al. 2004).[1]

Contrary to a paper-based patient record, the record is now stored electronically and is available through computers. The EPR is defined as:

> *A clinical information system which directly supports the daily process*
> *oriented examination, diagnosis, treatment, and care of the patient* (IT-
> Sundhed 2002, p. 26, own translation).

With this new technology, it is possible for the healthcare professionals to access patient data simultaneously from different computers as well as entering data into the system from several sites at the same time. The EPR system is presumed to make work processes and communication channels more systematic and efficient and thereby ensuring the quality of core hospitals services and reducing waiting time.

To date, implementing IT within the public sector has not been without complications (Lorenzi, Mantel et al. 1990; Kristensen and Nøhr 2000). A study made by J. Mcdonagh in 2000 show that 40% of IT projects within large organizations turned out to be failures, 80% were delayed and more expensive than budgeted, and 90% of the projects were not able to live up to what was set out as the expectations (EPJ-Observatoriet 2000; Mcdonagh 2001). Often such IT implementations are described as: "*Endurance tests, fiascos, living to tell about it and war stories* " (Parr and Shanks 2003, p. 197). In Denmark, it turns out that EPR implementations have faced similar patterns. Several organizations within the healthcare sector have experienced obstacles in the implementation process when introducing new IT

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[1] The sentence 'or as soon as possible from that date' is a modification to the motion from the Danish Ministry of Health added by the county council union (Amtsrådsforeningen). Implementing the EPR system before 2006 is considered as a major challenge for a majority of the Danish hospitals as the number of beds covered by EPR systems only amounted to 22% in 2004. Ref.: EPJ-Observatoriet (2004). EPJ-Observatoriets statusrapport.

systems. Often these obstacles occur due to conflicting interests within the organization that have to be reconciled (Høstgaard, Aalborg Universitet et al. 2003).

When considering the complex nature of an EPR implementation process, it is understandable that various operating obstacles might occur. Implementing EPR systems often requires considerable organizational change and accordingly user involvement (Lorenzi, Mantel et al. 1990). The ability to engage the employees in the change process in order for the implementation process to release its full potential becomes central. One reason for these past failures, or at least for the obstacles regarding the implementation process, might be related to the lack of consideration as to differentiating the role of the diverse users in this process. The assumption then rests on exploring the differences regarding users' perceptions and their role in this change process. The PhD project consists on revealing the extent of interrelated purposes and common values among the professionals (in this paper, attention is paid to the nurse group). In other words, the project management should consider these possible differences if the implementation process aims to be successful. The more embedded and flexible the implementation phase of this EPR, the more useful the system will likely turn out to be in the daily work processes of the professionals (Lorenzi and Riley 1995; Kristensen and Nøhr 2000). In relation to this, Weiner, Gress et al. conclude from a survey study regarding the implementation of an inpatient computer-based provider order-entry system (POE) that doctors and nurses have distinctly different views about the effects of the system. The authors therefore highlight the need to consider both perspectives when assessing the impact of the implementation (1999).

Lorenzi and Riley (1995) have pointed out two criteria to be met in order to obtain a successful implementation of health informatics systems. First of all, a successful implementation must meet the criteria set by the project management, i.e. the project is accomplished within budget, on time, and to the technical specifications. Second of all, the implementation should meet the perceived needs of more than 90 percent of the end users. From experience, both criteria are difficult to meet as an EPR implementation brings along a radical change when it comes to the different tasks and work procedures of the professionals (Borum and Larsen 1981; Kristensen and Nøhr 2000; Andersen and Kølsen de Wit 2003). The latter criterion is considered as highly important and should not be discounted in the implementation since it puts the organization members' involvement at the core of the process. An understanding of how the healthcare professionals perceive this process must therefore be considered as critical to obtain a successful clinical IT project by avoiding user reluctance and enhancing their confidence. This perspective represents the main incentive for focusing on EPR implementations from an end user perspective.

1.2 Motivation for Focusing on EPR Implementations

Studying health informatics is a relatively new field of research. In recent years, more attention has however been paid to research within this area as well in Denmark as abroad.

This research is comprised of different scientific disciplines and research environments within fields of computer science, sociology, medicine, ethnography etc. Important journals in this area of research comprise the International Journal of Medical Informatics, the Journal of the American Medical Informatics Association, Health Informatics Journal, and International Journal for Quality in Health Care.

At the department of Organization and Industrial Sociology at Copenhagen Business School, a research centre for hospital management and organization (FLOS) was established from 1999 to 2004.[2] The objective has been to promote knowledge about the prospects for organizational change and managerial innovation in hospitals. Within this research centre, Svenningsen has centered her dissertation on the implementation of the EPR in relation to medical practice examining how the work is performed after the implementation of the EPR and what consequences the system entails (2002). Furthermore, Vikkelsø and Vinge have investigated into the fundamental dynamics and dilemmas related to the healthcare sector (2004). This research mainly concentrates on the intrinsic consequences of the implementation – i.e. when the EPR system constitutes itself as an actor in the network. Whereas much of the research has focused on the consequences of the implementation process, scarce evidence has highlighted the possible characteristics that typify this process. The aim of the PhD project is therefore to look upon the operating aspects relating to the implementation process, and in this paper, focus is directed towards one group of professionals, namely the nurses.

Furthermore, a Virtual Centre for Health Informatics (V-CHI) has since 1996 been situated at Aalborg University.[3] The centre performs research and development within the field of information technology in the healthcare sector. Within this centre, an EPR Observatory was established in 1998 as a part of the plan of action set out by the Danish Ministry of Health.[4] The main focus of the EPR Observatory has been to follow and evaluate on the EPR projects initiated in Denmark. Some of the research conducted in Aalborg is considered to be useful for the PhD project as such since it centers on change management and user participation.

A range of international studies similarly focuses on the implementation of IT within the healthcare sector. The research made on an international basis similarly differs in focus and in methodology. Some of the studies include Berg (1996; 1999; 2000), Lorenzi and Riley (1995), Nikula and Elberg (1999; 2000) just to mention a few. Berg centers his research on the way patient records and healthcare workers interact and mutually have an effect on each

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[2] FLOS was based on a network of researchers at the Copenhagen Business School, at Aalborg University, and at the Danish Institute for Health Services Research and Development. A center for Health Management is established in 2005 to continue the work initiated by FLOS.
[3] V-CHI is a formal network co-operation between different research and development groups at Danish universities, public and private companies, healthcare institutions, hospitals, and county councils.
[4] The action plan was in Danish termed HEP – Handlingsplan for Elektronisk Patientjournal.

other (1999). Nikula and Elberg have brought up valuable notions by introducing the concept of "price to pay" which indicates that it takes human effort to obtain better health-care. In that sense, they highlight the contributing role held by healthcare professionals when implementing EPRs (Nikula and Elberg 2000). In addition, a research group at the Erasmus University in Rotterdam focuses on IT in healthcare practice and on management based on a sociotechnical approach.[5] Finally, several evaluations with practical ambitions have been made on different hospitals in Denmark in order to report the outcomes of the EPR implementations (Fischer and Lorenz 1999; Udviklings- og uddannelsesafdelingen 1999; Ankerhus 2002; Andersen, Jensen et al. 2004).

The author has for some years had an interest in EPR implementations in Danish hospitals. This interest, which stems from the author's participation in a research group at the Aarhus School of Business, builds on evaluating the process and the outcomes of an EPR im-plementation at a hospital in the Northern part of Jutland (Andersen, Jensen et al. 2004).[6] Rich on this experience, the author has observed several organizational factors that might complicate an IT implementation process. There appear to be some strong disciplinary boundaries between the three groups of professionals – nurses, doctors and administrative staff (also known as professional hierarchies). Each group performs some specific tasks with clear functional boundaries. Even though redefining the tasks and the boundaries already set up can turn out to be a rather complex organizational matter, it appears as a necessary step for the progress and the success of the implementation process (Andersen and Kølsen de Wit 2003). Beyond a certain degree of reluctance among professionals, there seems to be different perceptions in particular regarding the nurses and doctors, when it comes to the implementation process. The EPR implementation with regard to the Digital Hospital noticed but did not fully integrate the differences in the perceptions of these two groups in the planning process. Instead, more functional considerations were approached and developed by the project management. At last, it should be noticed the difficulty in observing and representing the interrelations and mechanisms governing these different activities within the implementation process. However, it appears crucial to understand the frame across the attributes, consequences but also values, articulating the implementation process in relation to each group of professionals. The EPR project manager from the Digital Hospital Project mentioned with regard to this point:

> *I would like to obtain some good advice concerning the implement-*
> *ation process. How do you ascertain that the system is well received?*
> *How do you know how much user training people need?*

In other words, there seems to be a lack of knowledge on concrete activities in the implementation process and the relations between these activities and their consequences or

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[5] The research group on 'Research on IT in Health care practice and Management' (RITHM) is affiliated the Institute of Health Policy and Management at the Erasmus University in Rotterdam.
[6] The project is also known as the *Digital Hospital Project.*

outputs. Even though there has been and still is focus on EPR implementations and the Danish healthcare sector, the area remains a relatively uninvestigated area of research. So far, no organizational studies provide an in-depth understanding of how activities in an implementation process may influence the future use and the outcomes of an EPR in a healthcare organizational context from a professional perspective. In other words, the methods that are available are not entirely grounded in the daily behavior of the healthcare professionals when it comes to an implementation. More attention should therefore be given to qualitative data collection procedures which allow the informants to express their own perceptions. A Means-End Chain approach is chosen as the framework in this study to highlight some of these relations (cf. section 2 for an elaboration of the MEC approach). These considerations lead to the purpose of this study.

1.3 Purpose of the Study

The PhD project takes its outset in the assumption outlined above indicating the complexity when implementing EPRs in Danish hospitals. As mentioned earlier, this paper is an integrated part of a larger PhD study which means that only few aspects will be touched upon here.

The purpose of the paper is to provide a better understanding of the relations between the activities in the EPR implementation process and the consequences that follows these activities. In order to provide this understanding, focus is directed towards the perceptions of one group of professionals, namely the nurse professionals. The context is an EPR implementation process that was initiated in 2001 on a department of Cardio-Thoracic Surgery at Aalborg Hospital in Denmark. The method used for generating the relations is a Means-End Chain (MEC) approach, normally used within marketing research. MEC and a so-called laddering methodology are used to study the activities that are central to the nurse professionals in the EPR implementation process in question. The aim is to point out which consequences the activities have with regard to the involvement of the nurses and their future engagement in using the EPR system as a tool in their daily working procedures.

Through qualitative interviews with nurses, the relations between the activities (means) that the nurses consider important in the implementation process and subsequently act on in accordance with the consequences and their desired values (ends) are examined. Knowledge of the means-ends connections is presumed to yield important information about the nurses' involvement in the EPR implementation. On the basis of the interviews, the relations and hierarchies between the specific activities, consequences and values are found and generated into graphical representations. The aim is to get an overview of the implementation from the nurses' own point of view and thereby to improve the understanding of the demands of the nurses – based on their own frame of reference.

1.4 Outline of the Paper

In the following section, the fundamental aspects of the means-end approach will be described. It is explained how MEC is normally used within consumer research and how it can be applied onto an organizational context as it is the case in this paper. The laddering methodology will then be described in further detail together with arguments for choosing an MEC approach. Subsequently, the study design will be described followed by a case presentation of Cardio-Thoracic Surgery at Aalborg Hospital (more precisely unit T) and a description of the EPR implementation process which was initiated in 2001. This presentation leads up to the research findings including a categorization and a content analysis of the relations between attributes, consequences and values sought by the nurses when it comes to their perceptions of the implementation process. The analysis is centered on five areas of interest when it comes to the EPR implementation: 1) Support, 2) User training, 3) EPR workstations, 4) Integration between the EPR system and supporting systems, and 5) Information activities. These areas will be presented in detail in section 5.2 based on their central means and ends represented in hierarchical value maps. On the basis of the analysis, the implications of this study are discussed. This is done with regard to the research contributions when it comes to criteria such as validity, reliability and generalizability. Finally, implications for future research as well as implications on practice will be presented.

2. Means-End Chain Approach

2.1 Means-End Chain

As mentioned in the introduction, MEC is a framework developed for studies in marketing and consumer research. It was first introduced in marketing research by Reynolds and Gutman and has become a frequently used method to uncover cognitive structures with respect to customers' favoring of different product classes (Reynolds and Gutman 1988; Hofstede, Audenaert et al. 1997). According to Skytte and Bove (2004), the assumptions behind the MEC theory have their beginning in the personal construct theory developed by Kelly in 1955. Kelly argues that an individual tries to simplify, systematize and thereby understand the information that s/he is confronted with through sets of bipolar constructs. The construct's reality exists in the mind of the individual who interprets the elements in order to give them meaning and to deal with them. This theory has been further developed and termed as means-end chains in consumer research by Reynolds.

The purpose of applying the means-end method to marketing research is to obtain an understanding of the rationale underlying a person's values for certain consumption. MEC rests on the assumption that personal values are based on the consequences in question (Hofstede, Audenaert et al. 1997). Essentially, the method focuses on the connection between a product's *attributes*, the *consequences* and the *values* for choosing a product as a three-level chain illustrated in figure 1 below:
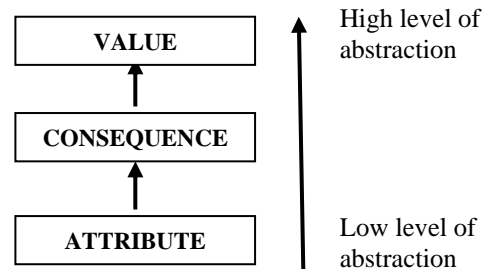
Figure 1 Attributes, consequences and values as a three-level chain

The *attributes* are dimensions which are clearly associated with and represent the product, i.e. the characteristics of the product which are important to the preferences of the consumer (Gutman 1982; Reynolds and Gutman 1988; Grunert, Grunert et al. 1995). Skytte and Bove characterize the attributes as:

> *The attributes are what constitute the product, i.e. its features, and its component parts or activities* (Skytte and Bove 2004, p. 6).

For example "the small size" and "the design" might be considered as the main attributes of mobile phones today. Similarly, "motivating" and "educational ability" might be possible attributes describing a teacher's competences in primary school. When it comes to an implementation process, the attributes correspond to the *activities* that make up the implementation process, e.g. "training in the use of the EPR" and "analysis and design of work processes". In other words, the attributes represent the different activities in the implementation process.

Activities in an implementation process are however difficult to define and delimit. Skytte and Bove further describe the attributes as:

> *Means are objects (e.g. products [i.e. their physical aspects], **or***
> ***activities which people engage in**) (Skytte and Bove 2004, p. 5, bold*
> added).

More precisely, the attribute level covers the activities that the healthcare professionals engage in, as described in the quotation. However, this definition is not totally adequate when it comes to an implementation process. Some of the nurses may not have been involved in the diverse activities during the EPR implementation – e.g. "the selection of the EPR system" or "the analysis and design of working procedures". And though, these activities may have been of importance for the nurses' future use of the system. This is why the definition of the attribute level also needs to include activities that may have influenced the nurses' daily working procedures – e.g. "support arrangements", "information activities", "set-up of the system at the ward".

In sum, the attribute level covers in this regard concrete and separate activities in the implementation process that the nurses have been engaged in or have been influenced by.

The activities are related to a consequence level. From a marketing perspective, the *consequences* represent the functional and psychological implications of a consumer's purchase and use of a product. Bech-Larsen et al. defines the consequence level as:

> *Consequences are expected functional and psychological implications*
> *of the consumer's purchase, use, or disposal of products* (Bech-Larsen,
> Nielsen et al. 1997, p. 1)

If we continue the example above, "the design" of the mobile phone may relate to the consequence of "impressing others". Likewise, "the educational ability" of the teacher may lead to "better learning abilities" for the pupils. The consequence level is discovered by asking the informant about how a particular attribute or activity has influenced him/her. This is in line with Skytte and Bove who indicate that:

Consequences are the outcomes produced by the attributes (Skytte and Bove 2004, p. 5)

Consequences play a central role in establishing engagement among the actors. Certain activities in the implementation process must be considered to have some consequences on how the nurses perceive and use the system, e.g. "the nurses recognize how alterations of the work procedures can help optimizing their daily work", and "EPR user training" may lead to the consequence of "obtaining sufficient knowledge about the EPR".

Finally, the desired end-states or *values* are at the top of the hierarchy. They are placed on the most abstract level. In marketing, the values guide the consumer's attitudes and behavior and they represent an intended consequence that an individual strives for when choosing a specific product or service among other products/services (Gutman 1982). In other words, a value is broad in nature and may be appropriate across different products and use situations (Jolly, Reynolds et al. 1988). Skytte and Bove give the following definition of values:

...ends are individuals' preferred end-states of existence (Skytte and Bove 2004, p. 5).

According to Zeithaml, a value is not a value until it is perceived to be one. Perceived value is considered to be: "*the consumer's overall assessment of the utility of a product based on what is received and what is given*" (Zeithaml 1988, p. 14). Zeithaml argues that the value represents a tradeoff between something that is received and given which is much in accordance with the concept of "the price to pay" introduced by Nikula and Elberg. From an MEC approach, consumers' perceptions are evolved hierarchically as benefits from product attributes (Gutman 1982). In this study, the nurses' perceived values are in focus based on the activities and consequences in the implementation process. The need for assessing the value at the consequence and desired-end level from the nurses' point of view is advocated for in order to conclude on their perceptions of the EPR implementation.

In continuation of the example above, "the design" of the mobile phone may "impress others" and the mobile owner will in turn obtain "self esteem" and "feel good about him-self" (values). Finally, "the educational ability" of the teacher may lead to "better learning abilities" when it comes to the pupils which in turn may relate to the teacher being "respected and recognized for a well done teaching" among colleagues. This again may have implications to the teacher's self-worth. According to Reynolds and Gutman (1988), the attributes which are related to values are more central to the person interviewed than the attributes that are only associated to consequences. In an implementation process, the activities and consequences reflect the underlying *values* among the nurse professionals, e.g. "to ensure optimal patient quality", "avoid frustration" and "being engaged and motivated" (cf. section 5 on the research findings).

The end in one means-end relation is the means to achieve another end in a succeeding means-end relation. In this way, the connected means-end relations form an entire chain of means and ends – a ladder or a hierarchical map as it is also called. This will be specified in section 3 where the study design will be discussed in further detail. It is essential to uncover the personal values among nurses as they may reflect their fundamental needs when it comes to an implementation process.

2.2 How to proceed: The Laddering Technique

A Means-End Chain approach combines qualitative interviews with quantitative data analysis. The interview is based on a one-to-one interviewing technique where the aim is to obtain an understanding of how the nurses translate the activities in the EPR implementation process into associations with their personal values or motivations (Reynolds and Gutman 1988). A so-called laddering technique is used to uncover the relations across attributes, consequences and values. The laddering procedure is used as a means for obtaining a higher level of abstraction on the basis of the activities, i.e. to see how the nurses link relevant activities to higher levels of consequences until personal values are reached.

Jolly, Reynolds et al. (1988) provide examples of different ladders concerning cognitive bases of performance appraisal in a sample of 22 nurse supervisors on an attribute (A), a consequence (C) and a value (V) level. One of the ladders, represented in their work, is depicted in figure 2:

Self-esteem/worth (V)
↑
Personal accomplishment (V)
↑
Better patient wellness (C)
↑
Less patient anxiety (C)
↑
Caring/does extra (A)
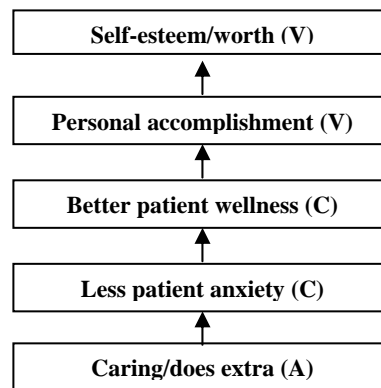
Figure 2 Laddering of cognitive bases for performance appraisal among nurse supervisors

The elements illustrated in the figure have been elicited from a set of interviews based on the laddering technique asking: "Why is that (attribute or activity) important to you?", and its ability to make the informant think critically about the connections of attributes and the personal motivations when it comes to performance appraisal among nurses. The purpose of the interviewing process is, in other words, to extract the associations between the means and ends that a certain group of informants has with regard to a specific field of study. The main purpose is to make the informant answer the question posed and to react on that response. It is important:

...to understand the way in which the respondent sees the world, where the world is the product domain comprised of relevant actors, behaviors, and contexts (Reynolds and Gutman 1988, p. 13).

In other words, the responses that are obtained via the laddering technique are content analyzed and classified according to their level of abstraction, i.e. whether they are on an attribute, a consequence or a value level. A hierarchical value map (HVM) is created on the basis of the laddering methodology, showing the main ladders in a graphical representation. This map summarizes the total interviews across the informants and can be interpreted as the dominant way-of-thinking with respect to the product or in this case the implementation process in question. For a more detailed example and an illustration of a HVM, see (Jolly, Reynolds et al. 1988, p. 166) and section 5.2 in this paper.

In order to gain a more complete and in-depth understanding of the nurses' ends-directed behavior, it is essential to consider the entire means-end structure. This structure provides us with the hierarchical relationships between the means and ends at all levels of abstraction, from rather concrete to abstract levels (Pieters, Baumgartner et al. 1995). This will be elaborated on in the content analysis in part 5.2.

2.3 Why an MEC Approach?

The Means-End Chain approach is, as mentioned, developed for studies in marketing. Within this area, the approach has proved useful in understanding consumer behavior, i.e. providing a more direct and in-depth understanding of consumers' cognitive structures. Rekom and Wierenga (2002) describe in an article how the means-end approach, from being a method concerned with products and services, in recent years has moved into a broader domain of research. Thus, although developed for consumer research, the method has also confirmed its usefulness in various organizational contexts. In Jolly, Reynolds et al. (1988), a means-end approach is applied to examine the nurse managers' cognitive bases of performance appraisal. In Skytte and Bove (2004), the importance of value in retail buying is analyzed from a means-end theory. In Rekom, Riel et al. (2000), means and ends are derived among organization members from their day-to-day behavior.

MEC is chosen as the approach in this paper of two main reasons: First of all, it is assumed that MEC will facilitate highlighting the most central activities in the EPR implementation process based on the nurses' point of view. Secondly, it may provide us with a picture of the connection between the most central activities in the implementation process, the consequences of each activity, and the relation to the nurses' desired end-states. The relations are considered to be important to uncover as it is a rather new area of research. Conceivably, an MEC approach will enhance the possibility to highlight some aspects with regard to an EPR implementation process that have not so far been in focus.

Consequently, the means-end approach is used as the framework in this paper as it offers different valuable types of information. It facilitates and offers a more structured knowledge of an EPR implementation process which is considered to be rather complex. MEC provides valuable guidelines for project managers in charge of the implementation process in question and for similar projects as it ensures a better understanding of the users – in this case the nurses. The findings can be considered as a seek-and-learn process and as a way of passing on experience and knowledge from one implementation process to another – exactly what the EPR project manager in the Digital Hospital Project asked for. Similarly, an MEC approach serves as a basis for developing strategies for similar projects in the future and as a possibility to improve those strategies. And finally, MEC is considered to be valuable as it allows the informants to use their own frame of reference when they provide their evaluations of the EPR implementation process. Since the means-end approach is new in this context, it is also important to validate its usefulness in this area and to determine whether to continue similar research activities within this domain. See part 6.1 for further discussion on the validation of this method.

3. Study Design

3.1 Selection of Informants

In order to make use of an MEC approach, it is preferable that there is some degree of homogeneity among the informants (Grunert, Grunert et al. 1995). In other words, it is important to ensure informant homogeneity when it comes to the research findings and in order for the HVM to reveal cognitive differences that are not related to socio-demographic profiles. When considering the total nursing group in Denmark, it is rather difficult to ensure a certain degree of homogeneity. This is due to factors such as: Different geographical contexts; the use of different EPR systems; different courses of implementation; different specialties – e.g. medicine, surgery etc. In order to be able to test the MEC framework and to avoid that the socio-demographic characteristics play a too important role, only nurses from the surgical area served as a sample. More precisely, 14 nurses from the department of Cardio-Thoracic Surgery at Aalborg Hospital, unit T, were interviewed. Their average age was 44 years and they had been working on the unit for approximately 8-9 years. In other words, the nurses interviewed all worked in the same unit and within the same speciality. They had all experienced the same implementation process, and they worked with the same EPR system. A further screening requirement was made ensuring that each informant had been involved in the implementation process of the EPR in question. In this case, it meant that the nurses had been employed at unit T since January 2001, as the EPR implementation started out that year. The screening requirement was done to make sure that each nurse could actually relate to the activities the implementation.

The research made in this study is based on a single case where only the perceptions of one nurse group with regard to the EPR implementation process are included in the empirical findings – that is 14 nurse professionals participated in the study. This number of informants does not live up to the recommendations of Reynolds and Gutman (1988), arguing for at least 30-50 informants. The method can, however, still be used with a smaller number of participants. Rekom et al. (2004), who use MEC in an organizational context, similarly operate with a small number of respondents – namely 25 of total of 900 respondents. They argue:

> *A relatively small sample can thus be fairly adequate for exploratory*
> *purposes, especially if the results are backed up with a representative*
> *survey* (Rekom, Riel et al. 2004, p. 9)

In another study, Rekom et al. only operate with 12 informants. The analysis in this paper is an integrated part of a PhD study which will include the perceptions of other healthcare professionals. The attempt may later on be to conduct a survey based on this explorative

first step. The survey will help generalizing on the findings – see part 6 for further elaboration on this point.

3.2 Index Cards as Elicitation Technique

21 index cards were prepared for the interview, each containing an activity in the EPR implementation process at a more or less abstract level. The index cards related to both organizational and technical aspects within the implementation process and were meant as a technique for elicitation (see appendix 1).

It is rather difficult to work out index cards that cover an entire implementation process. There is a vast set of activities on different levels that influence and characterize an implementation process, e.g. "training in the use of computers", "the teacher's competences", and "project management" etc. It is almost impossible to generate a complete list of activities, and if the set of activities becomes too exhaustive, it might confuse rather than help the informants during the interview situation. Furthermore, there might be too many activities for the informants to be able to get an overview. An alternative is to generate some cards at a more abstract level to help the informants to think back at the implementation process, e.g. "user training", "analysis of work processes" etc. as was the case in this study. The activities written on the index cards were identified as the most important ones when completing an implementation process. The index cards were based on literature reviews regarding:

- o Guidelines for project management
- o Critical success factors regarding innovative projects
- o Enterprise Resource Planning (ERP) implementations
- o Reports on EPR implementations in Denmark
- o Experiences with public IT projects

The first area, concerning guidelines for project management, was reviewed in order to get an overview of implementation processes in general and the key aspects that project managers have to consider when it comes to implementations of various arts. The main literature being reviewed was Mikkelsen and Riis (1998) and a project model termed PRINCE2 (2002). Secondly, literature on critical success factors regarding innovative projects was reviewed. This review was mainly based on a PhD from 2003, where critical success factors are identified and structured when it comes to major IS projects (De Witt 2003). De Wit has later on exemplified these critical factors with respect to the healthcare area. Thirdly, literature on Enterprise Resource Planning (ERP) implementations was reviewed. ERP implementations are considered to be quite similar to EPR implementations. Especially an article by Parr and Shanks (2003) was reviewed, where critical success factors when it comes to implementing an ERP are outlined in a model. Similarly, an article by Marcus and Tanis (Zmud 2000) has been an inspiration in the attempt to list the most central

activities in an implementation process. In their article, Marcus and Tanis stress the different events in an ERP implementation process – from adoption to success. Furthermore, a review was made of the different evaluations concerning EPR implementations in Denmark (Fischer and Lorenz 1999; Udviklings- og uddannelsesafdelingen 1999; Ankerhus 2002; Andersen, Jensen et al. 2004 etc.). Here, the activities in the EPR implementation process have been highlighted as well as the terminology used within the healthcare sector. Similarly, the author's own experiences from the Digital Hospital project in the Northern part of Jutland served as reference. Finally, a review of the experiences with regard to public IT projects was made. A report made in 2001 very well describes the problems when implementing IT within the public sector (Bonnerup 1995).

A validation of the list of activities was carried out by a former nurse having participated in several EPR implementations as project manager. A lecturer from the Aarhus School of Business with project management as research domain similarly reviewed the list. Finally, the list was sent to the head nurse at unit T in order for her to validate it in relation to the specific clinical context.

The index cards (based on the list) were used as an elicitation technique to help the informants associate to the implementation process that was initiated in 2001. Different techniques can be used in order to elicit which attributes to base the interview on. Reynolds and Gutman (1988) mention three different kinds of techniques: 1) *Triadic sorting*, where the informant is presented with sets of three products (called triads) that s/he has to choose between. The interview will then be based on the product/attribute that the consumer chose. 2) *Preference consumption*, where the informant is asked to choose one brand and argue why this brand is the most preferred (or second preferred or least preferred etc.) brand. And 3) *Differences per occasion*, where the informant is presented to a specific context from which the distinction is made. Bech-Larsen, Nielsen et al (1997) mention other elicitation techniques: 1) *Free sorting*, where the informant is introduced to a number of products and has to divide these products into different categories according to their characteristics. These characteristics will then act as attributes. 2) *Direct elicitation*, where the informant is asked which attributes s/he considers the most central regarding the product in question. The answer on this question will then make out the attribute(s) in the interview, and finally 3) *Selection from an attribute list*, where the informant is presented to a list of pre-defined attributes of a specific product. The informant is asked to single out the most important attributes/characteristics.

The elicitation techniques which can be used in this study (focusing on an organizational context) are direct elicitation and selection from an attribute list. The remaining techniques are all based on selecting between different products. Direct elicitation would be a relevant technique to use in this study. However, it demands that the nurses are able to get an overview of the entire implementation process and remember all the different activities as the

implementation was completed in 2001. Furthermore, the selection from an attribute list is by far the quickest technique. The time dimension was considered to be important as it had implications on the quality of the data collected due to the busyness of the informants. In this study, the interviews only lasted from 45 minutes to one hour. This technique was, however, combined with the direct elicitation technique as the informants in the end of the interview were to mention other attributes that had been important. This was made to ensure that no key elements were overlooked.

3.3 The Interview Situation

Data was collected from individual interviews lasting from 45 minutes to one hour. All interviews were carried out in the nurses' natural surroundings. Two interviewers were present at each interview. One interviewer was conducting the interview (the author), asking questions etc. and the other one taking notes and making sure that the interviewee would elaborate on certain aspects. The purpose was to get the informant to think seriously about the implementation process and to get him/her involved in the interview. An important aspect was to create a pleasant atmosphere in order for the informants to feel at ease and willing to reflect upon their answers. At the same time, it was important to be aware of the importance of gaining control over the interview by asking questions as direct as possible and thereby minimizing the response options so that the laddering technique could be followed. It was central to be aware of the guidelines when performing the laddering technique (Gutman 1982). Especially since this was the author's first experience in using the technique.

The nurses were asked to evaluate the importance of each activity (from the index cards) on a five-point Likert item scale ranging from "very important" (1) to "not important" (5). There was a primary focus on the activities rated as very important (1) from the informants' point of view and if there was more time left, the activities considered as important (2) were also included in the interview. The laddering technique was thereby based on the cards chosen, and each ladder had its outset at the most concrete attribute level. This was done by reversed laddering. First of all, the informant was asked: "What do you understand by…" or "what is implied by…" with regard to the activity chosen. This reversed laddering was used to get more detailed information about the activities considered important. For example, if the informant considered "EPR user training" to be a central activity, s/he was asked what was implied by "EPR user training", that is if it concerned "the teacher's competences", "the amount of hours disposed for user training" etc. The laddering technique was then continued by asking: "Why is that (activity/attribute) important to you?" If the nurse for example chose the activity concerning "EPR user training", a simple interview passage could look like this:

Interviewer:	*What do you understand by "EPR user training"?*
Nurse:	*That the teacher is able to teach me the most basic functionalities in the system.*
Interviewer:	*What do you understand by the most basic functionalities in the system?*
Nurse:	*How to write a nursing note, save it and be able to find it again. But these functionalities also concern procedures regarding the hospitalization of the patient.*
Interviewer:	*Why is it important that the teacher is able to teach you these functionalities in the system?*
Nurse:	*Because it makes me confident about using the system later on.*
Interviewer:	*Why is it important that you feel confident when using the system?*
Nurse:	*It is important so that I do not loose face in front of the patient and that I provide the best possible patient care.*
	...

The overall purpose of the interview was to retrieve the criteria most salient among the interviewed nurses with regard to the EPR implementation process in question. The criteria were categorized into activities, consequences and values as illustrated below (based on the example):
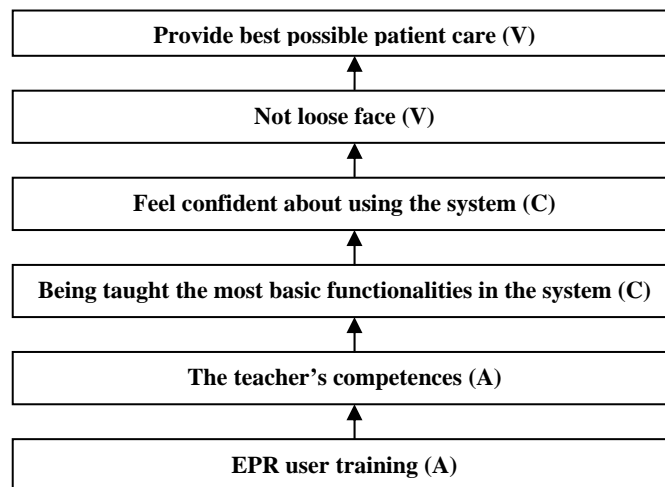

Figure 3 Laddering of cognitive bases for EPR user training among nurse professionals

The most abstract level was found when the informant could no longer answer or elaborate further on the why-questions. The fact that the nurse could not answer the why-questions any more could imply that s/he had reached the value level. However, it could also mean

that s/he did not know what to answer or more simply did not want to answer. A way to get round this situation was to rephrase the question or to use a technique called negative laddering where the informant was asked what would happen if the activity did not exist (Reynolds and Gutman 1988; Björk 1993). Reynolds and Gutman mention other methods to be used in order to continue the laddering procedure: Evoking the situational context, postulating the absence of an object or a state of being, age-regression contrast probe, third-person probe, and redirecting techniques such as silence and communication check (Reynolds and Gutman 1988, pp. 16-18).

At the end of each interview, the informant was asked to mention one or more aspects considered to be of importance in an implementation process which were not necessarily written on the cards or that the informant had come to think of during the interview. This was done to prevent the loss of any activity not incorporated on the pre-established cards. Finally, the interview was concluded with questions about demographic information concerning the informants' job experience, conditions of employment and related data. The procedures of the content analysis and the findings will be presented in part 5. In the subsequent part, the case will briefly be described, i.e. unit T where the study was carried out. There will be a brief presentation of the EPR implementation process which was initiated in 2001.

4. Case: Cardio-Thoracic Surgery

The focus of this study is the department of Cardio-Thoracic Surgery on Aalborg Hospital in the Northern part of Jutland, where an EPR has been in use in the daily working procedures since the beginning of 2001.[7] The department of Cardio-Thoracic Surgery takes care of all adult surgical treatment regarding heart, pneumonia, and throat surgery. The department consists of a standard unit, an outpatient department, a perfusion department, and a secretariat. It is the standard unit which is the empirical focus of this study. The standard unit (unit T) has a capacity of 32 beds and have approximately 52 nurses employed. The nurses co-operate to a large extend with doctors, physiotherapists, dieticians, social workers and secretaries. The nursing procedures are organized on the principle of primary nursing, which implies that one nurse is responsible for providing care to the patient in question during the entire hospitalization.

The implementation of the EPR system at unit T was considered as a pilot project for the future EPR projects at Aalborg Hospital and on other hospitals within the region of Northern Jutland – among these Vendsyssel Hospital (Ankerhus 2002; IT-Sundhed 2002). Some of the main advantages of implementing the EPR system were outlined as: Working routines and communication channels become more systematic and efficient; the quality of core hospitals services is raised; uncertainty regarding medicine handling is reduced; waiting time is reduced (Ankerhus 2002; IT-Sundhed 2002). The fact that this project was a pilot project meant that not all advantages of the EPR could be obtained at once as the remainder of the clinical departments at Aalborg Hospital did not take part in the project and thereby did not possess an electronic record. The report, provided by the consulting company Ankerhus, concludes that the working procedures at unit T have become more structured and organized compared to the situation before the EPR implementation. Furthermore, the majority of the healthcare professionals state that they have more time for the patient treatment as a consequence of the implementation.

The effects and advantages, however, perceived by the different healthcare groups, vary to a certain degree (Ankerhus 2002). The doctors and the secretaries state that they have obtained saving of time and they recognize a higher quality on certain aspects after the EPR

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[7] The EPR system, introduced at the department of cardio-thoracic surgery, is developed by IBM and is a so-called first generation system. These types of systems are based on chronological and source dominated documentation structures reflected in a separation of nurse and doctor notes – i.e. the healthcare professionals do not write in each others' records. The Danish EPR Observatory recommends second generation systems with a more interdisciplinary documentation structure. Such systems are not yet fully developed, however, at present seven so-called GEPKA projects have been established in order to test a fundamental structure for EPRs (also called G-EPJ). The basis of this structure is an interdisciplinary sequence and a diagnose-oriented way of documenting the treatment of the patient where estimations, objectives, planning, actions, and evaluations are documented in the record. Ref.: Sundhedsstyrelsen (2000). Forslag til grundstruktur for udveksling af oplysninger i elektronisk patientjournal. København.

implementation. On the contrary, the nurses have a sense of an increase in the time spent on a majority of their working procedures. This group underlines a decline in the patient quality in general and state that the EPR system has failed to replace their paper based note system (in Danish called "kardex") which was highly structured and organized.

5. Research Findings

5.1 Coding the Interviews

Through the interview, the informants were to comment on whether some of the index cards were related to the same topic or unit of analysis. This process of grouping the cards during the interviews and the following reading of the transcripts have resulted in the grouping illustrated in the first two columns in figure 4:

Unit of analysis	Index cards	Average of importance (1-5, where 1 is 'very important' and 5 is 'not important')	Number of informants commenting on the groups (max 14 informants)
Support	o Support on the ward o Training of super users (competences)	1,29	14
User training	o Basic computer training o EPR user training o User training in changed work processes o Follow-up user training	1,63	14
EPR workstations	o Establishment of EPR workstations	1,71	6
Integration between EPR and other systems	o Integration between EPR and supporting systems	1,93	6
Information activities	o Information activities	1,99	6
Work processes (analysis, design, and optimization)	o Analysis of work processes o Design of new work procedures o Optimizing of work procedures	2,38	4
EPR system	o Definition of terminology to be contained in the EPR o Selection of EPR system o Setting up the EPR on the ward o Upgrading the EPR o Support and maintenance of the EPR at the ward	2,64	7

Figure 4 A prioritized list of the index cards

As shown in the figure, the area of "support" covers the index cards of "support on the ward" and "training of super users (competences)". The area of "user training" covers the

22

index cards regarding "user training in IT", "EPR user training", "user training in changed work processes", and "follow-up user training" and so forth with the rest of the groups.

In column three in the figure, it is indicated how the nurses ranged the different groups related to their importance in the EPR implementation process according to the Likert scale mentioned above. The first five areas were rated to be very important and will therefore be commented on in the analysis. The remaining of the index cards has *not* been rated to be that central by the informants and they will therefore not be subject to analysis. Finally, column four shows the number of informants who actually did comment on the different areas. Support and user training have been commented on by all the informants. This will be elaborated on below.

5.2 Content Analysis

The responses obtained in the interviews, by using a laddering technique, are rather distinctive from one informant to another. It is therefore necessary to perform a content analysis and to sort the data into a limited number of categories. To be able to carry out this classification, each interview was first of all tape-recorded and typed out. From the transcribed text, a definition of the means, the ends and their relations, using the informants' own expressions, was made and a thorough content analysis of all elicited concepts was conducted. Categories were developed to capture the main thoughts expressed by the informants on an attribute, a consequence and a value level in a so-called coding table. Coding tables have been worked out on the following areas (cf. figure 4 above):

1) Support
2) User training
3) EPR workstations
4) Integration between EPR and other systems
5) Information activities

These five areas will be treated separately in the sections below.

It is recommended to work out the coding table based on a theoretical basis (Grunert, Grunert et al. 1995). This table is then to be extended and adjusted to the specific context during the analysis of the transcripts founded on an iterative process. However, it was rather difficult to find an appropriate theoretical basis for developing the coding table that would fit this particular context as it is a rather new area of research. This is the reason for choosing a more explorative approach where the coding table is generated on the basis of the transcripts, which is much according to Kvale's recommendations on how to code qualitative interviews (Kvale 1997). Each interview was narrowed down into different categories according to the statements of the informants. These categories were the point of departure for creating the coding table that was continually adjusted. In order to ensure a

strict correspondence between the coding scheme and the interviews, two people individually worked out coding tables on each of the areas mentioned above. The tables were subsequently compared and the final coding tables were developed (cf. appendices 2-6 for an overview of the coding tables).

It is rather complicated to determine the level of abstraction when developing the categories in the coding tables. According to theory, the categories should be so comprehensive that more than one informant makes a statement that can fit a category. However, they should not be so comprehensive that they will not make any sense (Reynolds and Gutman 1988; Grunert, Grunert et al. 1995). A rather low level of abstraction in the coding table was chosen. This will of course lead to many categories and may in the end result in few answers within each category. This approach will, however, leave us the possibility for joining some of the categories later on.

A structural analysis was conducted to identify the relations between the categories at different levels. The relations between the means and ends within the five areas mentioned above were analyzed by using a program called MECAnalyst. For each informant, the relations between the attributes, consequences and values were typed in the program. The total of relations between each element is noted in a correlation matrix, one for each of the five areas: Support, user training, EPR workstations, integration between EPR and other systems, and information activities. These matrices are shown in the appendices 7-11. The matrices represent the number of times an element indicated in one of the rows (e.g. attributes, consequences and values) directly or indirectly relate to an element indicated in one of the columns (e.g. consequences and values). In appendix 7 (concerning the area of support) the element of "IT competences of super users" (A5) leads to the "possibility to solve a problem at once/get help" (C2) one time directly and three times indirectly.

The analysis served as the basis for developing a HVM on each area, as illustrated in the sections below. All chains cannot be represented in the hierarchical map as it would be too complex and too difficult to interpret. This is why a cut-off level is set. A cut-off level is defined as: "'*The minimum number of times two elements must have an indirect link to be mentioned in the hierarchical maps*" (Skytte and Bove 2004, p. 15). A high cut-off level will ensure that many informants have mentioned the relations indicated in the HVM, which will provide a good opportunity for generalizing the results. However, a lot of information will be lost in designing the value map. A low cut-off level will provide a more substantial map, however the possibilities for generalizations will be poor. The limit for the cut-off level is normally from three to five depending on the size of the sample. Reynolds and Gutman recommend a cut-off level that appears to be at the time the most informative as well as the most stable when it comes to representing the set of relations. They also point out that a cut-off level of four relations is typical for a sample of 50 informants (Reynolds and Gutman 1988, p. 20). Skytte and Bove recommend a cut-off level that will represent

between 50-70% of the relations. In their study with 12 informants, they set the cut-off level at three (Skytte and Bove 2004). The dilemma when making the HVM is therefore at what level to make the cut-off. It has to be low enough to include as much data as possible from the interview. However, it should not be so low that it yields a map too incomprehensible.

In this study, there are 14 informants and from 38 to 190 chains (depending on the five areas of analysis). The areas of user training and support are far the biggest areas and have been prioritized as the two most important areas by the nurses. The three remaining areas have only been commented on by half of the informants. The cut-off level 2 preserves the chains that the theory prescribes, however it may seem a bit difficult to get an overview of the results. At the cut-off level 3, the amount of chains is reduced within the five areas, but it provides the reader with an overview. Finally, the cut-off level 4 is not useful in this study as it in most of the cases provides too small a number of the total chains or relations and not much information will be left to interpret the results. Therefore, the cut-off level 3 is chosen for the areas of support, user training, EPR workstations, and information activities as is prescribed by the theory and as it gives a good overview of the means and ends that are mentioned by the nurses. When it comes to the area of integration between EPR and other systems, a cut-off level 2 is chosen. A cut-off level 3 only represents 30% of the active links.

The HVMs represent the most common and dominant relations and categories between attributes and consequences, and between consequences and values mentioned by the nurses (Björk 1993). The value maps will be discussed separately in the sections below, starting with support.

5.2.1 Support

The HVM illustrated below in figure 5 represents the most common and dominant relations and categories between the means and ends when it comes to the area of support. All in all, 9 categories were classified as attributes, 13 were classified as consequences, and 10 as values when it comes to support (cf. appendix 2 on the different categories). As mentioned, it is difficult to determine how many categories to extract from the interviews. The more categories, the harder it is to interpret the data. However, few categories can mean a loss of data and precision. The coding process was accomplished by two coders. This was done to compare the content codes and to compare the findings from the coding in order to meet the criteria of validity and reliability (cf. part 6). It was important to ensure a coding as close to the informants' interpretations as possible and thereby to make the coding process as transparent as possible.

On the basis of the categorization process, a correlation matrix was constructed, see appendix 7. This matrix shows the number of times a chain (or relation) appears between different means and ends (i.e. attributes, consequences and values).
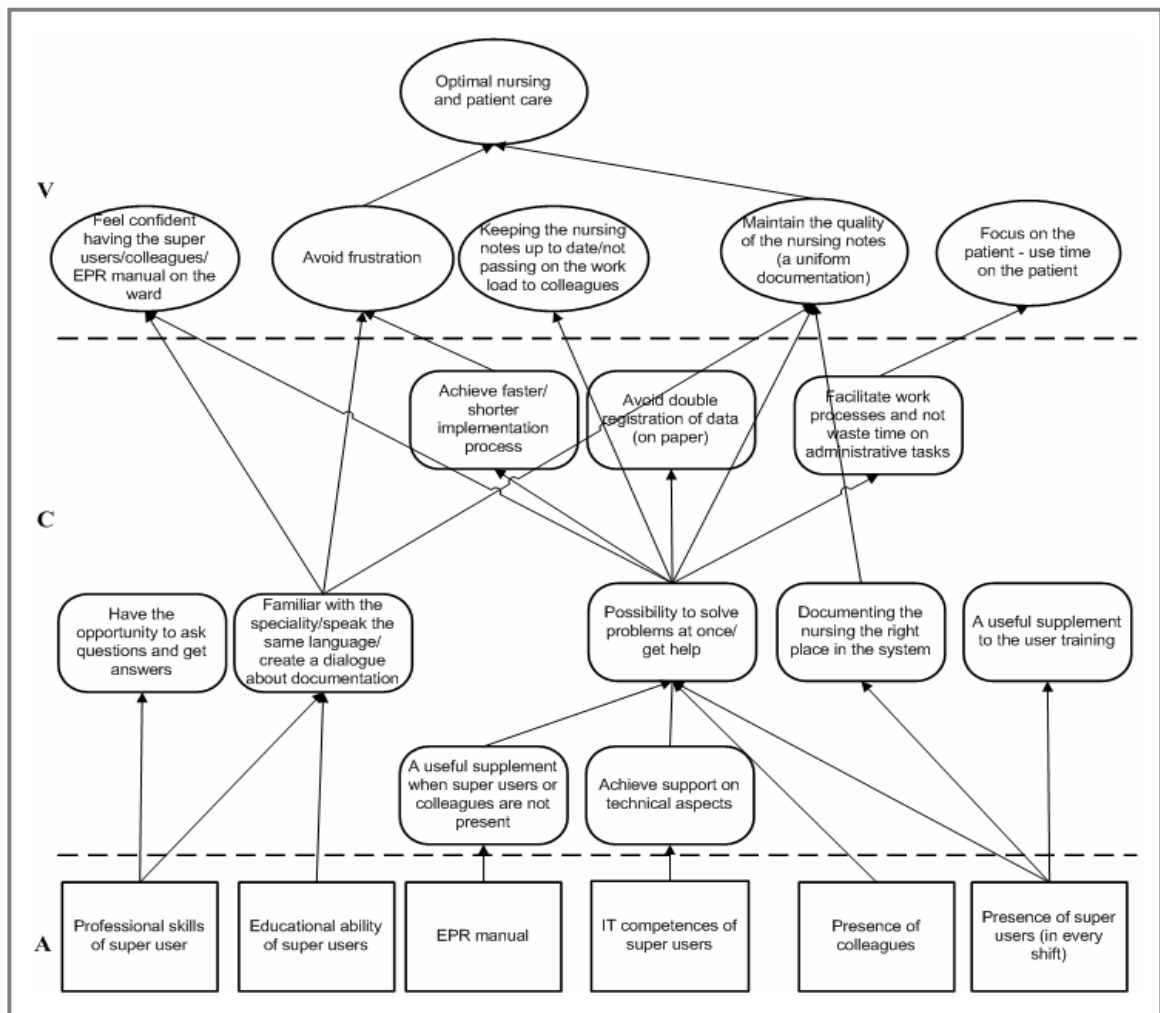
Figure 5 HVM: Support

The attributes or activities illustrated in the HVM are considered to be of significant importance to the nurse professionals when it comes to the area of support. The main attributes in the HVM can be categorized as:

- Presence of super users in every shift
- Presence of colleagues
- Presence of the EPR manual at the ward
- Professional skills and educational ability of super users
- IT competences of super users

These areas will be discussed in succession below.

Presence of super users in every shift

At unit T, thirteen healthcare professionals were trained as super users (including doctors, secretaries and nurses) – among them eight nurses. During the first three months of the implementation process, there was a super user present in every shift to help and support the remaining of the nurse group in using the EPR. The majority of the nurses consider the presence of super users in every shift as highly important when it comes to implementing the EPR. There are several reasons for that: First of all, the presence of super users on the ward makes up a useful supplement to the user training. The majority of the nurses only received four hours of training and it is therefore considered to be important that someone is able to supplement the training sessions, i.e. to help the remaining colleagues to use the EPR in their daily work procedures:

> *Interviewee (1): It would have been an advantage if all the nurses obtained a super user level from the beginning. However, it is not possible in our working day because it requires a certain amount of extra training. Everybody could have needed this training however the resources were allocated elsewhere. It is therefore important that we [the super users] can help the others.*

Second of all, the presence of super users in every shift ensures that the nurses get an overview and an understanding of the EPR whereby the documentation of the nursing care is done correctly (e.g. under the right terms and search functions) in the system:

> *Interviewee (6): Very quickly you make up some arguments claiming that the system is inappropriate. Then you start documenting the nursing under a wrong term or in a wrong place in the system. It is not to the benefit to anyone that you write an entire note under the term "short notice".*

Documenting the nursing correctly in the system is based on the value of being able to maintain the quality of the nursing notes and to ensure a uniform documentation. This is a very important value for the nurses and a central aspect of their job:

> *Interviewee (6): Unless everyone does it correctly and alike, some things will fail. We are very careful about ensuring that we do the things the right way.*

> *---*

Interviewee (6): Otherwise, I do not know how to document my nursing and how to report my things to my colleagues. There is a documentation claim in our job and you can be held responsible if it fails.

This value leads to the superior value of achieving an optimal nursing and patient care.

Finally, the presence of super users ensures the possibility to solve problems at once and for the nurses to get help if they cannot perform their daily tasks. This consequence of being able to get help and solve problems at once is a central aspect when it comes to support, as illustrated in figure 5:

Interviewee (14): It is nice that they [the super users] are there when several of us have a problem.

Interviewee (14): At the same time we had the super users to help us if we got stuck.

Interviewee (4): At that point, you have someone to ask for help when you use a lot of time on something that you used to know how to do.

The aspect of solving problems at once and to get help has had different outcomes, both on a consequence and on a value level. On a consequence level, it means a facilitation of the work processes and not a waste of time with regard to administrative tasks:

Interviewer: What happens on your ward if you experience too much trouble with the computer?

Interviewee (4): You know we would like to spend our primary time together with the patient and a small amount of time on admini- strative tasks. Then there is more time together with the patient.

This consequence is considered to be central as it ensures the value of focusing on the patient and using quality time on the patient, which is another aspect characterizing the values of the nursing group.

Another consequence, when it comes to solving problems at once and getting help is to avoid double registration of data on paper:

Interviewer: What would have happened if the super users were not present?

Interviewee (2): Then it would not have been so easy to carry it through [the implementation]. Then we would have been obliged to document the nursing on a piece of paper. If you do not know how to write a nursing letter (…) which is to be sent to the home care, then you start writing something on a paper.

Interviewee (5): We were a couple of nurses who were tired of that. We were not able to write a nursing letter to the home care, because of some specific terms and other things. At the end, we had to handwrite it.

If a problem can be solved at once, when the nurse is using the EPR system, she will not be compelled to write the notes on a piece of paper until the problem can be solved. A last consequence of solving problems at once is the fact that the nurses are able to achieve a faster and shorter process as to implementing the EPR system:

Interviewee (2): There has always been someone to ask and to guide you through all this. In that way, you will be able to learn to use it [the system] much faster. Then it will sooner become a profitable system. And it will sooner become a success.

This leads to an important value of avoiding frustration and finally it ensures that the nurses accomplish an optimal nursing and patient care:

Interviewer: What does it mean to you that you get through these frustrations much faster?

Interviewee (3): Then they are gone and you do not have to remember all the different things. If your head is full of ten things that you are not able to accomplish in the EPR system at the office then you do not listen to and experience all the things that you have to do when it comes to the patient.

The consequence of solving a problem at once also fulfills the value of feeling confident with the super users on the ward:

> *Interviewer: Why do you think it is important that you feel confident with the super user?*
>
> *Interviewee (12): Well, if you are not confident and if you have a feeling of bothering the super user, then you will not ask questions about anything. And then there are some things that you will not get because you do not ask.*
>
> *---*
>
> *Interviewee (3): It made me feel confident knowing that whenever I was working, there was always someone who knew the system better than me.*

This confidentiality is a highly important aspect from a nurse point of view.

Finally, the possibility to solve a problem at once and getting help leads to the fact that the nurses keep their nursing notes up to date and do not pass on the work load to colleagues:

> *Interviewer: Why is it important that you get your things done?*
>
> *Interviewee (5): Otherwise, I will forget what I was just doing. I prefer to get the things done right away. It suits my work procedures best. Or else, it is only half-done.*
>
> *Interviewer: What happens if you do not get your things done at once?*
>
> *Interviewee (5): Then they will be postponed. And then my colleague who will be on the shift after me will have to take over where I left.*
>
> *Interviewer: How do you feel if someone has to take over where you left?*
>
> *Interviewee (5): If it cannot be otherwise, then it is ok. We are here to help each other, but it is always better if you get your things done – both for me and for my colleague.*

Presence of colleagues

The presence of colleagues in the daily work procedures is equally considered to be a central support factor when implementing the EPR:

> *Interviewee (12): I received help from my colleagues. Sometimes, they know some things that I do not know, and sometimes I know how to do other things. In that way, we have been able to complement each other.*
>
> *---*
>
> *Interviewee (9): Some of my colleagues knew more than I did. So, I was able to ask them on aspects with regard to using a computer, not really on how to use the EPR. Even though they were not super users, I was able to use them to get help.*

During the interviews, the nurses have expressed the presence of the colleagues as highly important and almost equal to the presence of super users. This attribute leads to the possibility of solving problems at once and getting help when that is needed, which is one of the consequences when considering the presence of super users. The consequence of getting help at once and solve problems is discussed above and will not be described in further detail here.

Presence of the EPR manual at the ward

The fact that there is an EPR manual at the ward has also been appraised by the majority of the nurses during the interviews:

> *Interviewee (12): They have been writing an EPR manual. And it is a useful thing having the manual at hand if you are in doubt on how to accomplish some tasks [in the EPR]. For example, if you are working in a shift and have to hospitalize a patient, which is something that we rarely do because it is the task of the secretary, then it is useful to know where you can find this type of information.*

The manual, which also includes laminated guidelines, is considered to be a useful supplement when the super users or colleagues are not present at the ward or do not have time to help:

> *Interviewee (8): There were some main points that were listed on laminated paper beside the computer screens so they are easy to find. These papers are accessible right away. And the paper is not*

crumpled. It actually means a lot to us. We have received some A4
pages and they are accessible and incredible effective. It works very
well.

The manual is also considered to be important if the nurse wishes to solve a problem on her own. The presence of the manual as a supplement to other types of support means that the nurses are able to solve problems at once and get help. Again, this is one of the main consequences when it comes to support, and the further consequences and values of this aspect have been outlined above.

Professional skills and educational ability of super users

The nurses that were appointed to be super users had a thorough knowledge of the nurse profession and were able to guide their colleagues based on a clinical point of reference. When it comes to the competences of the super users, the nurses stress their professional skills:

> *Interviewee (8): It is an advantage with people from our own*
> *profession. They are far better at describing and understanding the*
> *examples … because we have a common way of thinking.*

> *---*

> *Interviewee (9): Of course, they know more about the EPR and they*
> *have a specific background when answering our questions.*

Similarly, the educational ability of the super users is considered to be an important competence:

> *Interviewee (6): It is important that they know how to teach someone*
> *who are just normal users.*

> *---*

> *Interviewee (12): It has something to do with the ability to provide us*
> *with a knowledge that is comprehensible and useful.*

> *---*

> *Interviewee (9): They need to be able to sense what learning level you*
> *are on. There are many different levels and they need to use that as a*
> *point of reference.*

The professional skills are important because of the opportunity to ask questions and get an answer to a specific question. Another consequence of the professional skills and the educational ability of the super users is the fact that the super user is familiar with the speciality of the nurses and s/he speaks the same language, i.e. use the same technical terms. This means that the nurses and the super users can create a dialogue about how to document the nursing care in the most optimal manner for all parties:

> *Interviewer: Why do you think it is important to have some super users that have some kind of nursing experience?*
>
> *Interviewee (13): Because they know the rhythm on our ward. And we are not to discuss that rhythm and how we shall perform things.*
>
> *Interviewer: What do you mean by rhythm?*
>
> *Interviewee (13): I mean the daily work procedures. You know, how the nursing has to be accomplished. This was not a question. We all had the same judgment on how to take care of the patient.*

The familiarity with the speciality leads to three different values, namely the value of being confident having the super users on the ward, avoiding frustration, and maintaining the quality of the nursing notes and thereby withhold a uniform documentation within the nurse group. The two latter values result in a value on a more abstract level, namely that of optimal nursing and patient care.

IT competences of super users
Another competence of the super users considered important is their IT skills. It is important that the super user have technical knowledge about computers in order for the nurses to achieve support on more technical aspects:

> *Interviewee (6): It is important that you choose someone who has some kind of flair for the EPR system, for computers.*
>
> *---*
>
> *Interviewer: You mentioned before that they [the super users] need to be skilled in IT?*
>
> *Interviewee (7): Yes, there are a lot of things they need to know and must be able to do. They need to know where to find the '@' and how*

to take a short cut from one frame to another. They have to be very skilled in IT.

The IT skills are considered to be central among the nurse group. The support on technical aspects will lead to the possibility to solve problems at once and to get help, which is one of the main consequences mapped in the HVM. The reader may confer the section on the presence of super users for elaboration on this aspect.

This section has been dealing with important characteristics when it comes to the area of support in the EPR implementation process. The hierarchies and relations mapped in the HVM have been elaborated on in order to provide an understanding of the nurses' perceptions. In the following section, the area of user training will be discussed.

5.2.2 User Training

Figure 6 below displays the categories when it comes to user training on an attribute, a consequence and a value level.
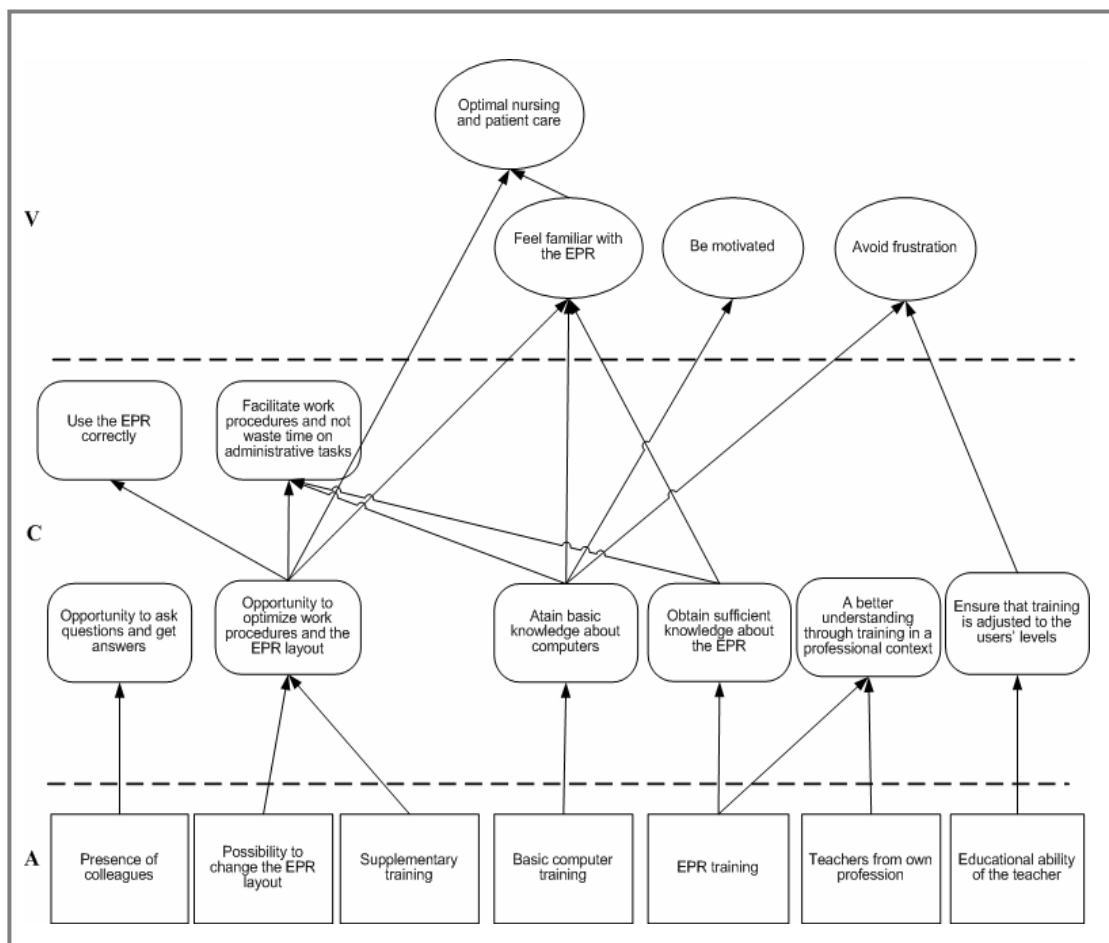
Figure 6 HVM: User training

15 categories were classified as attributes, 13 were classified as consequences, and 11 as values when it comes to user training. On the basis of the categorization process, a correlation matrix was constructed, see appendix 8. Not all these categories are represented in the HVM as it is only the most dominant relations that are included in the ladder map.

The main attributes in the HVM, when it comes to user training, can be classified as:

- Basic computer training
- EPR training and teachers from own profession
- Educational ability of the teacher
- Presence of colleagues
- Possibility of changing the EPR set-up/layout and supplementary training

Each of these areas will be commented on below.

Basic computer training

The majority of the nurses at unit T were not skilled in using computers when the EPR implementation was first initiated. A survey was carried out in the beginning of the imple-mentation process to get a picture of the IT competences among the nurse professionals. This examination indicated that there was a rather important need for basic computer training (IT-Sundhed 2002). Sessions in computer training were therefore provided to the nurses who did not have the basic skills. The computer training was organized as group instruction and as e-learning sessions.[8] The training consisted of how to start up a computer, how to use the Internet and the mail system, and how to use different clinical systems such as the patient administrative system (PAS).

A nurse who did not have much computer experience before the EPR implementation explains why basic computer training has been important:

> *Interviewee (8): It is all about being able to relate to the computer, become familiar with it, and go beyond your limits. Tell yourself that you are able to use it [the computer] and that nothing terrible will happen if you push a wrong key...It is important to obtain this confidence.*

The nurses who needed some basic computer training all got two sessions of four hours. Basic computer training was considered as an essential activity in the implementation process as it helped the nurses to attain basic knowledge about computers on a consequence level (cf. figure 6):

---

[8] E-learning is Internet based lessons.

Interviewee (1): For me it was important that everybody felt prepared for working on it [computer]…that you have some kind of basic knowledge about computers. There were some basic things that you need to be able to do.

The basic computer training was considered to be essential. However, the majority of the nurses criticize the e-learning sessions:[9]

Interviewee (3): We started out having some e-learning. It was not very easy when you are not used to working on a computer.

Interviewee (1): It was not worth the effort, the e-learning, to sit there all by you self and get familiar with it. Perhaps it is a good way for some [to learn how to use a computer] but it is not optimal for others and it definitely was not optimal for me.

The basic knowledge about computers, when ignoring the e-learning, meant that the nurses were able to facilitate their work procedures and not waste time on administrative tasks:

Interviewer: Why is it important to you to be familiar with computers?

Interviewee (12): Well, it facilitates the daily work procedures, when you later on have to use the electronic patient record. You know by then what to use the different keys on the keyboard for.

Interviewee (1): It is very time consuming for those who have never used a computer before, to type all the information on the computer, if you are not able to type very fast. It is much more time consuming than normal handwriting. We are very busy at the ward, and we should not spend all our time at the office. We have some patients to take care of.

Second of all, the basic computer training made the nurse group feel familiar with the EPR later on, and it helped them in being motivated for this implementation and for using computers. Finally, it implied that the sense of frustration among the nurses was reduced:

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[9] The aspect of e-learning is not included in the HVM in figure 6 as it was only a minority of the nurses who mentioned that aspect.

Interviewee (2): I got much more relaxed [after the basic computer training].

Interviewee (12): I think it is important to understand it [the computer] and be able to work with it...If not, you will quickly give up and you will have a negative attitude towards it.

By being familiar with computers and with the EPR system, the nurses had a sense of being able to provide an optimal nursing and patient care:

Interviewee (12): You need to be able to control things so that you are not afraid that something will fail when it comes to the patients. That all the information gets lost and your nursing gets poor.

EPR training and teachers from own profession

After the basic computer training, the nurses were trained in using the EPR. This training was, similar to the basic computer training, divided into group sessions as well as e-learning. The group sessions were provided by two teachers – a representative from the nurse group and a doctor. Super users were trained for four days and normal users received four hours of EPR training in small groups of eight to ten people. The basic computer training and the EPR training were provided from October 2000 until January 2001 (IT-Sundhed 2002).

Not surprisingly, the nurses evaluated the EPR training as an important aspect in the implementation process:

Interviewee (6): It was some relevant things we were taught in [EPR training]. They used some relevant examples and we tried to work with some familiar things.

Interviewee (10): We went off to some other premises and I think it was really good. It was very useful for me, the way it was. There were two or three teachers and some super users, I do not remember how many. And then we sat there in front of the computer screen and went through all the aspects in the EPR. We were to try out ourselves what they showed us – the procedures on the overhead. I think it was the right way to do it.

Another important attribute was the fact that the teachers were from the nurses' own profession. This meant that the nurses could obtain sufficient knowledge about the new patient record. Furthermore, it meant a better understanding through training in a professional context on a consequence level:

> *Interviewee (3): ...Jens [one of the teachers] had accommodated it himself [the layout of the system]. It was him and Hanne [the other teacher] who designed it together...In that way, it became more personal for us than if it was a consultant from IBM.*

> *---*

> *Interviewer: Why was it important with teachers from your own profession?*

> *Interviewee (4): They know what is relevant for us. They do not teach us in things that are not that relevant.*

The knowledge that the nurses gained about the system through the EPR training led to consequences such as a facilitation of the working procedures and not wasting time on administrative tasks. Finally, a consequence mentioned by the nurse group was obtaining familiarity with the system. The familiarity concluded in an optimal nursing and patient care on a value level.

Educational ability of the teacher
The educational ability of the teacher was also rated as an important factor when it comes to user training:

> *Interviewee (10): I think the teachers were very good... If we had a problem that we did not know how to solve, they simply came down to help us. And then the rest of the class just waited for you to catch up.*

> *---*
> *Interviewee (3): He [the teacher] was amazing. He has an impressive way to teach. Even though you thought "Oh no, I will never learn that", he just helped us all...I left after four hours thinking "when Jens says so, then it will be ok".*

This ability of the teachers ensured that the training was adjusted to the users' levels and it helped the nurses to overcome their frustration as one of their main ends:

Interviewer: What does it imply, if the teaching is not adjusted to your
level?

Interviewee (8): Well, I become angry and irritated, I become really
angry…And then after a while, I will give up and try out some other
solutions.

The nurse group primarily mentions values dealing with being motivated in the implementation process, feeling familiar with the system, and avoid frustration as to using the system. These values all seem to relate to a value on a more abstract level – namely the value of securing optimal nursing and patient care. A nurse mentions:

Interviewee (4): We want to be with the patients. We want to use least
possible time on administrative tasks and more time with the patients.

The overall goal for the nurses is in other words to ensure and maintain the well-being of the patients.

Presence of colleagues
The HVM shows that the nurse group, to a large extend, prioritizes the presence of colleagues in order to get the opportunity to ask questions and get answers to their immediate problems when using the EPR:

Interviewee (5): I was amazed that it [to get to know the system] went
so fast. It was of course because I was stubborn, but my colleagues
were also very good at helping me…and I was not afraid to ask.

Interviewee (6): I have learned from my mistakes. I have discussed it
with my colleagues and tried to feel my way.

Interviewer: Why do you think that it is important for you?

Interviewee (6): I just believe that it is the best way for me to
learn…talking with others and with colleagues.

This support from colleagues seemed to help each nurse to carry out the daily work procedures on the ward (cf. section 5.2.1 for elaboration).

Possibility of changing the EPR set-up/layout and supplementary training
The possibility of changing the EPR set-up and layout was considered to be important by the majority of nurses:

> *Interviewee (14): It was Ulla [the teacher]. She was good at reporting to everybody if she changed something and telling us what direction to take.*

Supplementary training in the use of the EPR was also considered to be a central attribute:

> *Interviewer: What do you think of when you see supplementary training written on this card?*
>
> *Interviewee (6): Then I think that we did not have any supplementary training…It meant that we continued on a sidetrack, we made some mistakes that made us very frustrated…both bad habits and some things that are difficult for us to change now.*

These two attributes provided the nurses with the opportunity to optimize the work procedures on the ward and to optimize the layout of the EPR as central consequences. This opportunity helped facilitating work procedures and reduced the time, the nurses used on administrative task. They did not have the sense of feeling that they wasted their time on administrative tasks:

> *Interviewee (9): Then I do not use too much time on it [writing on the computer]. And then I will have more time available to take care of the patients.*

Furthermore, the optimization of work procedures and of the EPR layout resulted in them using the EPR correctly. This consequence must be considered to be primarily based on the fact that the nurses got supplementary training. Finally, the opportunity to optimize the layout and the work procedures is based on the value regarding an optimal nursing and patient care:

> *Interviewee (9): All in all, it will mean something for the patients, that they will get a better treatment.*

Again, the overall value is to ensure good conditions for the patients.

In the second quarter of 2001, the pilot operation of the EPR was initiated at unit T. Five computers were placed at the nurse office and one computer at the office of the nurse in

charge. The set-up of EPR workstations was considered as a central activity in the implementation process and will be elaborated on below.

5.2.3 EPR Workstations

When it comes to EPR workstations, 3 categories were classified as attributes, 5 were classified as consequences, and 8 as values. Again, a correlation matrix was constructed on the basis of the categorization process, see appendix 9.
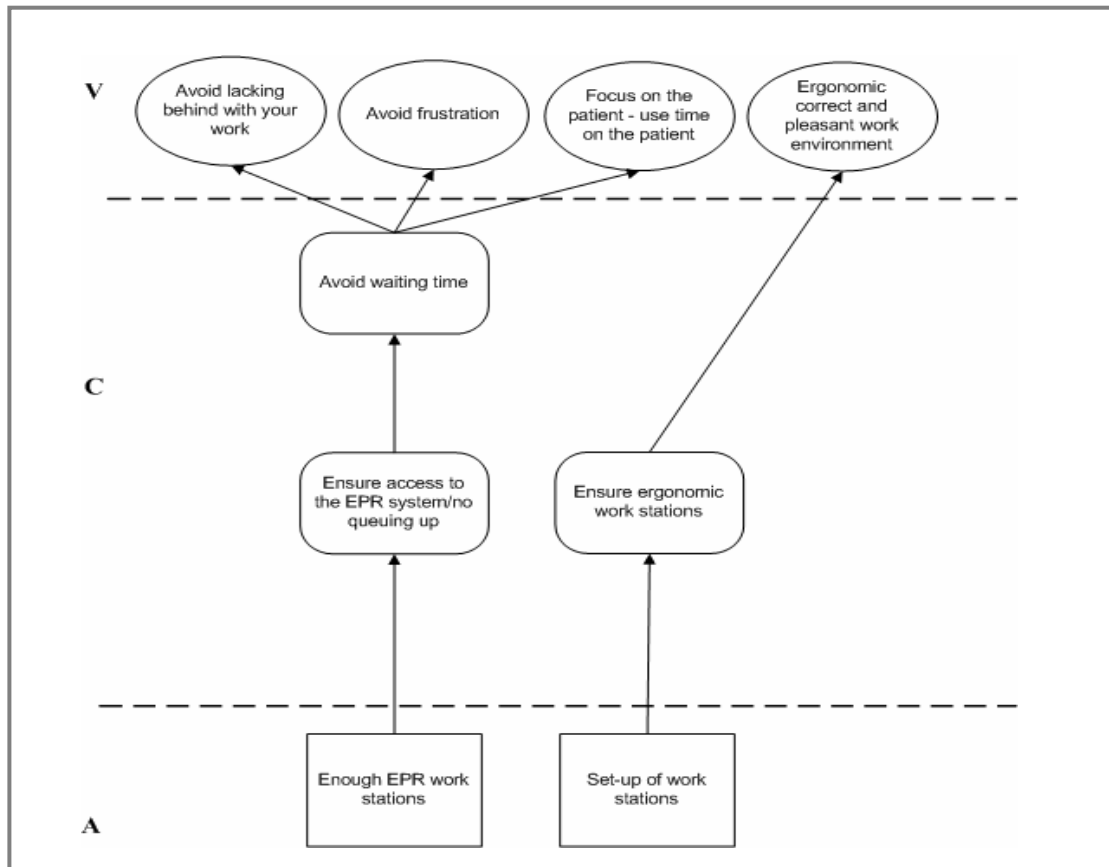
Figure 7 HVM: EPR workstations

The attributes, consequences and values illustrated in the HVM in figure 7 are considered to be of importance to the nurse professionals when it comes to setting up EPR workstations at the ward. The main attributes in the HVM can be classified as:

- Enough EPR workstations
- Set-up of workstations

These two areas will be treated in the following.

Enough EPR workstations

The six nurse professionals, who have commented on the area of EPR workstations, have rated the number of workstations as a very important factor. This attribute is central as the right number of workstations ensures access to the EPR system and no queuing up in order for the nurses to attain information from the system or to document the nursing in the system. Two nurse representatives explain:

> *Interviewee (10): The most important thing is to have access to a computer at the ward. We did not always have access in the beginning. There simply were not enough computers so we had to work by turns. Of course it was irritating to be the last one [accessing a computer].*
>
> *---*
>
> *Interviewee (14): The basic critic is probably that there are too few computers for the number of people who have to use them. The doctors often come, we have many doctors coming, and we have to make sure that they can access the EPR and read what we have been documenting about the patient.*

The basic problem about queuing up or not having access to the EPR system leads to waiting time as another consequence. This bottleneck is especially a problem at the changing of the shift in the morning where the nurses have to read about their group of patients and in the late afternoon where they have to document their nursing notes in the system:

> *Interviewee (10): In the morning we sit and read in the EPR, while in the afternoon we have to document on what has happened during the day. We are only nurses on the ward and we all need to use the computer. We are many users. And it can still be a problem that we have to wait.*
>
> *---*
>
> *Interviewer: What do you mean by having enough computers at the ward?*
>
> *Interviewee (8): We have to have enough computers to be able to access the EPR. It must not be too often that we shall have to wait.*

It is a central aspect for the nurses to avoid this waiting time in order to avoid lacking behind with their work and to avoid frustration. Furthermore, one of their main values is to

focus on the patient and to use time on the patient. It is especially the fact that they lack behind with their work that is frustrating:

> *Interviewer: Why is it important for you not to wait to get access to a computer?*

> *Interviewee (8): Because you have to be able to organize your work in practice as well as the tasks at the office. So, if you have the opportunity to leave the patient care and if you have ten minutes. Then you enter the office and you cannot document your nursing because you cannot access a computer, then what do you do?*

Another nurse agrees with that point of view and continues:

> *Interviewee (10): I have problems in waiting. It is not that frustrating if you are only responsible for one patient, but if you are in charge of several patients then you are impatient about getting started. And then you are one step behind for the rest of the day.*

It is also very frustrating for the nurses if they have to use time on waiting to get access to a computer. A nurse argues:

> *Interviewer: What does it mean that you have to wait to access a computer and at the same time, you know that the patient needs you?*

> *Interviewee (10): You get very stressed and frustrated. There will be quite some things that you will not be able to do. Again, it has something to do with your overview – it tends to slip.*

Again, this statement shows that the focus is on the patient. One of the nurses states that:

> *Interviewee (14): My nursing is with the patient. I shall not use my time on sneaking out to get access to a computer.*

As it has been illustrated above, the facility to access a computer during the workday is considered as an important aspect closely related to different ends (consequences and values). Another important aspect is the set-up of workstations at the ward.

Set-up of workstations

The majority of the nurses favor a pleasant work environment at the ward. Therefore, the placement and the set-up of the EPR workstations on the ward is an important aspect when it comes to the implementation process:

> *Interviewee (8): You need the right tools to fulfill your tasks. And then it has something to do with the right heights and the right light and so on in order for it to be as optimal as possible.*
>
> *---*
>
> *Interviewee (10): It is so packed at the office. We have five computers...*

It is important for the nurses that the set-up of workstations has been thought through during the implementation process. The main consequence is to ensure ergonomic workstations at the ward which is related to the value concerning an ergonomic correct and pleasant work environment:

> *Interviewee (13): We wanted it to be attractive, for example to get flat-screens. We really had to fight for that. And the computers require a lot of space and it has changed how it used to be.*

Finally, the attribute concerning "laptops on the ward" is not included in the HVM as only a minority of the nurses did mention it as an important attribute when talking about the EPR workstations. The few nurses who mentioned this attribute argued that laptops would facilitate the work procedures and reduce the double registration of data on paper. One nurse explains:

> *Interviewee (1): It is important to be able to facilitate the work procedures...The students use a lot of their time working on the system because they have to figure out how it works. It hinders us [the other nurses] in using the system. And you are so dependent on it. We do not have any laptops. At the office there is a terrible noise level. We are queuing up to get access to one of the five computers. And it is like that every single day.*

In other words, laptops would be a way to avoid the bottlenecks when it comes to accessing the EPR system.

44

5.2.4 Integration between EPR and Other Systems

The HVM below shows the dominant means and ends regarding the area of integration between EPR and other systems. All in all, 3 categories were classified as attributes, 7 categories were classified as consequences and 4 as values. Once again, a correlation matrix was made, cf. appendix 10.
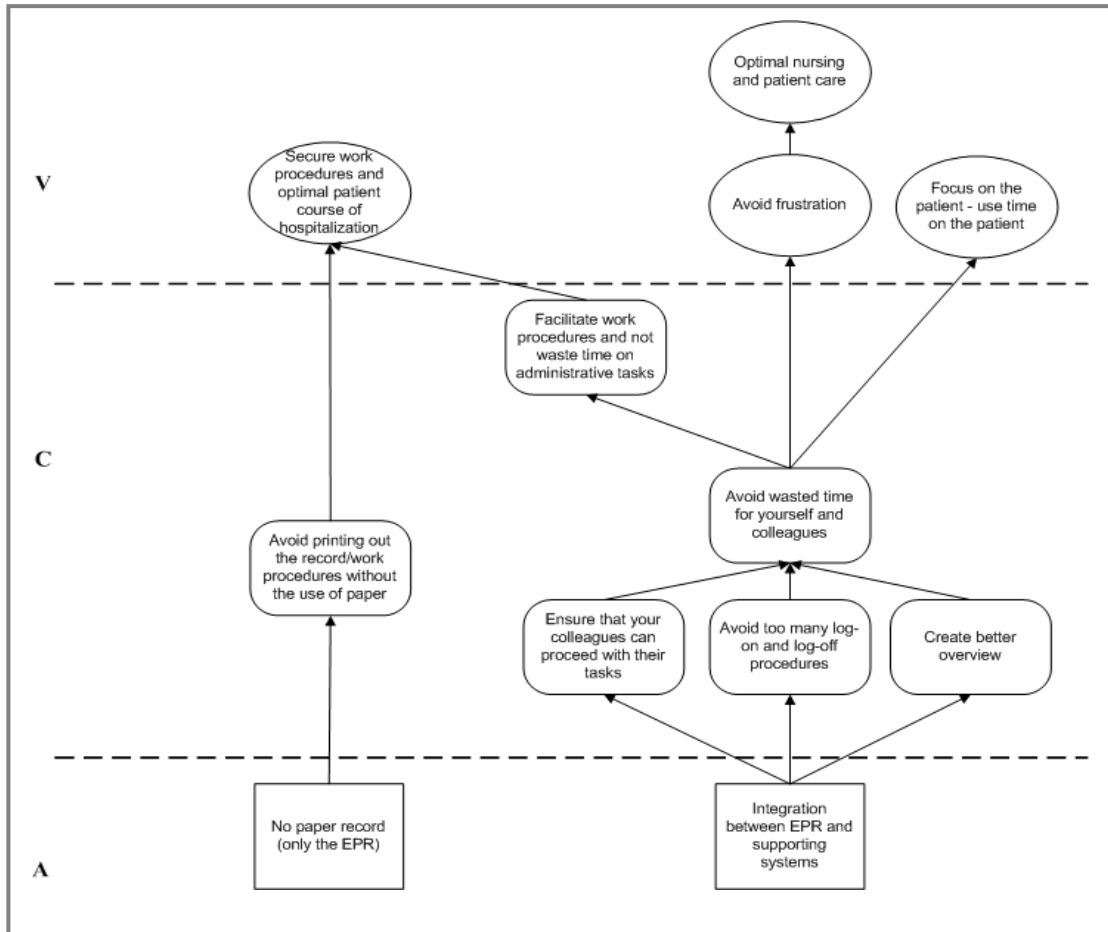
Figure 8 HVM: Integration between EPR and other systems

The main attributes can be classified as:

- No paper record (only the EPR)
- Integration between EPR and supporting systems

These will be elaborated on below.

No paper record (only the EPR)

So far, unit T is the only ward at Aalborg Hospital having implemented the EPR system together with Thorax intensive care unit. This means that the documentation of the nursing and the patient care between unit T and the other wards is still paper based. Furthermore, patients that have been hospitalized before already have a paper based record together with the EPR record:

> *Interviewee (7): It would be nice if the things that were written in the paper record also were integrated in Labka [laboratory system] and the EPR.*
>
> *---*
>
> *Interviewer: You still have the paper record and the EPR? Does that influence your tasks?*
>
> *Interviewee (7): Yes, it actually does. We receive the blood tests [on paper] and show them to the doctors if there is something unusual.*

In the interview, the majority of the nurses declare that they would prefer to work without the paper based record and only use the EPR system as it would ensure work procedures without the use of paper as a main consequence. Thereby, the nurses would not have to print out the record that often:

> *Interviewee (1): … Then you have to print the whole record. It is an enormous task.*
>
> *---*
>
> *Interviewee (1): There is a lot of printing out that we would like to get rid of.*

The fact that the work procedures still include the use of paper means that the nurses do not feel that they can obtain one of their main values – namely to ensure secure work procedures and an optimal patient course of hospitalization. One nurse points out that:

> *Interviewee (5): It would be more secure in the long run [if everything was integrated in the EPR system].*

Another nurse adds:

Interviewee (7): Sometimes, I miss some information if it is not documented in one place. That is why I think it would be an advantage if it was all gathered in one system.

Interviewer: What happens if it is not gathered in one system?

Interviewee (7): First of all, I will have to work against the clock. And sometimes, the information will be missing.

Interviewer: What does it mean if some of the information is missing?

Interviewee (7): Then I need to use time searching for it. And if the information is gone, then I do not know what to do.

Interviewer: Does this have any influence on the patient?

Interviewee (7): In the worst case, it can prolong the course of hospitalization for the patient and it can imply errors as well.

In the quotation, the nurse expresses the importance of ensuring an optimal course of hospitalization and a secure work procedure.

Integration between EPR and supporting systems

Another important attribute mentioned by the nurse professionals is the integration (or the lack of integration) between EPR and supporting systems such as the patient administrative system (PAS), the pathology system, and the laboratory system (Labka). According to the evaluation report from 2002, there have been some problems in integrating the EPR and PAS whereby some adjustments have been arranged for (IT-Sundhed 2002). These adjustments have been made since the release of the report and the integration is now obtained. Similarly, the integration with the pathology system is on its way which will mean that requisitions on pathology and answers on these requisitions will be made through EPR. Finally, the integration with Labka is minimal. The nurses can make orders in Labka from the EPR and the replies are likewise integrated in the EPR. However, other ways of interaction with Labka does not exist.

The attribute concerning integration between EPR and supporting systems implies several consequences for the nurse group such as creating a better overview, avoiding too many log-on and log-off procedures, and a guarantee that the colleagues can proceed with their tasks. When it comes to creating a better overview, a nurse representative mentions:

Interviewer: Why is it important to have this integration between the systems?

Interviewee (5): It safes me some time and it provides me with a better overview.

The time factor is rather important, especially when it comes to avoiding too many log-on and log-off procedures:

Interviewee (5): It would mean a lot to me if everything was gathered in one place instead of having to log off one system and log on to another. If I am responsible for a patient that I have not been taken care of the day before and I need to control whether the blood samples are ordered, then I need to log off VIPS [the nursing part of the EPR] and log on Labka to see what has been ordered. It is a bit stupid. If it concerns an X-ray of thorax [the chest], then I need to log on to a third system.

Interviewee (1): It would be an advantage to have a small window for each program [EPR and Labka], so you do not have to log on all the time.

The integration between the different systems also has an influence on whether the colleagues can proceed with their tasks:

Interviewee (1): The pathology system is not integrated. And PAS neither. We have had a lot of problems with PAS with regard to discharging the patients. We have a practical problem because we as nurses have to discharge the patient in the EPR before the secretary can discharge the same patient in PAS...Every time, the secretary has to wait for us having done that.

The three consequences mentioned above are all related to another consequence at a more abstract level in the HVM, namely that of avoiding wasted time for yourself and your colleagues. The above quotation implies wasted time for the secretary who has to wait that the nurse finishes her task. The same nurse mentions that the hospital porter often has to wait for her printing out the record if a patient has to be transferred to another ward:

Interviewee (1): It is a waste of time for the hospital porter.

48

This consequence leads to yet another consequence as well as two values. The consequence regards the facilitation of work procedures and not wasting time on administrative tasks. This consequence relates to the value of secure work procedures and an optimal patient course of hospitalization which has been mentioned above. The other two values, showed in the HVM, concern focus on the patient and to guarantee a low level of frustration:

> *Interviewer: What does it mean to you that the integration between the systems is missing?*

> *Interviewee (6): It is frustrating. It is irritating that we have to use so much time on it. It is unsatisfactory.*

> *Interviewer: Do these frustrations still exist?*

> *Interviewee (6): Yes, they certainly do.*

These frustrations prevent the nurses from reaching the most preferred value, namely that of providing an optimal nursing and patient care. The nurses want their patients to be pleased about being hospitalized on the ward.

When it comes to focusing on the patient, the nurse professionals highlight:

> *Interviewer: What are the consequences of having to log on and log off the different systems?*

> *Interviewee (1): It is all a matter of time. I personally think it is a waste of time. I would rather use my time together with the patients than sitting by the desk.*

Again, the patient is considered as the main value for the nurse.

5.2.5 Information Activities

The final area of analysis concerns the nurses' perceptions of the information activities in the implementation process as illustrated in the HVM in figure 9. In this case, only 2 categories were classified as attributes, 5 as consequences, and 3 categories were classified as values, cf. appendix 11.
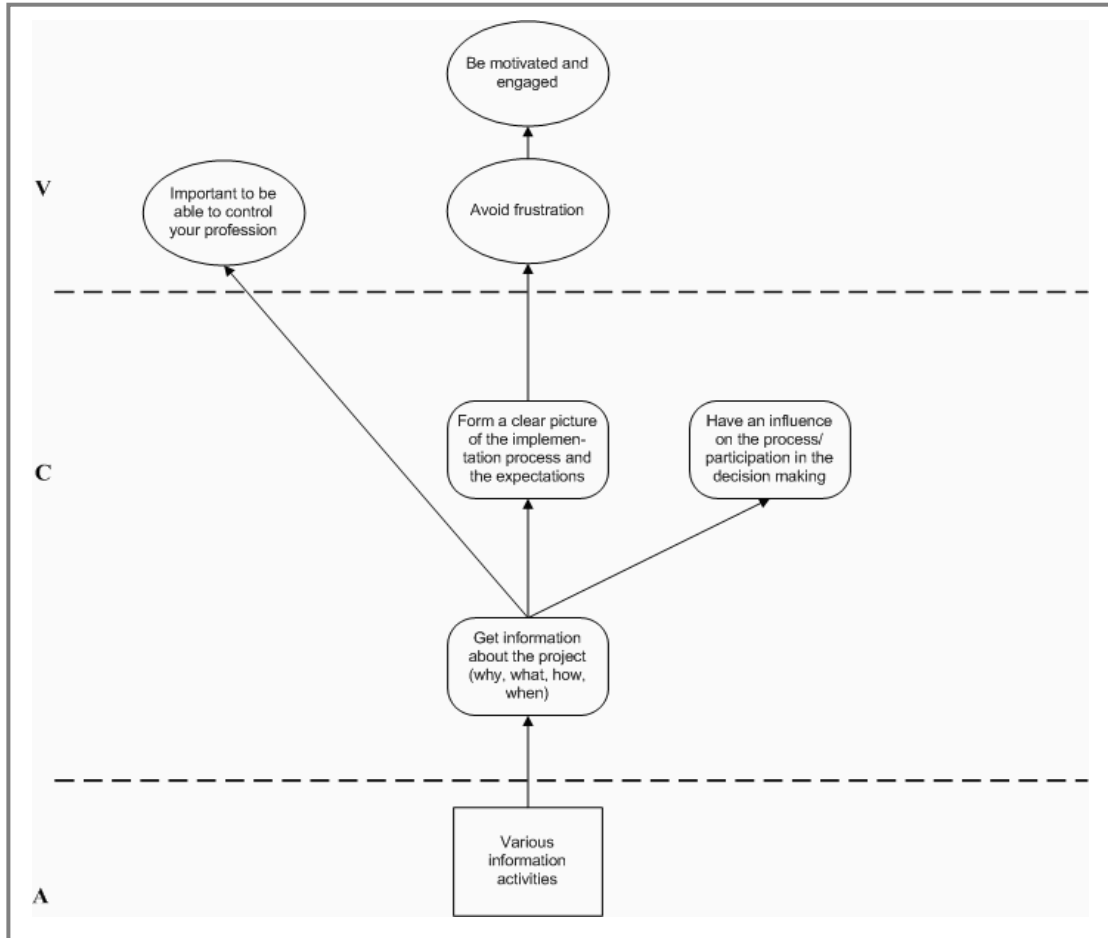
Figure 9 HVM: Information activities

Only one attribute was classified as important by the nurse professionals, namely:

- Various information activities

This attribute and its main relations will be commented on below.

Various information activities

During the course of the interview, the nurses mentioned different information activities which had been important during the implementation process. These activities concerned among others: Information meetings, news letters, information from the super users, the establishment of EPR cafés, and question sessions. In June and August 2000, two information meetings were held for all the employees concerned. At these two meetings, the visions and the purpose of the project were presented. Furthermore, the project schedule was introduced and the EPR system was demonstrated by a representative from another Danish county.

50

The different types of activities will be treated under one heading, namely that of "various information activities" as the nurses did not distinguish between the different undertakings during the interview.

Another attribute, only mentioned by a minority of the nurses, regards the demonstration of the EPR system. This attribute has not been included in the HVM and will not be treated in further detail in the analysis. The few nurses mentioning this attribute related it to the consequence of getting an idea about the structure of the EPR system.

The various information activities relate to the consequence of obtaining information about the project – that is achieving information about the why, what, when and how:

> *Interviewer: What do you think of when it comes to information activities?*
>
> *Interviewee (4): Well, it all started out with a meeting for all concerned in Skovpavillonen where they told us how they would proceed...I remember some more formal meetings. I think there have been two meetings for all concerned.*
>
> *---*
>
> *Interviewee (4): It is all about them informing us about why they chose that particular system and how they intended to train everybody [in using the EPR].*

This information is central as it leads on to two other consequences and one value (cf. the HVM above). The consequence of getting information about the project relates to the value of being able to control the nurse profession. One nurse expresses it in the following terms:

> *Interviewee (2): It is important that you can orient yourself in your daily work.*

One of the consequences is related to the fact that the nurses had an influence on the process and were able to participate in the decision making:

> *Interviewee (3): It is important that you – as a user of the system – will be heard. Otherwise, you loose the inspiration to work with the system...They have always been listening to our wishes.*

The other consequence deals with the fact that the nurses were able to form a clear picture of the implementation process and the expectations:

> *Interviewee (5): It helps if you are able to create a picture of it.*
>
> *---*
>
> *Interviewer: What does it mean to you that you receive news letters?*
>
> *Interviewee (3): I think it is important to know what I am supposed to do and what they expect from me.*

This consequence leads to the value of avoiding frustration and being motivated and engaged. These aspects are mentioned in the quotation below:

> *Interviewer: Why is it important to have an understanding of the process?*
>
> *Interviewee (4): Then I tend to work better. Then, I am able to understand the idea behind it all. Otherwise, I would not be that engaged and I would become rather negative. It influences the whole work procedure. If I have an understanding of why this and that is going on, I tend to do a better job.*

All in all, the information activities are important in order for the nurses to be motivated and engaged when it comes to implementing the EPR system.

6. Implications

This study has shown that MEC can be a useful tool to uncover the means and ends sought by the nurse group when it comes to the EPR implementation. On the basis of this approach, the main relations and the main perceptions of the nurses have been highlighted on areas such as support, user training, EPR workstations, integration between EPR and other systems, and information activities. The laddering procedure has been capable of eliciting consequences and values from an attribute level. This must be considered as encouraging as it is the first application of the MEC approach to an EPR implementation process.

In the sections below, the research contributions will be discussed in more detail, and some of the main implications for future research and for the practical use of the findings will be outlined.

6.1 Research Contributions

In order to consider the contributions of this research study, it is necessary to address issues such as validity, reliability and generalizability.

Validity regards whether the method used has proven to be successful in representing the perceptions of the nurses when it comes to the implementation process (Rekom, Riel et al. 2000, pp. 17-18). In other words, validity concerns whether a method investigates what it claims to investigate. From a quantitative point of view, validity refers to the truth and the correctness of a statement or method: "*…whether a method investigates what it purports to investigate*" (Kvale - forthcoming, p. 158). In more qualitative terms, the concept of validity refers to whether the study thoroughly reflects the phenomena of interest to the reader (Kvale 1997).

It must be assumed that the analysis and the HVMs describe the nurses' perceptions and experiences when it comes to the EPR implementation. This has been ensured by being two persons conducting the interviews and the coding of the results. Furthermore, each informant has been asked to validate his/her answers and the researchers' interpretations in the course of the interview. During each interview, the laddering technique was explained to the informant to facilitate a better understanding and as a validation of the interpretations made. Another possibility or a supplement to the interviews would have been to conduct a focus group with some of the nurses after the analysis to get the results verified and validated. Due to a limit in time and other constraints, it has not been possible to conduct a focus group in this study. It will, however, be considered when conduction future studies. Finally, the interview process and the analysis have allowed the informants to use their own frame of reference when they provide their evaluations of the EPR implementation process. The concept of value termed realism, which is mentioned by Brinberg and McGrath

(Brinberg and McGrath 1985) must be considered to be fulfilled in this study as the relations between attributes, consequences, and values are termed on the basis of the nurses' own frame of reference. Furthermore, direct quotations from the interviews have been integrated to support the means-ends relations represented in the HVMs. Finally, the HVMs are consistent with the nurses' own statements in the interviews.

Reliability refers to the consistency and credibility of the findings and implies whether another study under similar circumstances will produce similar findings (Rekom, Riel et al. 2000; Kvale - forthcoming). In other words, reliability regards whether the findings are reproducible if other researchers are to conduct a similar study at another point of time. The laddering technique seems reliable for establishing concepts and for looking at the means-ends chains. The concepts that have many relations can be considered to be more reliable and robust than those with a smaller number of relations. In qualitative studies, it is rather difficult to ensure the reliability criteria as the findings are often considered to be both context and time specific. This means that the specific field of study might have changed when and if another researcher gets engaged in the same field (Kvale 1997). Furthermore, the study conducted is highly explorative and subjective in nature (e.g. the establishment of the index cards and the coding of the interviews), and it might be difficult for other researchers to reproduce the exact same study. Yet, the coding categories and the list of attributes have been outlined above and are included in the appendices in order to ensure a certain degree of transparency of the process.

It is difficult to determine whether the results of the analysis would have turned out differently if the investigation had been extended to include a larger number of nurses. However, it was not possible to interview other nurses on the Cardio-Thoracic ward in Aalborg as the remaining nurses did not participate in the implementation process in 2001. Furthermore, it was not possible to interview other nurse groups at Aalborg Hospital, since Cardio-Thoracic Surgery is the only ward using the EPR. Finally, there was little variation in the nurses' statements when conducting some of the last interviews. According to Kvale, a researcher will continue a qualitative study until s/he feels a certain point of saturation, that is, where further interviews or investigations will yield little new knowledge (Kvale 1997).

It will not be possible to generalize on the basis of the results obtained in this study for the simple reason of the rather small number of informants. Within qualitative studies, it is, however, possible to indicate some tendencies and some patterns based on what is termed analytical generalization (Maaløe 1996; Kvale 1997; Cresswell 1998). Analytical genera-lization may be based on a combination of qualitative and quantitative data. Furthermore, the researcher may conduct smaller comparison studies, e.g. conduct other case studies to be able to ensure a certain diffusion of the phenomenon in question. Finally, it is possible to compare the research findings in question with other studies made within the same area to

get an idea of the scope of the findings. In this study, the second approach is considered to be relevant as the investigation in Aalborg is a part of a PhD study where other cases at other hospitals will be involved. The knowledge produced in this study may be transferable to other situations, where the EPR is to be implemented. The author will in January 2005 conduct a similar study at another hospital in Denmark, however this time interviewing doctors. The method used in Aalborg (that is the attribute cards, the coding tables etc.) is to a large extent considered to be repeatable in that connection.

6.2 Implications for Future Research

As mentioned in the beginning, further applications may extend from this study. First of all, interesting questions for future research would be an examination of whether other health-care professionals, such as doctors, have similar or different perceptions of an EPR implementation process. It is the assumption that different groups of healthcare professionals have different values and attitudes vis-à-vis an IT implementation (Orlikowski and Gash 1993; Lorenzi and Riley 1995). Vinson, Scott et al. argue that: "*values are culturally and socially learned*"(1977, p. 50). It would therefore be interesting to see whether the cultural and social differences between nurses and doctors influence their perception of the implementation process. If this is the case, how can project managers facilitate the EPR implementation process so that it accounts for the differences among the different groups of healthcare professionals?

The laddering technique has been useful in this study as it is simple, systematic and rather flexible. The technique can with advantage be integrated with other techniques, e.g. observation, questionnaires and focus group interviews. Based on focus groups, it might be possible to highlight shared cognitive structures or so-called cognitive maps among the different stakeholders in an organization. Such interviews may provide an opportunity for observing similarities and differences between the different stakeholders (Orlikowski and Gash 1993). There may be great advantages and challenges in using several techniques to complement each other which will be examined in subsequent studies. Furthermore, this study may be combined with other studies made here in Denmark with regard to the health-care sector concerning change readiness and what project organizations shall take into account when planning future implementation processes.

6.3 Implications for Practice

The study shows the importance for project managers and hospital managers to focus on and try to understand the users' perceptions and values and not solely to concentrate on generic implementation models when implementing EPRs. It is on the basis of the activities reliant on their interpretations that nurses seek to attain their own values. In other words, it is vital for project managers and hospital managers to understand how the healthcare professionals, in this case the nurses, perceive this implementation process and what they consider as

important activities in order to be able to use the EPR system and thereby to achieve engagement from this group of users. From this approach, managers will be able to understand which aspects the healthcare professionals consider as their main ends and why these ends or values are relevant.

The findings therefore deserve some attention as they stress the potentiality of the means and ends approach for studying cognitive structures among nurses when it comes to their perceptions of an EPR implementation process. The analysis has proved to be useful for determining specific means-end structures. It has been argued that the cognition of the nurses is a key to understand the organizational impact of new technologies.

7. Conclusion

The purpose of this study has been to offer a framework for investigating how nurses perceive an EPR implementation process within Danish hospitals. Although explorative in nature, the study has revealed which activities, consequences and values exist among nurses when it comes to implementing EPRs in their daily work procedures. In other words, the study has served as an introductory look at the potential for applying the MEC approach and the laddering technique to the area of the EPR implementation process.

The findings from the study reveal that it is possible to analyze the hierarchy between the means and the ends sought by the nurses when it comes to their perception of the EPR implementation on five different areas: Support, user training, EPR workstations, integration between EPR and other systems, and information activities. The potential for an improved understanding of the cognitive structures among nurses when it comes to the implementation process seems great. Apart from a deeper insight in and an understanding of the nurses' perceptions, the method also provides a practical tool for researchers, project managers, hospital managers, healthcare professionals and others that are interested in understanding and improving an IT implementation process within the healthcare sector. It is through an understanding of the means and the ends among nurses that a deeper knowledge of a healthcare informatics implementation can be striven for. Focus has to be on all job categories that are involved in the implementation process in order to get a picture of the overall pattern and the diverse relations. The findings are useful for researchers studying the role of technology in organizations and for practitioners managing the implementation of technological change.

8. References

Amtsrådsforeningen, Indenrigs- og Sundhedsministeriet, et al. (2004). Amternes økonomi 2005.

Andersen, P. R., T. B. Jensen, et al. (2004). Effektvurdering af den elektroniske patientjournal, IPJ. Det Digitale Sygehus. Sygehus Vendsyssel, Frederikshavn. Aarhus.

Andersen, P. R. and C. Kølsen de Wit (2003). "Kritiske succesfaktorer for EPJ-projekter." Dansk Projektledelse blad(nr. 3).

Ankerhus (2002). Evaluering af EPJ. Thoraxkirurgisk afdeling & Medicinsk område, maj 2002. Nordjyllands Amt.

Bech-Larsen, T., N. A. Nielsen, et al. (1997). Attributes of low involvement products - a comparison of five elicitation techniques and a test of their nomological validity, Aarhus Business School.

Berg, M. (1996). "Urinbeholdere og Infusionspumper." Philosophia **25/3**: 167-195.

Berg, M. (2000). "Lessons from a dinosaur: Mediating IS research through an analysis of the medical record." Paper for the IFIP WG 8.2 Working Conference.

Berg, M. and e. al. (1999). "Changing Networks of Care: Electronic Patient Records and the Social Organization of Health Care Work." Social Science and Medicine.

Björk, P. (1993). Kunskabsstrukturer i gruppbeslut som föregår inköp av högengagemangprodukter. Exemplifierat med hushålls beslutsprocess vid köb av bostad. Economi och samhälle. Helsingfors, Handelshögskolan.

Bonnerup, E. (1995). "Erfaringer fra statslige IT-projekter - hvordan gør man det bedre?" Teknologirådet.

Borum, F. and T. J. B. Larsen (1981). Sygehuse - opgaver, struktur, medarbejdere og teknologi. København, DIOS dansk institut for organisations studier.

Brinberg, D. and J. E. McGrath (1985). Validity in the Research Process, Sage Publications.

Cresswell, J. W. (1998). Qualitative Inquiry and Research Design. Choosing among Five traditions, Sage, Thousand Oaks.

De Witt, C. K. (2003). Kritiske Succesfaktorer for IS-projekter. Department of Information Science. Aarhus, Aarhus Business School.

EPJ-Observatoriet (2000). EPJ-Observatoriets statusrapport. Aalborg. http://www.epj-observatoriet.dk.

EPJ-Observatoriet (2004). EPJ-Observatoriets statusrapport. Aalborg. http://www.epj-observatoriet.dk.

Fischer and Lorenz (1999). "Indføring af elektronisk patientjournal på Sct. Hans hospital U7."

Grunert, K. G., S. C. Grunert, et al. (1995). "Means-End Chains and Laddering: An Inventory of Problems and an Agenda for Research." Journal of Marketing.

Gutman, J. (1982). "A Means-End Chain Model Based on Consumer Categorization Processes." Journal of Marketing **46**.

Hofstede, F. T., A. Audenaert, et al. (1997). "An investigation into the association pattern technique as a quantitative approach to measuring means-end chains." Intern Journal of Research in Marketing **15**: pp. 37-50.

Høstgaard, A., Aalborg Universitet, et al. (2003). Forandringsparathedsundersøgelser som forberedelse til indførelse af elektroniske patientjournaler i sygehusvæsenet. Belyst med undersøgelser på fire afdelinger i København Amts sygehusvæsen. Aalborg.

Indenrigs- and Sundhedsministeriet (2003). National IT-strategi for sundhedsvæsenet 2003-2007. København.

IT-Sundhed (2002). Evaluering af EPJ-pilotprojekterne på Thoraxkirurgisk Afdeling, Aalborg Sygehus og Medicinsk Afdeling, Hobro/Terndrup Sygehus. Nordjyllands Amt.

Jolly, J. P., T. J. Reynolds, et al. (1988). "Application of the Means-End Theoretic for Understanding the Cognitive Bases of Performance Appraisal." Academic Press: pp. 153-179.

Kristensen, M. and C. Nøhr (2000). "Technological changes in the healthcare sector. A method to assess change readiness." Poster presentation at Medical Informatics Europe, Hannover.

Kvale, S. (1997). InterView - en introduktion til det kvalitative forskningsinterview. Denmark, Hans Reitzels Forlag a/s.

Kvale, S. (- forthcoming). Producing Knowledge Through Interviews.

Lorenzi, N. M., M. I. Mantel, et al. (1990). "Preparing Your Organization for Technological Change." Healthcare Informatics **December 1990**: pp. 32-34.

Lorenzi, N. M. and R. T. Riley (1995). Organizational Aspects of Health Informatics. Managing Technological Change. New York, Springer-Verlag.

Mcdonagh, J. C. (2001). The Art of Clinical Inquiry in Information Technology-related Change. Handbook of Action Research. P. H. Reason, Saga Publications. **pp. 372-379**.

Mikkelsen, H. and J. O. Riis (1998). Grundbog i Projektledelse, Prodevo ApS, 6. Udgave.

Maaløe, E. (1996). Case-studier. Af og om mennesker i organisationer. København, Akademisk Forlag.

Nikula, R. and P. B. Elberg (1999). "Clinicians must invest resources when implementing Electronic Patient Records." Proceedings of the MIE'99: The 15th Medical Informatics Europe Conference: 824-827.

Nikula, R. and P. B. Elberg (2000). "Informed decisions by clinicians are fundamental for EPR implementation." International Journal of Medical Informatics **58-59**: 141-146.

Orlikowski, W. J. and D. C. Gash (1993). "Technological Frames: Making Sense of Information Technology in Organizations." ACM Transactions on Information Systems.

Parr, A. and G. Shanks (2003). Critical Success Factors Revisited: A Model for EPR Project Implementation. Second-Wave Enterprise Resource Planning Systems. G. Shanks, P. B. Seddon and L. P. Willcocks. Cambridge, Cambridge University Press.

Pieters, R. P. G., H. Baumgartner, et al. (1995). "A means-end chain approach to consumer goal structures." Intern Journal of Research in Marketing **12**.

Prince (2002). Ledelse af succesfulde projekter med PRINCE 2, Crown.

Rekom, J. v., C. B. M. v. Riel, et al. (2000). "Sensemaking from Actions: Deriving organization member's means and ends from their day-to-day behavior." ERIM Report Series Research in Management.

Rekom, J. v., C. B. M. v. Riel, et al. (2004). A Methodology for Assessing Organizational Core Values. Rotterdam, Erasmus University Rotterdam.

Rekom, J. v. and B. Wierenga (2002). "Means-End Relations: Hierarchies or Networks? An Inquiry into the (A)symmetry of Means-End Relations." ERIM Report Series Research in Management.

Reynolds, T. J. and J. Gutman (1988). "Laddering Theory, Method, Analysis, and Interpretation." Journal of Advertising Research(February/March).

Skytte, H. and K. Bove (2004). "The importance of value in retail buying. Retailers' buying behaviour for pork and fish products in Denmark and Germany." Journal of Agribusiness.

Sundhedsstyrelsen (2000). Forslag til grundstruktur for udveksling af oplysninger i elektronisk patientjournal. København.

Svenningsen, S. (2002). Electronic Patient Records and Medical Practice. Reorganization of Roles, Responsibilities, and Risks. <u>Department of Organization and Industrial Sociology</u>. Copenhagen, CBS - Copenhagen Business School.

Udviklings- og uddannelsesafdelingen, U., Fyns Amt (1999). Evaluering af SHIFT-EPJ-projekt. Elektronisk PatientJournal i Sygehus Fyn. Fyns Amt.

Vikkelsø, S. and S. Vinge (2004). <u>Hverdagens arbejde og organisering i sundhedsvæsenet</u>. København, Handelshøjskolens Forlag.

Vinson, D. E., J. E. Scott, et al. (1977). "The Role of Personal Values in Marketing and Consumer Behavior. Can personal values be used to assist marketers in determining consumer choice behavior?" <u>Journal of Marketing</u>: 44-50.

Weiner, M., T. Gress, et al. (1999). "Contrasting Views of Physicians and Nurses about an Inpatient Computer-based Provider Order-entry System." <u>Journal of the American Medical Informatics Association</u> **6: 234-244**.

Zeithaml, V. A. (1988). "Consumer Perceptions of Price, Quality, and Value: A Means-End-Model and Synthesis of Evidence." <u>Journal of Marketing</u> **52**: 2-22.

Zmud, R. W. (2000). <u>Framing the Domains of IT Management</u>. Cicinnati, Pinnflex Educational Resources.

Appendix 1

List of 21 index cards used in the interview

> **Organization**
> 1. Analysis of work processes (before the implementation of the EPR)
> 2. Design of new work processes (together with the implementation of the EPR)
> 3. Definition of the information and terminology to be contained in the EPR
> 4. Information activities (demonstration of the EPR, introduction to the goals, the project plan etc.)
> 5. User training in IT (basic course in the use of computers etc.)
> 6. User training in the EPR (class lessons and e-learning)
> 7. User training in changed work processes and in the new terminology (used in the EPR)
> 8. Support on the ward in how to use the EPR (super users, EPR manual etc.)
> 9. Training of super users
> 10. Follow-up user training after having started to use the EPR
> 11. Optimization of work processes after having started to use the EPR
>
> **Technology**
> 1. Selection of EPR system
> 2. Setting up the EPR on the ward (in accordance with the chosen terminology)
> 3. Testing the EPR
> 4. Adjustment of the EPR after the test
> 5. Integration between EPR and supporting systems (Patient Administrative system, requisition/response system, Laboratory system, pathology system etc.)
> 6. Transfer of data to the EPR form existing patient records
> 7. Transfer of data to the EPR form existing IT systems
> 8. Establishment of EPR workstations (the amount of pc, desk for the ward round, laptops, wireless network etc.)
> 9. Upgrading the EPR after having started to use it
> 10. Support and maintenance of the EPR at the ward (IT support etc.)

Appendix 2

Coding table of attributes, consequences and values: Support

	Categories	Examples
A1	Presence of super users (in every shift)	"They [the super users] were present in the beginning [of the implementation process]"; "The super users were there 24 hours non stop"; "They were there the whole time"
A2	Presence of colleagues	"Sometimes there was a colleague who had been in the same situation as yourself and who was able to help you"; "Often you could get help from your colleague who understood the things that I did not understand"
A3	Presence of IT-Sundhed	"You could get help from IT-Sundhed as well"
A4	Professional skills of super user	"It is important that it is someone who knows [...] the ward"; "It is an advantage that they are professionals, you know within the same speciality"
A5	IT competences of super user	"It is important that you choose someone [super users] who have a flair for the EPR, computers and IT"
A6	EPR manual	"We had the EPR manuals"; "There have been some manuals"
A7	IT support and maintenance of the EPR system	[from the list]
A8	Educational ability of super users	"It is important that they are able to teach the system to others. We were just normal users"
A9	Super users with no patient responsibility	"It was a good aspect that the super users were exempted from taking care of the patients."; "They were there to help us"
C1	Have the opportunity to ask questions and get answers	"There has always been someone you can ask and someone who can guide you through this"; "Just to know that there is someone you can ask…and I can see that all the others also ask"
C2	Possibility to solve problems at once/get help	"Everybody can help someone who does not know that much"; "If there is something wrong, you would like to get it solved at once"; "They were there to help us at once"
C3	Achieve a faster/shorter implementation process	"It will much faster become a profitable system. It will faster become a success"; "Otherwise, it will be a slow process to implement the system"; "the process would have been longer"
C4	Finish/solve a task at once	"It is all about the practical things. We cannot document our nursing if we are not able to hospitalize the patient, that is, to place the patient in the EPR system"; "Then I can get help to finish for example the letter to the home care right away"
C5	Facilitate work processes and not waste time on administrative tasks	"We want to be there for the patients and use as little time as possible on administrative tasks"; "The time we use in the office is reduced on the caring of the patient"
C6	More effective learning process (know your skills)	"Then it would have been must slower";
C7	Documenting the nursing the right place in the system	"So we do not use the system wrongly"; "Then you just document the nursing where you think it will fit"
C8	Familiar with the speciality/speak the same language/create a dialogue about the documentation of the nursing care	"It is important that they [super users] are familiar with the nursing and the working routines"; "It is important that they [super users] have some opinion on how to treat the patient"
C9	A useful supplement to the user training	"It is a useful supplement to the user training. We did not have much training you know"
C10	A useful supplement when super users or colleagues are not present	"It [the manual] is a good tool in the evening shift where we are to hospitalize a patient"; "At other times, in the evening shift, there is nobody there to help you. Then you need to use the manual"
C11	Create better overview	"For example to find the same frame again in the system"; "Otherwise, there is a lack of overview and we will not write the things the right places in the system"

	Categories	Examples
C12	Avoid double registration of data (on paper)	"We were not able to carry out this task. Finally, we had to write it on the paper"; "If you are not able to do it [use the system], then you need to find a piece of paper and a pencil"
C13	Achieve support on technical aspects	
V1	Feel confident with super users/colleagues	"We felt confident with them [the super users]"; "We were not afraid to make a fool of ourselves"
V2	Focus on the patient – use time on the patient	"It is after all our job to take care of the patients"
V3	Feel confident having the super users/colleagues/EPR manual at the ward	"They [the super users] were there on each shift the first three months. It was nice to know [that they were there]"; "We knew that the super users would be there and help us in the beginning the first months. Then you were not that frightened as in the beginning"
V4	Avoid frustration	"It is difficult for us to sit in the office and be enormously irritated and actually a bit insecure as to whether there was someone who knew and understand this"; "They [super users] have to be here so we will not be frustrated"; "You felt so frustrated"
V5	Keeping the nursing notes up to date/not passing on the work load to colleagues	"If it cannot be otherwise, then it is ok [to pass on some work to your colleagues]. We are there to help each other out, however, it is always nice to do the things yourself, both for myself and for my colleague"
V6	Maintain the quality of the nursing notes (a uniform documentation)	"You have to be certain that the next one [a nurse] finds the information"; "Otherwise, I do not know how to pass on my information. It is a documentation requirement in our job and it be taken into account if something is missing"; "It can mean a bad quality"
V7	Secure and social work environment	"We are good colleagues. We have a good working environment"; "It is a good atmosphere at our ward, we help each other"
V8	Optimal nursing and patient care	"Ultimately, it is the patient that looses out"; "It has never been a discussion of how to take care of the patient"
V9	Avoid overtime	"First of all, we had to work overtime at least one hour"
V10	Avoid someone leaving the ward	"If it is too hard being here, because you do not know how it [the system] works, you simply leave"

Appendix 3

Coding table of attributes, consequences and values: User training

	Categories	Examples
A1	Basic computer training	"We were offered lessons in how to use a pc"; "We attended this basic course in computer training"
A2	Sufficient training in the EPR	"We could have used some more training in the EPR"; "I think we had too little time for the EPR training. We could easily have used some more time"
A3	Training in new terminology	"We were to find our own recipe on how to set-up and organize the system"; "We were to decide where to set-up the nursing plans in the system, under which terminology"
A4	Hand-out of training material	"I have some folders with different descriptions"
A5	Training on the ward	"We did train in using the system at the ward"
A6	Reduction in patient admissions during the start-up phase	"The patient admissions should have been reduced even more during the implementation process"
A7	Possibility of changing the EPR set-up and layout	"It provides them with an opportunity to change the set-up of the system"; "It is Ulla who has noticed us if there have been some changes in the system"
A8	Same training for everybody	"She provided lessons to the doctors as well, so we all have the same background knowledge"
A9	Training in new work procedures	[Listed on an index card]
A10	EPR training	[Listed on an index card]
A11	Supplementary training	"I think it is important to get some kind of follow-up on the training. I kind of missed that"; "To get some few hours twice during the implementation"
A12	Teachers from own profession	"The two responsible for teaching us were from our own group of doctors and nurses"
A13	Presence of super users	"I think it is due to one of the super users that I am able to use the system today"
A14	Educational ability of the teachers	"They [the teachers] were good. They always helped you"; "The teachers have to be able to address themselves to people on different levels with different skills… someone who has never touched a keyboard and someone who is very familiar with computers"
A15	Presence of colleagues	"In the daily working procedures, we helped each other"; "My colleagues were there to help me"
C1	Create a sense of involvement in the project/create a feeling of solidarity around the project	"When you take part in a group of 5-8 nurses, you have something in common and we can help each other…but also to know that I am not the only one who think this is difficult"
C2	Have the opportunity to ask questions and get answers	"I was not afraid to ask questions"; "It gave me the opportunity to discuss it with the others. Where do you write this? How do you do that"
C3	Achieve better understanding through on the job training/ training in a professional context	"I need to learn it through on the job training. I need a sense of practice"; "The suddenly you can relate it all to your daily working procedures"
C4	Ensure that training is adjusted to the users' levels	"He was a very good teacher. Even though you sometimes thought that you would never be able to learn to use the system"; "They know what we are able to do and not to do"
C5	Obtain sufficient knowledge about the EPR	"Then it is easier to use. Then you can sense that you get more experience in using the system. And then you do not have to think so much on how you actually do the things in the system. Then it is all on your backbone"; "It is a good thing to try to use the system, to sit with it on your own"
C6	Attain basic knowledge about computers	"For me, it was important that everybody felt prepared to work with computers and the EPR. That we all had basic knowledge about computers"; "It is essential because you are no longer afraid to use a computer"
C7	Achieve a shorter implementation process	"We needed a short and fast implementation process"; "Otherwise it would have been too long a process before we would get the system implemented"
C8	Have the opportunity to optimize work procedures and the EPR layout	"They simply make changes if there are several of us mentioning that this and that does not function as it should. Then they can change it"; "Then suddenly, you have to change your way of doing things. Some things have changed"

	Categories	Examples
C9	Obtain a better understanding of the implementation process	"It provides us with a better understanding of the whole process"
C10	Create better overview	"It helps me to get a better overview"; "Otherwise, it is not easy to find my bearings"
C11	Obtain faster and more effective learning	"This is how I am able to learn by a visual, practical and theoretical training all at once. All these aspects need to be there all at once"; "That is the best way for me to remember and retain it all"
C12	Use the EPR correctly	"So you can use the system even better. We needed more training. There were some details that I did not know about the system" "There will be some aspects that you do not know how to make use of. Because not everybody is aware of it being so"
C13	Facilitate work procedures and not waste time on administrative tasks	"Slow working procedures"; "Suddenly, a whole new world opens up before you. Then you suddenly acknowledge that you can find a lot of information. And then you don not waste your time"
V1	Secure and social work environment	"I felt really safe by them being there"; "We could share the troubles together"
V2	Documentation lives up to documentation requirements	"If we had not solved that problem, we would have had a unsatisfactory and insufficient documentation practice" "We need to think about the documentation requirements. Otherwise, we just write the things wherever we think it appropriate"
V3	Feel familiar with the EPR and computers	"If I am not familiar with the system, I become insecure. I am afraid to overlook important things"; "Then you are not that insecure as in the beginning"
V4	Not passing on the workload to colleagues	"You have the sense of not helping your colleagues. If you do not have the time to write it down, you have to pass on so much information at the change of guard. And then you have to say to your colleague that I am sorry and that I try to finish my work tomorrow"; "Perhaps then, my colleagues need to use time on redoing it and then it is a burden for them"
V5	Avoid frustration	"It was characterized by a sense of frustration. You had a bad sense of it and you did not feel prepared to solve the task"; "It would have meant a lot of frustration"
V6	Optimal nursing and patient care	"This means that I am able to ensure a better patient care"; "As a consequence, the patients will experience a bad treatment and care"
V7	Focus on patients – use time on the patient	"Then I have more time to take care of the patient"; "We have to use our time and effort at the patient and not in the office"
V8	Avoid overtime	"I would like to be able to get home to my husband"; "During the implementation process, we had so much overtime"
V9	Avoid someone leaving the ward	"Some of the nurses did leave the ward because of the implementation of the EPR. That is a pity because they feel obliged to leave"
V10	Feel appreciated	"We were honored that they did choose us when it comes to the pilot implementation. It was exciting and you feel appreciated"
V11	Be motivated	"You become motivated and feel like using the system"; "Otherwise you stop using it"

Appendix 4

Coding table of attributes, consequences and values: EPR Workstations

	Categories	Examples
A1	Enough EPR workstations	"It is important that there is enough computers for us to be able to sit by it and work on it"; "It is important that you have enough computers"
A2	Set-up of workstations	"It has something to do with the right heights and the right light"; "It is important that the computers are placed where we need them"
A3	Laptops at the ward	"Once we had a laptop in the medicine room"
C1	Ensure access to the EPR system/no queuing up	"There is often a queue to access to the five computers" ; "It is important that you have access to a computer"
C2	Avoid waiting time	"It should not be too often that you will have to wait to get access to a computer"; "I do not feel like using time on waiting until a computer gets available"
C3	Finish/solve a task at once	"You have to be able to plan your work"; "If you cannot access a computer right away, then you might forget what you had to do"
C4	Avoid double registration of data (on paper)	"A lot of these procedures has to do with double registration, when we are measuring different values [e.g. temperature] and when we sign for the medicine"
C5	Ensure ergonomic workstations	"We wanted it to be attractive – for example to get flat-screens. We really had to fight for that"
V1	Avoid lacking behind with your work	"It will mean that you will be behind with your work when you do not have free access to a computer"
V2	Focus on the patient – use time on the patient	"You can go downstairs and work on a computer there, but then you will be away from the patient"
V3	Secure work procedures and optimal patient course of hospitalization	"Then we fail in making the registrations on the different values that we watch daily"; "I do not think we risk to make any errors when it comes to the medicine"
V4	Avoid frustration	"It has something to do with impatience";
V5	Keeping the nursing notes up to date/not passing on the work load to colleagues	"It is important not to lack behind with your work, because everything around here has to be done very fast"
V6	Ergonomic correct work environment/secure and social work environment	"It is important here to consider the physical opportunities"
V7	Avoid overtime	"I knew that if it was 2pm and I had still not been documenting my nursing, then I had to work overtime".
V8	Involve the patient in the nursing care	"It means a lot in these days that you make plans together with the patients. They talk a lot about co-operation with the patients and higher demands from the patients"

Appendix 5

Coding table of attributes, consequences and values: Integration between EPR and other systems

	Categories	Examples
A1	Integration between EPR and supporting systems	"It is annoying that it [the EPR] does not operate together with Labka"
A2	Integration between EPRs on the different wards	"It is a disadvantage that we are the only ward at this hospital having the EPR"
A3	No paper record (only the EPR)	"It would be nice if the things that were written in the paper record also were integrated in Labka and the EPR"
C1	Avoid too many log-on and log-off procedures	"It would be an advantage to have a small window for each program, so you do not have to log-on"; "It would be nice to have all the programs integrated instead of having to log-off and log-on"
C2	Finish/solve a task at once	
C3	Ensure that your colleagues can proceed with their tasks	"It is a problem because the nurse has to discharge the patient from the system before the secretary can discharge the same patient in PAS"
C4	Avoid wasted time for yourself and colleagues	"I think it is wasted time"; "It is a waste of time for the hospital porter"
C5	Avoid printing out the record/work procedures without the use of paper	"Then you have to print the whole record…it is an enormous task"; "There is a lot of printing out that we would like to get rid of"
C6	Create better overview	"It is difficult to get an overview when it has to do with patients with a rather long hospitalization"; "It [the integration between the systems] would create a better overview"
C7	Facilitate work procedures and not waste time on administrative tasks	"There are some practical procedures that we have to remember when the patient has to go to an examination and the radiologist is there too – then I need to remember to print out the record before the patient is sent for"
V1	Focus on the patient – use time on the patient	"I would rather use my time together with my patients than sitting by the desk"
V2	Secure work procedures and optimal patient course of hospitalization	"I think it would be more secure in the long run"; "It means that it will be a more secure and successful course of hospitalization"
V3	Avoid frustration	"We have often been frustrated that we cannot admit a patient in PAS [because it is not an integrated part of the EPR]"; "It creates frustrations. It is not satisfying"
V4	Optimal nursing and patient care	"We have to think about the patients. Even though they are pleased about being here, they prefer if we can reduce the duration of their hospitalization"

Appendix 6

Coding table of attributes, consequences and values: Information Activities

	Categories:	Examples
A1	Various information activities (meetings, news letters, super users, EPR café, question sessions)	[listed on an index card]
A2	Demonstration of the EPR system	"You get an overview when you get a demonstration [of the system]"
C1	Get information about the project (why, what, how, when)	"It all started out with a meeting for all concerned in Skovpavillonen where they told us how we should do"; "It is all about them informing us about why they chose that particular system and how they had intended to train everybody"
C2	Form a clear picture of the implementation process and the expectations	"It helps if you are able to create a picture of it"; "I think it is important to know what I am supposed to do and what they expect from me"
C3	Have an influence on the process/participation in the decision making	"It is important that you – as a user of the system – will be heard. Otherwise, you loose the inspiration"
C4	Create better overview/get an idea about the structure of the EPR	"I got an overview, a sort of a taste [of the system]"
C5	Create a sense of involvement in the project/create a feeling of solidarity around the project	"We are working at the same ward and we all have the same goals. So, we should be able to work together when it comes to this [the implementation]"; "We get the impression that we stand together"
V1	Avoid frustration	"Otherwise, I will be rather negative"
V2	Important to be able to control your profession	"It is important that you can orient yourself in your daily work"
V3	Be motivated and engaged	"If I have an understanding of why it happens, I tend to do a better job"; "Otherwise, you would not have been interested"

Appendix 7 – Correlation Matrix: Support

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
A1	Presence of super users (in every shift)	2.0	8.1	0.2	2.0	0.3	0.3	1.3		4.2		1.1	1.1	1.0	0.2	0.3	0.5	0.9		0.3	0.1	0.3		0.1
A2	Presence of colleagues		7.2	0.2	0.1		0.1		1.1	1.0			1.0		0.2	0.1		0.3	0.1	0.3	0.2			
A3	Presence of IT-Sundhed														1.0									
A4	Professional skills of super user	3.0	1.0	0.1	0.1	1.0		0.2	8.1		0.2				0.2	0.2	0.1	0.3	0.2	0.5	0.1	0.4		
A5	IT competences of super user	2.0	1.3		0.1		0.1		0.1		0.1		4.0					0.1	0.1	0.2				
A6	EPR manual		1.2		0.2						7.0	0.1	0.2	0.2			0.1			0.2	0.1			
A7	IT support and maintenance of the EPR system		1.0		1.1	0.1										0.1		0.1	0.1			0.1	0.1	
A8	Educational ability of super users		0.1			2.0		2.1								0.2		0.1		0.1	0.1			
A9	Super users with no patient responsibility		2.0				0.1	0.1								0.1		0.1						
C1	Have the opportunity to ask questions and get answers		1.0	0.1	1.0		1.0	2.0	1.0							0.1		0.2	0.2	0.2	0.2	0.1		
C2	Possibility to solve problems at once/get help			3.0	2.0	2.1	2.1	1.1		2.0		2.0	2.1		4.0	1.4	3.1	3.3	0.4	2.2	0.2	0.3		0.1
C3	Achieve a faster/shorter implementation process																	3.0	1.0	1.1		0.1		
C4	Finish/solve a task at once				1.0						1.0				1.0	1.0	2.0	1.1				0.1	0.1	
C5	Facilitate work processes and not waste time on administrative tasks															3.1		1.0		1.0		1.2		
C6	More effective learning process (know your skills)		1.0		1.0		1.0	1.0							1.0	0.1		0.1		1.0	0.1	0.1		
C7	Documenting the nursing the right place in the system										1.0					1.0	1.0	1.1	1.0	2.2	0.1	0.2		
C8	Familiar with the speciality/speak the same language/create a dialogue about the documentation		1.0	1.0		1.0	1.0					1.1			2.1	0.1	1.0	1.3		2.3	1.0	1.2		
C9	A useful supplement to the user training		1.0	0.1		0.1	1.0	1.0								0.1		1.1		0.1		0.1		
C10	A useful supplement when super users or colleagues are not present		3.0		1.1						0.1	0.1	2.0				1.0		0.1	0.1				
C11	Create better overview															2.0		1.0		0.1				
C12	Avoid double registration of data (on paper)		1.0													1.0	2.0							
C13	Achieve support on technical aspects		3.0		1.0		1.0		1.0		0.1					0.1		0.1						
V1	Feel confident with super users/colleagues															0.1		1.0	2.0	1.0				
V2	Focus on the patient – use time on the patient																	1.0				2.0		
V3	Feel confident having the super users/colleagues/EPR manual at the ward																			2.0				
V4	Avoid frustration															1.0				2.0		2.1	1.0	0.1
V5	Keeping the nursing notes up to date/not passing on the work load to colleagues																					1.0		
V6	Maintain the quality of the nursing notes															1.0		1.0				3.0		
V7	Secure and social work environment																							
V8	Optimal nursing and patient care																							1.0
V9	Avoid overtime																							
V10	Avoid someone leaving the ward																							

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
A1	Basic computer training			2.0		8.0						0.2	0.1	1.3			0.3		0.3	0.3	0.1		0.2		0.2
A2	Sufficient training in the EPR				2.0	2.0	1.0				1.0	1.1	0.1			0.1			0.2			0.1			
A3	Training in new terminology								1.0		0.1			1.0			0.1		0.1	0.1					
A4	Hand-out of training material						1.0																		
A5	Training on the ward			0.1								1.0	0.1				0.1								
A6	Reduction in patient admissions during the start-up phase							1.0								0.1			0.1	0.1					
A7	Possibility of changing the EPR set-up and layout							3.0								0.1	0.1		0.2		0.1				
A8	Same training for everybody							1.0												0.1					
A9	Training in new work procedures							2.0				0.1		1.0		0.1			0.1						
A10	EPR Training	1.0		3.0	1.0	4.2	0.1	0.1			0.2	0.1		0.3	0.1	0.1	0.4	0.1	0.2	0.2	0.2		0.1		0.2
A11	Supplementary training			2.0					5.0	0.1		0.3	0.2				0.2	0.1	0.1	0.1			0.1		0.1
A12	Teachers from own profession			3.0	1.0					1.0		0.1	0.1			0.1	1.0		0.1		0.1			0.1	
A13	Presence of super users					1.0																			
A14	Educational ability of the teachers		1.0		4.0	0.2	0.1									0.1	0.2								0.2
A15	Presence of colleagues		4.0			1.0		0.1	0.1			0.1	0.1				0.2		0.1						
C1	Create a sense of involvement in the project												1.0				0.1						0.1		
C2	Have the opportunity to ask questions and get answers				1.0	1.0	0.1				2.0	1.1	0.1			0.1	0.1	0.1	0.1	0.2	1.0				0.2
C3	Achieve a better understanding through on the job training				1.0	1.0	1.0	2.0	1.0			1.0	0.2	1.0			2.0		0.2						0.1
C4	Ensure that training is adjusted to the users' levels		1.0			2.0	0.1					1.0					0.1		2.2						1.1
C5	Obtain sufficient knowledge about the EPR							1.0				1.0		2.1		1.0	5.0		2.0	0.1	0.2	1.0			0.1
C6	Attain basic knowledge about computers											2.0	1.1	1.2			3.0		2.1	1.2			0.2		1.2
C7	Achieve a shorter implementation process											1.0		1.0		1.0			0.2	0.2					0.1
C8	Have the opportunity to optimize work procedures and the EPR layout									1.0			3.0	2.1		2.0	1.1	0.1	0.1	1.2		0.1			
C9	Obtain a better understanding of the implementation process												1.0												
C10	Create better overview													1.0	1.0				0.1						
C11	Obtain faster and more efficient learning											2.0	1.0				1.1	0.1	1.0	0.1					0.2
C12	Use the EPR correctly													1.0			2.0		1.0	0.1	0.2		1.0		1.0
C13	Facilitate work procedures and not waste time on administrative tasks															1.0	2.0	1.0	2.0			1.0			1.0
V1	Secure and social work environment																1.0						0.1		
V2	Documentation lives up to documentation requirements																	1.0	2.0	1.1					
V3	Feel familiar with the EPR and computers																		2.0	3.0	1.0				1.0

V4	Not passing on the workload to colleagues	1.0		
V5	Avoid frustration	1.0	2.0	1.0
V6	Optimal nursing and patient care			1.0
V7	Focus on patients – use time on the patients			
V8	Avoid overtime			
V9	Avoid someone leaving the ward			
V10	Feel appreciated			
V11	Be motivated			

Appendix 9 – Correlation Matrix: EPR workstations

		C1	C2	C3	C4	C5	V1	V2	V3	V4	V5	V6	V7	V8
A1	Enough EPR workstations	4.0	2.2	0.2			0.4	0.3		0.4	0.2		0.2	0.1
A2	Set-up of workstations			4.0								0.4		
A3	Laptops at the ward	1.0		0.1	1.1				0.1		0.1			0.1
C1	Ensure access to the EPR system/no queuing up		3.0	0.2	1.0		0.3	0.2	0.1	1.3	0.2		0.2	1.0
C2	Avoid waiting time			2.0			2.2	1.2		2.1	0.2		0.1	0.1
C3	Finish/solve a task at once						2.0	1.0	1.0	1.0	2.0			0.1
C4	Avoid double registration of data (on paper)			1.0					0.1		0.1			
C5	Ensure ergonomic workstations											4.0		
V1	Avoid lacking behind with your work							1.0					1.0	
V2	Focus on the patient – use time on the patient									1.0				1.0
V3	Secure work procedures and optimal patient course of hospitalization													
V4	Avoid frustration										1.0		1.0	
V5	Keeping the nursing notes up to date/not passing on the work load to colleagues													
V6	Ergonomic correct work environment/secure and social work environment													
V7	Avoid overtime													
V8	Involve the patient in the nursing care													

Appendix 10 – Correlation Matrix: Integration between EPR and other systems

		C1	C2	C3	C4	C5	C6	C7	V1	V2	V3	V4
A1	Integration between EPR and supporting systems	2.0	0.1	1.2	1.4		2.0	0.2	0.2	0.2	0.3	0.3
A2	Integration between EPRs on the different wards					2.0	0.1			0.1		
A3	No paper record (only the EPR)				0.1	2.0		0.1		0.2		
C1	Avoid too many log-on and log-off procedures		1.0	0.1	1.1		1.0	0.1	0.2	0.1		0.1
C2	Finish/solve a task at once			1.0	0.1				0.1			
C3	Ensure that your colleagues can proceed with their tasks				2.0			1.0	0.1		0.1	
C4	Avoid wasted time for yourself and colleagues							2.0	2.0	2.1	3.0	1.2
C5	Avoid printing out the record/work procedures without the use of paper				1.0		1.0	0.1		2.1		
C6	Create better overview			1.0	2.0			0.1	0.1	0.2	0.1	0.2
C7	Facilitate work procedures and not waste time on administrative Tasks									2.0		
V1	Focus on the patient – use time on the patient											1.0
V2	Secure work procedures and optimal patient course of hospitalization											1.0
V3	Avoid frustration											2.0
V4	Optimal nursing and patient care											

Appendix 11 – Correlation Matrix: Information activities

		C1	C2	C3	C4	C5	V1	V2	V3
A1	Various information activities (meetings, news letters, super users, EPR café, question sessions)	5.0	1.4	2.2		0.2	0.4	0.4	0.3
A2	Demonstration of the EPR system	1.0			1.0			0.1	0.1
C1	Get information about the project (why, what, how, when)		4.0	1.2		1.0	2.1	1.3	1.1
C2	Form a clear picture of the implementation process and the expectations			2.0			3.0	0.2	0.2
C3	Have an influence on the process/participation in the decision making					1.0	1.0	1.0	0.1
C4	Create better overview/get an idea about the structure of the EPR								
C5	Create a sense of involvement in the project/create a feeling of solidarity around the project						1.0	1.1	1.0
V1	Avoid frustration							1.1	3.0
V2	Important to be able to control your profession								
V3	Be motivated and engaged							1.0	