Evaluating Clinical Decision Support Systems

– a case study at the Department of Orthopedics at Sahlgrenska University Hospital

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Abstract

There are a limited number of scientific studies concerned with the evaluation of DSS in general, and even less concerned with the evaluation of DSS in a clinical context. The purpose of this study is to evaluate the clinical DSS at the Department of Orthopedics at Sahlgrenska University Hospital in order to answer how one should evaluate clinical DSS. We have in our study created a research framework that assesses the effectiviness of clinical DSS within a hospital context. The framework examines if a clinical DSS fullfills a set of clinical DSS key contributions and what influence these key contributions have on decision outcome quality, decision-making process efficiency, and decision maker satisfaction. A qualitative case study has been done in order to measure these factors, and our findings shows that the clinical DSS used at the Department of Orthopedics at Sahlgrenska University Hospital is effective overall. However, not all of these factors were conclusive due to the early phase of system use. Our study also shows a number of new findings that haven't been present in existing theory on clinical DSS, where the most important one highlights the role of law and regulation with regards to clinical DSS evaluation and use.

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1 Introduction

1.1 Background

Making decisions within an organization is a very complex process (Hall, 2008). Decision Support Systems (referred to as DSS) provide knowledge and/or knowledge-processing capabilities that aid in making decisions, helping decision makers to make sense of decision situations (Holsapple, 2008). The process of making a decision is simplified by the use of DSS, which helps to enhance the decision outcome (Holsapple, 2008). The overall purpose of any DSS is to provide decision makers with a solution through the evaluation of a given complex problem (Liang et al., 2008). DSS can be found in a large variety of software applications (Pick, 2008) and clinical DSS have generally targeted quality, risk mitigation, productivity, and profitability outcomes in hospitals (Kohli & Piontek, 2008).

Case studies presented by QlikTech show that Sahlgrenska University Hospital (referred to as Sahlgrenska) use the software QlikView as their clinical DSS with great success (QlikTech a; QlikTech b; QlikTech c). However, the Sahlgrenska implementation is different than what is suggested by QlikTech. It is only the Department of Orthopedics at Sahlgrenska (referred to as DO-SU) that uses QlikView. Documents provided by Department of Orthopedics at Sahlgrenska University Hospital (2008) describe that DO-SU had suffered from a decline in quality of service provided to patients after relocating. Practical problems included an increase in waiting times, an increase in surgery cancellations, and an increase in post-surgical infections, among other things. This led to DO-SU receiving criticism from Socialstyrelsen (referred to as SoS) as well Sahlgrenska. As a counter-measure DO-SU decided to increase the intensity of existing efforts at solving these issues as well as creating a new action plan primarily aimed at dealing with the concerns raised by SoS. This new action plan included the implementation of clinical DSS based on QlikView (Department of Orthopedics at Sahlgrenska University Hospital, 2008).

1.2 Problem statement and research question

Rhee & Rao (2008) note that there is a limited number of academic studies concerned with the evaluation of domain-technology-specific DSS, compared to the efforts within the business world. We have found that there are an even more limited number of studies that are concerned with the evaluation of DSS in a hospital context. QlikTech has done some case studies on the clinical DSS at DO-SU as described above, but they are also the developers of QlikView and as such their case study evaluations are business world related rather than academic. Obviously their case studies also function as promotional material for their own product and as such we are concerned with the bias in and validity of their studies. The intensive care units in Region Skåne are another example of a similar evaluation problem (QlikTech d). Considering this and the limited amount of academic DSS evaluation studies we see an opportunity to create an academic evaluation framework for clinical DSS and to test it. We are aware that there are studies that assess general DSS success factors.

However, one needs to consider that hospitals in Sweden follow strict governmental regulation and therefore it seems reasonable that not only general success factors are relevant for clinical DSS, but also other strict quality indicators as expressed by external institutions. We therefore propose that any evaluation of clinical DSS will need to be based on scientific theory regarding DSS and decision-making theory as well as have additions in terms of requirements from hospitals in general, SoS, and Swedish law. Using this as a base, the evaluation should assess the effects that the clinical DSS has on the decision-making process in the hospital as DSS are primarily aimed at improving the decision-making process (Holsapple, 2008; Pick, 2008). Finally, we also need to consider the stakeholders where we propose that the primary group of interest will be employees with decision power regarding IT projects in hospitals, decision-makers within medical units, and finally patients in the end.

Rhee & Rao (2008) suggest several ways of conducting academic DSS evaluation studies, acknowledging the case study approach as one way to study the problem. We suggest that since hospitals are strongly regulated by Swedish law there are good opportunities for generalization between different Swedish hospitals. Doing an in-depth case study of the clinical DSS evaluation problem within a specific hospital should also prove to be transferable onto other Swedish hospitals to a large extent, even if some discrepancies may exist. With regards to the above problem statement we will use DO-SU as our case, proposing the following research question:

- How should one evaluate the clinical decision support system within the context of the Department of Orthopedics at Sahlgrenska University Hospital?

1.3 Purpose

This study aims towards creating a research framework that is able to evaluate the clinical decision support system being used at the Department of Orthopedics at Sahlgrenska University Hospital. The research framework is to be created based on literature relevant to DSS as well as clinical DSS, and applied to the Department of Orthopedics at Sahlgrenska University Hospital.

1.4 Delimitations

Firstly, the evaluation model will mainly be based in clinical DSS theory, meaning that we are interested in success factors for clinical DSS specifically and not DSS in general. Secondly, this study will only be concerned with Swedish hospital regulation and quality indicators with regards to the use of clinical DSS. Thirdly, the evaluation will be concerned with a specific type of DSS technology (QlikView in this case). Finally, due to time limitations we will only study the clinical DSS at DO-SU, and since that system is already running on a small scale our study will not consider evaluation factors that are important during clinical DSS development.

2. Literature review

2.1 The process of making decisions

Decisions are made at a continuous rate in organizations and due to limited decision-making time enough information cannot be collected to make "best case" decisions (Hall, 2008). Instead Hall (2008) suggests that decision makers have to depend on limited information and their own experience to make as informed decisions as possible. However, the potential consequences of making an incorrect decision might prove immensely more severe in a later stage than initially assumed, if based on faulty or no information (Hall, 2008). Furthermore, the number of factors influencing a decision will most likely continue to increase as the information technology available to decision makers becomes more complex. It is therefore essential to ensure that any available information is collected and used in order to aid decision makers (Hall, 2008). This can be done through various information systems, such as DSS, allowing for decision makers to fully benefit from all the information available to them concerning a given problem (Hall, 2008).

Hall (2008) writes that decision making within organizations traditionally has been based on a structured process, from the classification of a problem to making a decision. The problem with this approach, according to Hall (2008), is that the assumption is made that all conditions will be optimal for each step of the decision process. Simon (1977) also discusses these assumptions and formulates them as follows: (1) all information will be available to a decision maker concerning a given problem, (2) the information is assumed to be accurate and representative of the problem as well as understood by the decision maker, and finally (3) it is assumed that the decision will be based on a rational perspective. Due to the fact that these three assumptions will almost never be true within the context of a modern organization Simon (1977) instead discusses organizational decision-making as four phases: (1) the intelligence phase, (2) the design phase, (3) the choice phase, and (4) the review phase. Hall (2008) illustrates this process in Figure 2.1, but does not account for the review phase. Simon (1977) does however suggest that the review phase exists even if it is not explicitly stated and as such we will not account for it to any further extent.

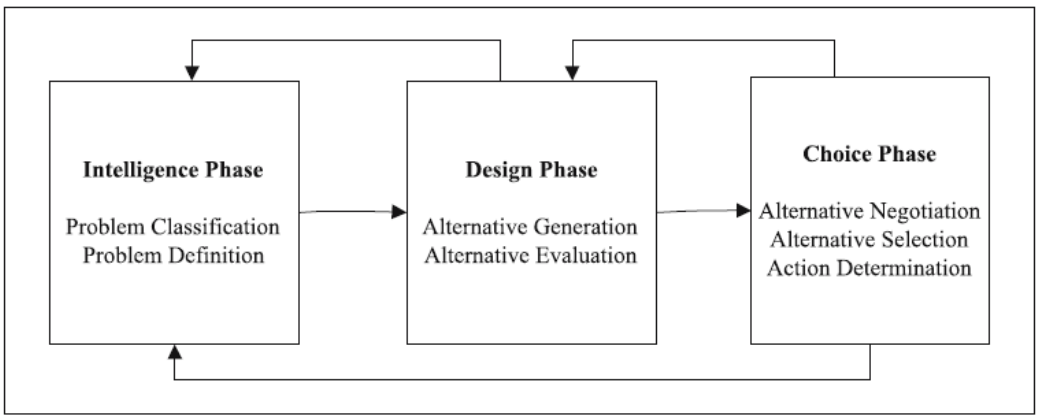

Figure 2.1. The Intelligence-Design-Choice model (Hall, 2008, pp. 85).

Simon (1977) describes *the intelligence phase* as the phase where the problem is identified or observed. Hall (2008) relates this to the classification of a problem, allowing for decision makers to compare a problem with previous solutions and then derive the extent to which the given problem is similar enough to adapt to an already existing solution. Hall (2008) suggests that the higher the level of similarity, the easier the decision-making process becomes as less effort is needed to create a new solution. Hall (2008) also discusses the definition of an end goal; something that once dealt with the problem should lead to. If the given goal is achieved as a result of a decision, it is to be considered to have been a successful decision (Hall, 2008). However, if one incorrectly defines a problem it may result in further problems, such as the collection of faulty information or to the use of ineffective or incorrect solutions (Hall, 2008).

Once the intelligence phase is completed Hall (2008) suggests that one should start defining a desired end-state as a starting point for *the design phase*. This is essentially the same as stating the goal during the intelligence phase with one significant difference; the goal is not just stated, but also ways of obtaining that goal are defined as different possible solutions (Simon, 1977). Each solution that can solve the problem should be considered (Hall, 2008). It should however be mentioned that each alternative also needs to be evaluated. During the evaluation process the requirements connected with a given decision are examined as to derive if a certain alternative outcome will satisfy the predefined conditions or not (Hall, 2008). Any alternative that deviates from the existing requirements should be discarded (Hall, 2008).

Once the design phase is completed the process moves on to what Simon (1977) calls *the choice phase*. During the choice phase all of the alternatives are analyzed and compared. Hall (2008) describes this as first evaluating the different decisions and the extent to which they would obtain the goal, and then identifying which of the selected alternatives that lie within the pre-defined parameters of the organization (with regards to budget, time, technical constraints, and so on). Once an alternative is selected, the given decision is made.

2.1.1 Decision-making context

Holsapple and Whinston (1996, from Hall, 2008) lists four types of contexts stated as levels, which can be used when trying to illustrate the influence on the actual decision-making process. These are: (1) the management level, which can be seen as the context in which strategic decisions are made by upper management, and (2) the operational level, which is the context in which decisions are made concerning operational procedures within the organization. Following this is (3) the middle management level, which is the context between the operational and strategic contexts and thus concerned with some strategic decisions as well as some operational decisions, and finally (4) the cross section level, which is a context in which all types of decisions can be made, it covers everything from operational to strategic decisions.

These four contexts are continuously found within organizations, something that proves problematic when organizations move towards a flatter structure. These contexts have a tendency to merge together when the boundaries between individuals and specific units merge together (Hall, 2008). This means that most decisions are made at the cross section level, as different individuals from a range of different management levels are involved in the decision-making process (Hall, 2008). We do not intend to extensively go into decision-making context as we only wish to

recognize the effect that the context might have on the decision-making process. We want to account for it to the extent we find fitting for our given study, but not focus on it to any larger extent.

2.2 Decision Support Systems

The purpose of DSS is to support the various phases of the decision-making process in order to enhance the quality of the process and/or the outcomes of decision-making (Holsapple, 2008; Pick, 2008). As Holsapple (2008) explains this is achieved by allowing DSS to relax various limits on the decision maker (such as cognitive or economic ones) through actions in the decision process, which then allows for decisions to be made more *productively*, with greater *agility*, with increased *innovation*, with greater *reputability,* and with higher *satisfaction* (PAIRS). Figure 2.2 illustrates the role of DSS with regards to the decision-making process and PAIRS. The black box representing the decision process can be thought of as Simon (1977) description of the decision-making process as illustrated in Figure 2.1. The process can involve the actions of other participants as well as a DSS. The sponsor, participant(s), implementer, and consumer can be played by different individuals, or a single individual may play more than one of these roles (Holsapple, 2008).

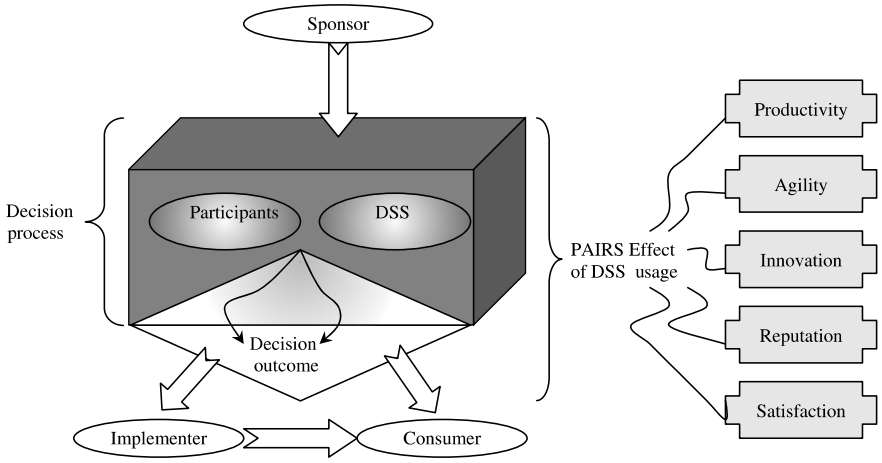

Figure 2.2. The role of a decision support system in decision-making (Holsapple, 2008, pp. 164).

In practice using DSS may result in more efficient use of resources, cost and risk reduction, increased profits, reduced decision-making time, more rich documentation of the decision process, and improved customer service (Pick, 2008; Udo & Guimaraes, 1994). Pick (2008) also adds that DSS may improve the overall reliability, and as such enhance the decision-making process as well as increase user confidence and understanding of different problem areas. DSS may support all phases of the decision-making process, but Ang et al. (1995) have noticed that the primary support is usually with the design and choice phase. To support the decision-making process a DSS needs to collect data, potentially originating from a variety of different sources. A DSS consists of a database (organizational transaction data), model base (statistical, mathematical, and/or financial models that describe how to manipulate the data), a database management system, model base management system, and a user interface. Figure 2.3 illustrates these basic components of a DSS. This model is the most common to illustrate the typical DSS architecture, but it is limited in the sense that it

only describes a small portion of all possible DSS combinations (Holsapple, 2008). However, it still helps to illustrate the generic DSS architecture and what components the system needs to support decision-making.

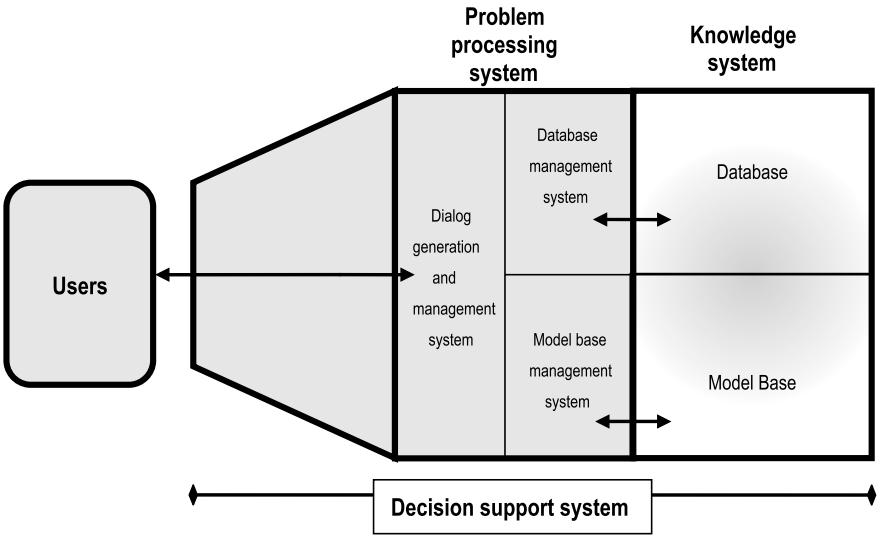

Figure 2.3. Basic architecture for decision support systems (Holsapple, 2008, pp. 183).

In order to obtain complete benefits of using DSS one also needs to consider the decision-making context in which the DSS will be implemented, as it must be designed, developed and implemented in a way that supports the complexity of the decision-making process (Hall, 2008).

2.3 Clinical Decision Support Systems

The primary use of DSS in healthcare is to monitor and enhance financial performance (Kohli & Devaraj, 2002; Kohli & Piontek, 2008). Increased costs within the healthcare sector have made it critical for hospitals and medical staff to make optimal decisions with regard to the efficiency and quality of healthcare services (Kohli & Piontek, 2008). DSS may also support other activities within healthcare, at the operational level for example decision-making is concerned with allocation of resources, activity based costs, and patient care decisions (Kohli & Devaraj, 2002). Kawamoto et al. (2005) have identified four features that are strongly related with DSS ability to improve clinical practice. These are (1) *automated decision support in clinical workflow*, (2) *just-in-time decision support*, (3) *DSS providing recommendations*, and (4) *DSS being computer based*. The common theme for these four features is that they make the use of clinical DSS easier with minimal effort for the end-user. Kohli and Piontek (2008) on the other hand classify the contribution of DSS to healthcare into four key areas: (1) quality and patient satisfaction, (2) efficiency and profitability, (3) risk mitigation, and (4) learning.

2.3.1 Quality and patient satisfaction

Quality issues are associated with cost and efficiency outcomes (Kohli & Piontek, 2008). Kohli and Piontek (2008) suggest that medical staff may use DSS to compare quality and cost outcomes in order to provide guidance on how to improve various areas within the clinic. They may also be used to examine variables that affect patient

care quality in terms of complications, readmissions, and mortality. This helps to design treatment protocols, based on historical data, which help to lead physicians' to desirable results. The situation is changing for physicians, from a situation where they 'knew best' to a situation where they know where to find the best information at the right time (Teutsch 2003, cited in Kohli & Piontek, 2008). Technology helps these physicians to access large quantities of information that they can use to produce best practices that support evidence-based medicine (Kohli & Piontek, 2008). Finally, patient satisfaction is also an indicator of healthcare quality, and is increasingly being used as quality measure with regards to patient suffering during treatment and quality of life after a treatment has ended (Kohli & Piontek, 2008).

2.3.2 Efficiency and profitability

It has been suggested that the identification of a cost component is a key input into DSS in order to assess the efficiency of clinical operations (Kohli & Piontek, 2008). Kohli and Piontek (2008) suggest that actions for cost reduction and efficiency gain at the operational level within hospitals have become very common because of minimal profit margins. A way to increase efficiency is by implementing evidence-based medicine in the DSS starting already at the patients' end, meaning that the DSS can use data from previous cases it has dealt with to suggest suitable solutions. By supporting physicians with information during the actual decision-making process there are vast benefits to be gained; patient complications can be avoided and treatment time can be reduced, leading to reduced costs (Kohli & Piontek, 2008). Zarling et al. (1999) demonstrated a prototype DSS that provided pre-emptive advice based on the analysis of the history of a large number of patients, cautioning physicians about new patients who were more likely to have complications. As such DSS can inform decision makers about different alternatives for a situation and the consequences of each alternative (Kohli & Piontek, 2008).

2.3.3 Risk mitigation

One of the most discussed risks within hospital organizations is hospital errors (Leape et al., 1995). This includes mislabeling of patient samples and administration of wrong drugs (Landro, 2006a), miscommunication (Landro, 2006b), adverse events (Brennan et al., 1991), and adverse drug interactions (Sanks, 1999, cited in Kohli & Piontek, 2008). Advances in DSS have helped to mitigate these errors (Kohli & Piontek, 2008), by helping to flag potential errors for example (Yan & Hunt, 2000, cited in Kohli & Piontek, 2008). Kohli & Piontek (2008) suggest that the use of DSS with regards to risk mitigation is limited but that there is great potential to be harnessed. Garg et al. (2005) have found evidence that clinical DSS improves physicians' practitioner performance. However, they also find that the DSS effects on patient outcomes are inconsistent. A threat to widespread DSS adoption is the large number of false positives such a system may generate. Therefore the efficiency of clinical decision rules is critical, in order to accurately guide positive alerts and to successfully implement DSS (Reilly & Evans, 2006).

2.3.4 Learning

When Simon (1977) discusses the decision-making process he discusses how the review phase may provide feedback for the next iteration of decisions. In the same way DSS allows decision makers to learn from the steps taken when using the system so that they can make better decisions in the future (Kohli & Piontek, 2008). Kohli and Piontek (2008) also suggest that the advances in terms of quality and efficiency,

as discussed above, are part a result of learning processes gained to support decision making. At the same time improper training and learning may lead to the technology itself introducing risks. Insufficient maintenance and operator training could lead to malfunction and misuse (Hammons et al. 2000, cited in Kohli & Piontek, 2008). When implementing DSS changing decision makers' behavior is important, but this is often meet with resistance and something a DSS implementation has to overcome (Kohli et al., 2001).

Areas of contribution	Advances	Key opportunities	Major supporting capabilities
Quality and patient satisfaction	• Move away from a focus on abstracting information from medical record reviews • Measuring effectiveness of clinical and patient satisfaction outcomes • Era of assessment and accountability	• Emerging as a scientific discipline of medical informatics • Physician's role in evidence based medicine • Technology improves quality by increasing adherence to guidelines. • Incorporating patient satisfaction as a quality outcomes	• Timely alerts to physicians, e.g. through computerized physician order entry (CPOE) systems • Physician profiling and pattern analysis systems
Efficiency, profitability	• Focus on health care cost • Creation of prospective payment system	• Enhanced costing methodology for determining and producing improved • Integrated cost-outcomes information • Measuring return on investment (ROI) of decision-support activities	• Intelligent agents in DSSs • Interoperable systems
Risk mitigation	• Patient bill of rights • Understanding of errors and adverse events	• Integration of clinical and administrative data • Proactive availability of data • Reducing false positives in ADE systems	• ADE systems • CPOE
Learning	• Availability of severity adjusted data sets • Availability and proliferation of evidence based medicine	• Use in of information science, statistical modeling and computer science in quality management. • Informed consumers • Ensuring physician adoption of DSS and change in behavior	• Web based knowledge • Web based quality report cards • Real time decision making availability

Table 2.1. Summary of areas of DSS advances and opportunities in various areas of contribution. (Kohli & Piontek, 2008, pp. 491).

2.4 Evaluating Decision Support Systems

The goals for evaluating DSS differ between scholars and practitioners. Rhee and Rao (2008) suggest that scholars want to provide insight on DSS while practitioners want to improve DSS, leading to greater evaluation effort within industry compared to academia. In their article they focus on presenting evaluation of DSS from a practitioners' perspective due to the limited number of academic studies on DSS evaluation. Rhee and Rao (2008) suggest three approaches for evaluating DSS; the three-faceted evaluation methods, the sequential approach to DSS evaluation, and the general model of DSS evaluation.

The three-faceted evaluation methods tend to be used when trying to evaluate different evaluation methods for a specific DSS requirement or need (Rhee & Rao, 2008). It is therefore not applicable for our study, as we have already defined the requirements and needs for clinical DSS in section 2.3. *The sequential approach to DSS evaluation* is useful when one wants to understand the fundamental evaluation process (Rhee & Rao, 2008), which would make it applicable to our study. However, some of the drawbacks of this method is that it is very difficult to implement, it is only concerned with the perspective of the evaluators, and it usually starts at the beginning of the development phase (Rhee & Rao, 2008). Finally, *the general model of DSS evaluation* focuses on what to evaluate, and allows for adaption to specific contexts (Rhee & Rao, 2008). This makes it very suited for our study as we use evaluation factors based in scientific theory that we need to adapt to the context of a Swedish hospital environment. Furthermore, it can be used widely over various types of DSS while allowing for the most flexibility when defining the criteria and measurement variables. As such we have chosen to use the general model of DSS evaluation for our study.

As Rhee and Rao (2008) point out, the domain of DSS ranges over most industries. Adam et al. (1998) suggest that the volume of dependence on DSS and the volume of use will increase across industries or domains. While information technology continues to develop more specific systems are developed (group DSS or clinical DSS, for example), which then move onto their own territories while at the same time adapting to each other (Rhee & Rao, 2008). An evaluation framework could function as a common guide for these systems, if one acknowledges that the ultimate goal for all of these systems is the same (Rhee & Rao, 2008), which arguably is suggested to be the improvement of the decision-making process (Leape et al., 2008).

Silver (1991) states that system restrictiveness is defined as the way users' decision-making processes are limited by DSS. A DSS that is very restrictive supports only a small subset of all possible decision-making processes (Parikh et al., 2001). System restrictiveness can be reduced by expanding functionality, which generally increases the decision quality but at the same times results in added complexity and higher cost of development and training. Therefore, system functionality should be balanced to reach moderated system restrictiveness. Parikh et al. (2001) also suggests that perceived restrictiveness is believed to be greater than system restrictiveness, and that it affects system evaluation negatively. The manner in which DSS leads users to structure and do their decision-making process is referred to as decisional guidance (Silver, 1991). Montazemi et al. (1996) suggests that decision guidance is of highest importance for DSS to be effective as it minimizes users' confusion and reduces the

system restrictiveness. Silver (1991) categorizes decision guidance into four aspects: (1) targets (structuring and execution), (2) forms (informative and suggestive), (3) modes (predefined, dynamic, and participative), and (4) scopes (short and long-ranged). Rhee and Rao (2008) suggest that evaluation criteria are usually defined in the early stages of DSS development and decision guidance may be a formalized adaption of these criteria. Rhee and Rao (2008) also suggest that when DSS development is based on the evaluation criteria it is often obvious that one can expect high performance with use of decisional guidance.

Without evaluation criteria there is nothing to base an evaluation on. Adelman (1992, cited in Rhee & Rao, 2008) defines evaluation criteria as an objective list of things that a system should be able to achieve as well as add value to. Adelman (1992, in Rhee & Rao, 2008) also discusses evaluation methods; how to measure the extent of how a criterion fits with a system, and that different criteria demand different evaluation methods. Rhee and Rao (2008) state that domain-technology-specific DSS can be guided by decisional guidance, which implies that there are criteria on which domain-technology-specific DSS can be evaluated. Rhee and Rao (2008) therefore suggest that it is the capability and need for evaluation, using decisional guidance, of domain-technology-specific DSS that matters and not the efficacy of decisional guidance itself. Therefore, they argue that the use of Silver (1991) four aspects of decision guidance and the suggestion that they maximize decision-making effectiveness is "out of the question". Evans and Riha (1989) suggest that examining the relationship between what has already been done and what should be done is what decision-making effectiveness may refer to, and a DSS may be considered as effective if the expected results in the DSS criteria are ensured (Rhee & Rao, 2008).

Rhee and Rao (2008) summarize the above theory into the model presented in Figure 2.4. Decision value consists of decision-making process and decision outcomes as identified by Forgionne (1991, cited in Rhee & Rao, 2008), and domain-technology-specific DSS are evaluated by considering these two. Perceived restrictiveness of the users is eliminated by the use of decision guidance as it prevents evaluators from being too subjective since evaluation criteria function as the bases for the decisional guidance (Rhee & Rao, 2008). This model can be used for evaluating a wide range of DSS, in terms of combinations between technology and domain (Rhee & Rao, 2008). The focus in the model lies on decision-making process efficiency, decision outcome quality, and decision maker satisfaction, which are measured based on decisional guidance.

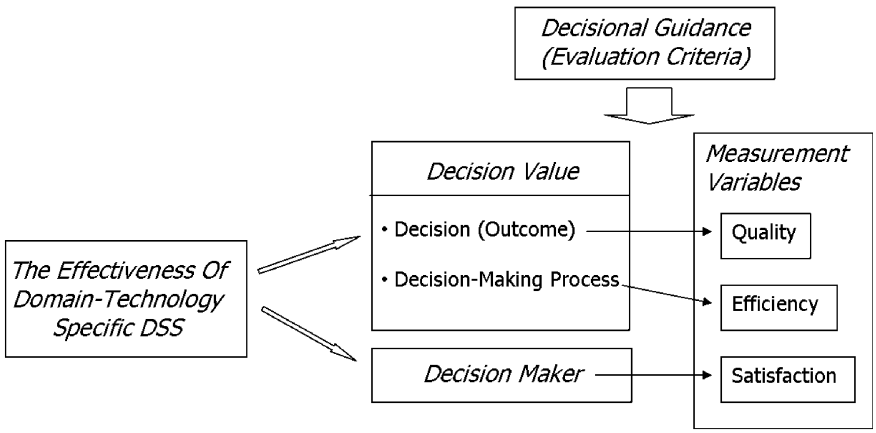

Figure 2.4. The general model of DSS evaluation (Rhee & Rao, 2008, pp. 324).

2.5 Adapting the general DSS evaluation model for a clinical context

As explained earlier, Rhee and Rao (2008) state that *the effectiveness of domain-technology-specific DSS* will be known by considering the other parts of the DSS evaluation model, and if all DSS criteria's are ensured the system may be considered being effective.

Following this we have *decision value*, which Forgionne (1991, cited in Rhee & Rao, 2008) describe as two activities in: *decision outcome* and *decision-making process*. Hall (2008) argues that any problem needs to have a final outcome, which it should strive to achieve. This means that the level of success for a given problem will be based on set criteria constituting the parameters in which a decision is to be considered successful or not. These parameters are described by the decision guidance or evaluation criteria in the model. The measure of quality is then a measure of the extent to which a given decision is within the parameters of the evaluation criteria specific for the quality, evaluating if it is successful or not. Hall (2008) also discusses the decision-making process suggesting that decision makers should depend on their experience and any information available to them when making a decision. In our study we will however adapt the efficiency measure (that the decision-making process influences) to fit with the evaluation criteria in which a decision must be in order to be considered efficient. This will involve regulatory considerations as well as general evaluation criteria related specifically to the efficiency of the decision.

The *decision makers*, as Kohli and Piontek (2008) state with regards to clinical DSS, are medical and administrative staff as well as physicians who treat patients and use DSS to make better decisions in order to provide better patient treatment. It is their satisfaction that we will measure. Gatian (1994) brings up the discussion whether user satisfaction actually is a valid measure for system effectiveness, suggesting that there is a very limited amount of information system studies that link effectiveness with user satisfaction. Her research suggests that there in fact is a link between user satisfaction and user productiveness in terms of data processing correctness, report generation, and distribution timeliness.

For our study Kohli and Piontek's (2008) summary of DSS contributions in healthcare will function as our primary *decision guidance* (see Table 2.1). It summarizes the major supporting capabilities as well as opportunities that clinical DSS provide to the healthcare environment. Using their summary we can see what areas clinical DSS usually support, and in our study we will measure if the clinical DSS does support these areas and to what extent in terms of *decision outcome quality*, *decision-making process efficiency*, and *decision maker satisfaction*. By using scientific theory as our decision guidance we minimize our subjective evaluation bias, as Rhee and Rao (2008) suggest that decision guidance should.

Also, as this study is conducted at a hospital there are a number of regulatory considerations that need to be taken into consideration. We will however not discuss these laws and regulations in great detail, as that would be a whole study itself. But we want to show awareness of the potential influence these regulations might have on the evaluation of the system and therefore account for them. Since Sahlgrenska is under the governance of the Swedish government they must follow (1) any laws

influencing their work, be it specific medical laws or law that are applicable on a wider context, and (2) regulations set by governing institutions such as SoS.

1. All laws, which are applicable to the given situation, must be followed. This means that even if a decision is considered to be less effective or if its outcome is of less quality it still needs to be made if dictated by any legal documents or guarantees.
2. All regulations created by SoS or any other governing institution must be followed according to the regulations created by that given institution, as long as these don't conflict with any of the laws previously mentioned (these laws and regulations should however never be in conflict).

An example could be what is in Sweden called treatment guarantee (translated freely from Swedish[1]). It is a guarantee provided by the Swedish government and healthcare system that defines the timeframe in which a patient has the right to receive medical care as well as the parameters within which it is applicable (Socialdepartementet & Landstingsförbundet, 2005). This means that decision-making timeframes have an indirect limit. Another example is the patient data act[2] that regulates how hospitals handle confidential information as presented in patient journals and records, which could affect what information is available to which decision maker (Gregow, 2010). The personal data act[3] is a third example (Gregow, 2010). Since Sahlgrenska must follow these laws and regulations we can assume that they must already be considered with regards to the system for it to be useable. A system that does not follow these regulations cannot be used within the context of a Swedish hospital and it is therefore a very important factor to consider, even if it's more indirectly applicable to the decision-making process.

2.5.1 Measurement variables

The focus in the evaluation model lies on measuring decision-making process efficiency, decision outcome quality, and decision maker satisfaction, which are based on decisional guidance (Rhee & Rao, 2008). As explained earlier, Adelman (1992, cited in Rhee & Rao, 2008) defines evaluation criteria as an objective list of things that a system should be able to achieve as well as add value to. From theory on clinical DSS we know what the key contributions of clinical DSS are as well as what they should achieve and add value to (see Table 2.1). The theory on evaluation shows us what we should measure to see if the domain-technology-specific DSS is effective (see Figure 2.4). We suggest that by connecting the key contributions of clinical DSS (our decisional guidance) with the three measurement variables of the evaluation model (decision-making process efficiency, decision outcome quality, and decision maker satisfaction), and then assessing if the key contributions are met we can assess how the three measurement variables are affected. Since all of the key contributions may be related to all of the measurement variables to some extent we will in the following text argue for what contribution is most strongly related to what measurement variable, to single them out in order to make the evaluation easier to grasp.

[1] Vårdgaranti

[2] Patientdatalag (2008:355)

[3] Personuppgiftslag (1998:204)

The decision support is automated
Kawamoto et al. (2005) suggests that by automating decision support the need for physicians to seek advice of the system becomes non-existent. A computer-based system improves consistency and reliability of clinical DSS by minimizing processes that are error prone and labour intensive, such as chart abstractions (Kawamoto et al., 2005). We argue that this mainly makes decision-making process more efficient as it minimizes physicians' effort to act on systems recommendations during the decision-making process.

The decision support is provided just-in-time
This is one of the features that Kawamoto et al. (2005) identify as essential for clinical decision support. As Kohli and Piontek (2008) point out, physicians are at a point where they need the right information at the right time and where technology helps them to draw upon large quantities of data. This also sets the premise for DSS providing recommendations. By minimizing the information searching and gathering, and by preventing information overload we argue that the decision-making process becomes more efficient.

The DSS provides recommendations
Both Kohli and Piontek (2008) and Kawamoto et al. (2005) suggest that clinical DSS providing recommendations and alternatives is a major contribution area such systems. Kawamoto et al. (2005) argue that an effective clinical DSS main focus should be on minimizing physicians' effort to receive and act on system recommendations. Hall (2008) relates to this by discussing the classification of problems; arguing that drawing on the experiences of previous decisions one can expect similar outcomes for similar problems if the same decision is made. Hall (2008) also argues that one should evaluate every possible solution to a given problem as to obtain the most suited decision alternatives. But as Davenport (2009) points out one should be aware that if an automated system makes poor recommendations, then things can go really bad very fast. Therefore there should also be room for human judgment.

By aggregating data from a wide variety of sources one ensures that a system has as much historical data available to it as possible, which ensures that decisions are made based on all previous experiences within the organization (Holsapple, 2008). Clinical DSS may be used for evidence-based medicine by allowing physicians to draw upon large quantities of patient and treatment information as well as allowing for the examination of variables that affect patient care quality (such as complications, readmissions, and mortality rates), which helps to design treatment protocols (Kohli & Piontek, 2008). This information may then be provided as recommendations. A clinical DSS may also use historical data to help to flag patients that are more prone to have complications (Zarling et al., 2008). We therefore suggest that a DSS providing recommendations based on historical data will not only make the decision-making process more efficient, by helping physicians to evaluate alternatives, but more importantly it will improve the decision outcome quality as it will help to make sure that patients get the correct treatment the first time around in a faster manner.

The DSS reduces costs
Kohli and Devaraj (2002) as well as Kohli and Piontek (2008) state that the primary use of DSS within the healthcare sector is to monitor and enhance the financial

performance. It is therefore essential that any decision made follow the general strategy of cost reductions within the organization. Kohli and Piontek (2008) argue that actions for cost reduction have become common in hospitals, which means that the identification of a cost component is a key input in DSS in order to be able to assess the efficiency of clinical operations. Furthermore, they suggest that a DSS may be used to compare quality and cost outcomes, which then can be used to improve various areas within a hospital. Kohli and Piontek (2008) also argue that DSS can help to reduce costs during the actual decision-making process, which in the end helps to reduce treatment time and avoid patient complications.

The DSS increases efficiency
Kohli and Piontek (2008) also argue that actions for efficiency gain have become common in hospitals in relation to cost reduction. One of the purposes of DSS, as explained before, is to support the decision-making process in order to enhance the quality of it (Holsapple, 2008; Pick, 2008). DSS also allows for decisions to be made in accordance to PAIRS (see Figure 2.2). As Pick (2008) and Udo & Guimaraes (1994) state, this in practice allows for resources to be used more efficiently, helps to reduce decision-making time, and so on. Within a clinical context it is increased costs that drive hospitals to make their processes more efficient (Kohli & Piontek, 2008). As such, we argue that the DSS will primarily make decision-making process more efficient. As noted by Ang et al. (1995) efficiency increases may be concentrated to specific phases of the decision-making process depending on what phases the DSS primarily supports.

The DSS increases patient satisfaction
Kohli and Piontek (2008) suggest patient satisfaction as an indicator of the quality of healthcare. A patient that is satisfied is probably one that has received help. Therefore we argue that if more patients are satisfied, with a higher level of satisfaction, then the decisions outcomes of their physicians' decisions must also have increased in quality.

The DSS reduces hospital errors
One major concern in hospitals is that of avoiding errors (Leape et al., 1995). Clinical DSS may help to mitigate these errors (Kohli & Piontek, 2008), which we argue may lead to more desirable decision outcomes. Clinical DSS may also help to flag errors (Yan & Hunt, 2000, cited in Kohli and Piontek, 2008). In these cases more emphasis is placed on the human judgment of physicians', but by making them aware of potential errors that may be committed we argue also helps to increase decision outcome quality.

The DSS improves physicians' practitioner performance
Garg et al. (2005) suggest that clinical DSS improve physicians' practitioner performance, which we argue, may lead to higher decision maker satisfaction since practitioner performance is more concerned with post-decision situations.

The DSS allow decision makers to learn from the steps taken when using the system
As Kohli and Piontek (2008) point out DSS allow decision makers to learn from previous steps, increasing their ability to make better decision in the future. They also suggest that decision-makers can learn how to use the system more efficiently as to best obtain a given solution. It is also suggested that the quality and efficiency issues discussed above are partly a result of learning processes that may be gained from

using clinical DSS (Kohli & Piontek, 2008). Learning processes initiated by DSS usage may therefore help to improve decision-making process efficiency by improving the physicians' decision-making workflows, and more importantly the decision outcome quality as it increases their ability to make better decisions that give more desirable outcomes as they learn more.

The DSS is functional

Insufficient maintenance of the DSS may lead to malfunction (Hammons et al. 2000, cited in Kohli & Piontek, 2008). If a widely adopted and integrated DSS malfunctions then it is likely that the decision-making process efficiency will be decreased. Misuse due to lacking operator training is another concern raised by Hammons et al. (2000, cited in Kohli & Piontek, 2008). If the DSS isn't used in a proper way, the way it is meant to be used, it is likely that it won't improve the decision-making process efficiency as suggested by DSS theory. Furthermore, Reilly & Evans (2006) have noted that a major threat to widespread DSS adoption is false positive generation. A DSS that generates false positives will reduce the decision-making process efficiency since it will extend the decision-making process until it manages to provide correct decision support. Implementing effective clinical decision rules is essential in order to guide positive alerts (Reilly & Evans, 2006). If the rules are efficient then it is likely that also the decision-making process will be more efficient as they guide the process and as well as the outcome.

The DSS overcomes any change and implementation resistance

Kohli et al. (2001) suggest that DSS implementations are usually met with resistance, as they require decision makers to change their behavior. We suggest that resistance might have a negative effect on mainly decision maker satisfaction as it might disrupt the morale among decision makers. We could also argue that it has a negative effect on the decision-making process efficiency since decision makers could be inclined to avoid using the DSS, or misusing it on purpose, and therefore never reap any DSS benefits at all. However, with no users an evaluation would not be possible at all and therefore we omit the second argument.

The DSS is adapted to regulation

We have suggested that regulation may have an effect on the decision-making process, limiting decision-making time and emphasizing quality. It is likely that such regulation also affects the decision support that supports the decision-making process. If regulation has a negative effect on decision support then it seems likely that the decision-making process efficiency will also be affected negatively.

2.5.2 Research framework

Clinical DSS key contribution	Decision Outcome Quality	Decision-Making Process Efficiency	Decision Maker Satisfaction
The decision support is automated		X	
The decision support is provided just-in-time		X	
The DSS provides recommendations	X		
The DSS reduces costs		X	
The DSS increases efficiency		X	
The DSS increases patient satisfaction	X		
The DSS reduces hospital errors	X		
The DSS improves physicians' practitioner performance			X
The DSS allow decision makers to learn from the steps taken when using the system	X		
The DSS is functional		X	
The DSS overcomes any change and implementation resistance			X
The DSS is adapted to regulation		X	

Table 2.2. Measurement table for clinical DSS effectiveness.

From the above theory we now have our final research framework that shows us what clinical DSS should be able achieve and add value to, as well as what part of decision-making every single contribution mainly affects. Using this information we will study if the clinical DSS that we are evaluating does achieve the key contributions and how it affects the different parts of decision-making. Table 2.3 shows a summary of all this theory where the *X* marks the connection between contribution and measurement variable based on our argumentation in section 2.5.1. Since this framework is based in the general model of DSS evaluation (see Figure 2.4) it is the effectiveness of domain-technology-specific DSS that we will be assessing.

3. Empirical approach

3.1 Motivation for case selection

Our research began with us identifying the situation of DO-SU and therefore we will begin this chapter with motivating our case selection. The selection of Sahlgrenska and DO-SU was based on a number of factors. During fall 2009 both of us took a course in DSS where we were introduced to a DSS called QlikView. When examining the developers QlikTech website[4] we found that a number of organizations use QlikView for business intelligence. QlikTech and as their partners have a number of case studies of their customers on their websites, where Sahlgrenska is also included (QlikTech a; QlikTech b; QlikTech c; QlikTech d). They picture the Sahlgrenska implementation as one with amazing success. When we read those case studies we couldn't help being critical and ask ourselves whether the system actually is that amazing for Sahlgrenska's organization. At the same time we were intrigued by the use of DSS for clinical practice.

Based on this we decided to contact Sahlgrenska by sending them an e-mail to their public contact e-mail address asking for contact information to their IT-department, which we received. We continued by contacting the IT-department, which notified us that it was only DO-SU which used QlikView. They provided us with contact information to *Informant C*, who is the one mainly responsible for the QlikView project. This contact was established several months before our research proposal was due to hand in, and as such much of the telephone and e-mail contact we initially had with *Informant C* was never recorded. We presented our initial ideas to *Informant C* who showed great interest as well as willingness, on the behalf of DO-SU, for a high level of cooperation that would allow us to take part of valuable information about the case. This willingness and interest from their side proved to be one of the main motivators for us to go on with the case study as we felt we had the opportunity to access a lot of valuable information compared to what would be possible from a private company in a competing business world.

We also needed to ensure that the DSS was actually being used within the organization by at least a small number of users to be able to measure changes in the decision-making process. The case of DO-SU fitted well enough with this requirement. The fact that the system used by the orthopedic clinic was initiated in 2007 (Department of Orthopedics at Sahlgrenska University Hospital, 2008) also meant that the system is relatively new, allowing for us to conduct an evaluation without having to worry about significant biases from the users due to a large extent of familiarity of the system.

[4] http://www.qlikview.com/

3.2 Research strategy and research design

Before establishing our contact with DO-SU the initial purpose of this study was to evaluate any form of DSS, meaning that we had not identified any specific area to focus our attention on. We therefore started to look at various aspects of DSS as well as the settings in which they were being implemented. Having studied numerous variations of DSS implementations it became evident that a vast number of research had been conducted on DSS in general terms, but less in areas of specific systems, contexts, and evaluations. We also realized that due to the amount of research that already existed we would contribute with very little new knowledge to the field if we focused on general areas and we therefore decided to focus on areas which had previously not received as much attention.

The idea of evaluating the use of DSS in healthcare contexts showed to be most interesting for us as it allowed us to study an area that not only had received relatively little attention previously, but also proved to be a context in which the type of DSS implemented was very specific, having unique factors influencing it that would need to be evaluated. Once the type of study was decided we needed to specify what exactly to study as even the narrowest of context can be the source of a vast number of different questions. We looked at numerous articles about DSS in general as well as articles specifically about DSS usage in hospital environments and concluded that we could not identify any form of evaluation method or procedure that was specifically designed for hospitals, only for DSS in general. Even looking at general DSS evaluation we could see that there is only a very limited number of studies within the academic world (Rhee & Rao, 2008). However, we also realized that simply identifying a question would not suffice as we were not sure how DO-SU was actually using the system. Though we knew our problem was that we did not know how to evaluate clinical DSS and therefore it was clear that we would need to ask a "how" question.

In order to find the best approach to our research we started with identifying factors which could potentially help us select what approach would be the most suitable for the study. Firstly, we observed that the situation being investigated is fairly unique as we have been unable to find methodologies or procedures in existing literature that would suffice to cover the scope of what we intended to do with the study. We also realized that due to the fact that the system at DO-SU is currently very young, we were dealing with a contemporary issue and the approach selected thus would need to be able to account for this. Based on the information that was collected in the initial stages of the study we could also conclude that due to the strict regulations governing a hospital we would not be able to affect the environment in which the system existed at all, and the approach selected would also have to account for that. Lastly, we also knew that a variety of sources would be used as we already initially had collected information from a vast amount of different sources. When looking at the different approaches available in qualitative research we concluded that there was one that stood out more than the others. We were convinced by Yin (2009) arguments for the use of a case study report, as they fulfilled most of the above requirements. By choosing the case study approach we were able to use any associated tools, methods, and techniques to manage such an environment (Yin, 2009). Since we were working with several information sources, there was a risk for information overload and

information mismanagement, if we were not clear on what information we needed to find.

Once we had determined that a case study approach was the most appropriate we needed to formulate our research design. We knew that we needed to be able to clearly identify the types of data which needed to be collected in order to answer our question. To assure that the data collected was not superfluous we used the five components suggested by Yin (2009): (1) study question, (2), propositions, (3) units of analysis, (4) logic linking data and propositions, and (5) criteria for interpreting the findings. By defining these components we could identify the data needed for the given question as well as avoid any unusable data. We can see that (1) the research question we were using was already aligned with Yin's (2009) suggestion of an explorative "how" question. We also formulated some propositions (2) of what we needed to research and evaluate, and what data we wanted to collect. We also had a clear purpose and an idea of what the final results of the study should be. The units of analysis (3) were defined with Sahlgrenska and DO-SU in mind. The fourth and fifth component concern data analysis and will be discussed in section 3.5.

Lastly, it should be noted that Yin (2009) suggests that interviewing several individuals could constitute as a multiple-case study. We would however argue that this study is a single case study as the primary unit of analysis will be DO-SU and not the individuals themselves. A multiple-case study in this context would involve the investigation of several departments at Sahlgrenska. It is not always easy to define the case, but it is related to the way the researcher question is defined (Yin, 2009). Due to time constraints we are not able to perform in depth analysis of several different hospital cases. However, as we suggest in the introduction, hospitals are strongly regulated by Swedish law. We therefore argue that there are good opportunities for generalizability and transferability of our results to other hospitals in Sweden, even if some discrepancies may be present due to locale or context, as the governing body of the hospital will remain the same meaning that the contextual differences will not be extensive.

3.3 Data collection methods

For this study we choose to use a qualitative approach for collecting data based on a number of reasons. Firstly, we were performing an explorative study (Yin, 2009) where we were gathering subjective information from a day-to-day work setting from a number of informants, which is hard to quantify (Creswell, 2007). We therefore had to consider what type of data collection method generates information that answers an explorative question. Secondly, we were exploring a specific problem where we wanted to get a deeper and more detailed understanding than a quantitative study can provide (Creswell, 2007; Jacobsen, 2002). Formally, there is no clear distinction between qualitative and quantitative research (Creswell, 2007). We however choose to make the distinction between hard and clear performance numbers versus intangible human accounts, definitions, and experiences. As such, using data collection techniques and data analysis methods and techniques that are associated with the quantitative research method would not work in analyzing data that concerns intangible subjective views. Finally, we also had to consider that we only had a very small number of informants to get data from as only a few people use the DSS at DO-

SU, meaning that any quantitative analysis would be unreliable due a too small sample size (Anderson et al., 2007). The qualitative data collection method is therefore the most fitting for an explorative case study such as this (Yin, 2009).

When doing qualitative research Yin (2009) suggest a number of different skills we as researchers should have; being able to ask "good" questions, being a "good" listener, having knowledge on the issue as a researcher, being flexible, and being unbiased. These were all issues we discussed and prepared for before actually doing our study at DO-SU. Did we have enough knowledge to ask the right questions yet? Did we have a good enough understanding of clinical DSS before talking to our informants? Another thing we considered is that different phases in the research progress may not always be distinctly separated and as such overlap (between interviewing and analysis for example). As such we choose to view this thesis as an iterative process where the different parts will be adjusted as our research progresses. A qualitative approach provided for more flexibility and less time consumption with this iteration in mind, as a quantitative approach would require follow-up on large sample sizes if some information was missing, which would be too time consuming for our time frame.

3.4 Data collection techniques

It was initially clear that we had three options to collect data from DO-SU due to the way the organization is run; through interviews, direct observations, and documentation. We decided that we would use all three to gain as rich information as possible. Since all of the data was available in digital form we also decided to structure and archive it digitally in order to easily access different pieces, and to be able to maintain a chain of evidence. These actions were all based in the three principles that Yin (2009) recommends when collecting data: (1) using multiple sources of data, (2) creating a database for organizing collected data, and (3) maintaining a chain of evidence, to increase reliability. Other ways for us to collect data were through archival records, participant observations, and physical artifacts (Yin, 2009). However, these were not used in our study as they did not provided any additional information that interviews, direct observations, and documentation already didn't.

3.4.1 Interviews

We used a semi-structured interview approach to obtain specific descriptions of our three informants' worldviews. One reason for choosing this technique is that it allowed us to ask open-ended questions and sub-questions, which then allowed us to evolve and adapt the interviews depending on what type of answers we were given (Kvale & Brinkmann, 2009). It meant to follow up on interesting concepts or key words that the interviewees might share that we have not thought of, but that could add important additions to our research. Also, by doing interviewing we choose a commonly used data collection technique where there are a lot of guidelines and process descriptions to guide us through our own data collection process. Though, as Kvale & Brinkmann (2009) write, performing too mechanical interviews will not gather the same knowledge as doing interviews based on social interactions. As such, it also requires skills from us in form of experience and personal judgment in order to ask the "right" follow-up questions, for example. Finally, to identify if the DSS at DO-SU actually fulfills the various clinical DSS key contributions we had talk to the

users and developers of the system. Since the key contribution might appear in a different manner in real life compared to theory, a semi-structured interview approach allowed us to mine for this information more effectively through added flexibility of going outside of our pre-planned protocol.

The questions for our interviews have been adapted from our research framework (see Table 2.3). Since the interviews were semi-structured they also were based around the three topics on decision outcome quality, decision-making process efficiency, and decision maker satisfaction (see Figure 2.4) to allow for the flexibility of a semi-structured approach. We then formulated specific questions that aim to answer on the existence of the different clinical DSS key contributions around these three topics (as argued in section 2.5.1), to create relevant boundaries within which the interviews could be conducted. Our full interview guide with the questions in detail is located in Appendix 1, while Table 3.1 below provides an overview of which question is linked to which topic and key contribution. Since the interviews were conducted at a Swedish hospital with Swedes we decided that to obtain the richest answers possible we had perform the interviews in Swedish rather than in English. This was partly motivated because we did not know the English skill level of our informants and we wanted them to be able to express themselves as fully as possible. We have tried to translate the questions as close as possible to their English counterparts to ensure that similar data would be collected as if the interviews were performed in English. Our Swedish interview guide and detailed questions can be found in Appendix 2.

Some of the answers we collected required us to conduct follow-up interviews. We decided to do these follow-up interviews using e-mail, as the answers we needed would be short and since it provided the most flexibility for us and our informants. Also, it was not feasible for us to go back to Gothenburg from Lund to perform additional interviews for such short answers. Telephone interviews were an option but we decided to send e-mail due to the added flexibility (possibility for off office-hours answers and so on). The follow-up questions were different for the different informants, and were all firstly formulated in Swedish. These can be found in Appendix 7 in form of the e-mails we sent out, where the italicized texts are the informants' answers. Appendix 8 has the English translation of these follow-up questions. Neither the transcripts of the original interviews nor the follow-up answers have been translated to English due to time constraints in relation to the effort of performing such a task, with issues such as loosing information in translation also in mind.

When selecting informants for our interviews our intention was to collect as much data from as many perspectives as possible, while still staying within the boundaries of our delimitations. However, during our empirical studies we found out that the system was only running in a pilot phase, and due to the system running on such a small scale the number of users was limited to three individuals. We could therefore not be selective with our interviewees as we still needed to collect data. However, due to the small user number we did in the end collect information from all three users involved in the project, and we can therefore simply state that our only real selection methodology was to include everyone. It does however need to be stated that the user interviews still represent an accurate depiction of the system use as they are classified as all the current types of users within the system.

Interview question	Clinical DSS key contribution	Decision Outcome Quality	Decision-Making Process Efficiency	Decision Maker Satisfaction
1	*The decision support is automated*		X	
2,3	*The decision support is provided just-in-time*		X	
8	*The DSS provides recommendations*	X		
4	*The DSS reduces costs*		X	
5	*The DSS increases efficiency*		X	
9	*The DSS increases patient satisfaction*	X		
10a,10b	*The DSS reduces hospital errors*	X		
12	*The DSS improves physicians' practitioner performance*			X
11a, 11b, 11c	*The DSS allow decision makers to learn from the steps taken when using the system*	X		
6a, 6b	*The DSS is functional*		X	
13	*The DSS overcomes any change and implementation resistance*			X
7	*The DSS is adapted to regulation*		X	

Table 3.1. Measurement table for clinical DSS effectiveness and interview questions.

3.4.2 Documentation and direct observations

Gathering documents was also a crucial data collection technique in order to identify what different institutions in relation to the clinical DSS implementation have formally defined with regards to quality factors and criteria's, and to identify what concerns have been raised around the DSS. Documentation allowed us to access information that is official, in contrast to interviews were some answers may be personal opinions of the informants. Reading documents also helped us to complement the information collected from the interviews (Yin, 2009).

Another data collection technique we used was direct observations. The case study involved us visiting Sahlgrenska and DO-SU for a whole day, where the interviews only were a part of a longer exchange. Except for the interviews we also had brief informal discussion with the users as DO-SU, for example. We also received a demonstration of the clinical DSS in use. Since these were not situations where we could formally record audio or video we decided to take observation notes that could aid us in our studies as well as the following interviews, helping us to discover discrepancies and important keywords that we needed more detailed information on. We did not follow any specific structure for our observations notes. Rather we just took notes of things we thought were vital to what the users were expressing, based on our own subjective knowledge on the subject. This also meant that both of us took our separate notes since both of us have different areas of expertise and experience, meaning that it was quite possible that we would deem different things to be of different importance. Our separate notes therefore complemented each other.

3.5 Data analysis methods and techniques

The analysis of our collected data is based in the coding of our framework as presented in Table 3.1. We have linked the different key contributions to specific interview question as well as the measurement variables of the general DSS framework as presented in Figure 2.4. As such we have a connection between the key contributions and what scientific theory says on it as well as what our interviews say on each key contribution. In our analysis we can then compare our interview answers directly with what the theory says on each specific key contribution to see if the key contributions in our case match up with what the theory says on them.

To make this analysis easier we have coded our transcriptions in two ways (see Table 3.2 for an example). Firstly we have established a referencing system so that we may reference directly to specific questions as well as specific sentences in our interview. Secondly, we have also coded our interview answers based on the three measurement variables; decision outcome quality (referred to as DOQ), decision-making process efficiency (referred to as DPE), and decision maker satisfaction (referred to as DMS), in order to quickly be able to see which topic every answer is related too as different parts of a single answer may be connected to different topics. We also have coded side-questions (referred to as SIQ); sub-questions that were not related to any of the three measurement variables but were still interesting to ask during the actual interview, and information on our informant (referred to as INF).

Our data analysis methods and techniques are not based in any specific methodology literature. Instead our choices are grounded in our wish to provide full transparency of our logical chain of analysis, through the use of the above referencing and coding system. The follow-up questions do not use any coding system however, as the information provided by them is so small that coding them would be superfluous. Instead we just refer to the specific questions in the follow-up question appendix directly. This approach also helped us to fulfill the final two of Yin (2009) components as discussed in section 3.2.

	DOQ	*8. Ger beslutstödssystemet rekomendationer och/eller råd?*
8.1		**INTERVIEWER:** Ok, Ger beslutstödssystemet rekomendationer och råd? Till den som använder det?
8.2		**INFORMANT:** Nej, det gör det ju inte idag, det var det jag byggde upp på nevrokirurgen, men där är vi inte idag. Det är min övertygelse att det kommer behövas, men det är en ganska svår sak.
8.3		**INTERVIEWER:** Men det är inte någonting som.....
8.4		**INFORMANT:** Där är vi inte med detta systemet idag. Det är vi inte.
8.5	SIQ	**INTERVIEWER:** Är det planerat att det ska komma in?
8.6		**INFORMANT:** Man kan inte säga att det är planerat. I mitt huvud är det planerat.
8.7		**INTERVIEWER:** Ok men inte på papper eller vad man ska säga?
8.8		**INFORMANT:** Nej

Table 3.2. Example of data analysis; interview coding.

3.6 Research quality considerations

3.6.1 Critical evaluation of literature

This study is mainly based on literature from recognized authors that are published in credible information systems journals. We do however need to account for the possibility that some of the secondary sources used are less credible. However, we argue that due to the fact that they are used by recognized authors they are still usable. As far as possible we have tried to find and read any secondary sources we have used, in order to ensure that they have been reviewed according to the standards expected for a study of this nature. However, in some cases we were not able to access them through our search engines while they still provided helpful theory, and therefore we decided to use secondary sources in some instances. It also needs to be noted that due to the fact that we have mainly used recognized authors there is a possibility of our sources being somewhat one-sided, as they have a tendency to discuss each other's findings. Related to this is also the fact that we have used two volumes of article collections to a large extent for our theory development, called the Handbook on Decision Support Systems (Burstein & Holsapple, Eds., 2008). These are collections of articles from various authors concerning DSS in a number of different ways. We therefore argue that since the collections are merely used to gather the information concerning DSS in one place, we can make the assumption that the sources are not intended to complement each other in presenting one specific view of DSS or similar. Instead, they complement each other to present different views on DSS.

ELIN@Lund has been our primary search engine for finding scientific articles. In some cases we have also visited the homepages of for us lesser known journals and universities, when we have used an article from such a place. This in order to establish that there is some kind of peer review process on the articles that they have published.

Another thing we have to consider with the literature used for this study is the contextual difference between the theory, being mainly Anglo-Saxon, and the empirical context, being Swedish. Much of the theory we use is based on research done in the United States, which may or may not be fully applicable in the context of Swedish hospitals. As we have mentioned previously, the issue of law and regulation was a factor we had to reconsider in the context of a Swedish hospital. Another was the issue of cost savings and profit, where Swedish hospitals are not allowed to make profit. However, we have discussed our motivations and changes when adapting the theory we did not see fitting for a Swedish context, and since we found all of our factors to be measurable to some extent we believe that this contextual difference is not that dramatic. Also, we want to note that we have not been able to find any Swedish research that is relevant for this study and as such we had to rely on the Anglo-Saxon perspective, doing our own adaptions for the Swedish context.

3.6.2 Bias

We are in control of the study and also the main investigators in it, and could therefore potentially add our own values and interpretations in areas where they should not be present (Pronin et al., 2004, cited in Ehrlinger et al. 2005; Hammersley & Gomm, 1997). To account for this we decided to conduct semi-structured interviews as an example, to ensure that our own views were not overly representative in the interviews allowing the respondents to dictate the importance of the various

aspects discussed. We were also aware that the informants could potentially be biased, especially since they have a strong connection to the project due to them being in charge of it.

However, bias for us as researchers becomes more important to consider. We have a lot of time and interest invested in the study and we must thus be aware of the actions taken and their potential consequences with regards to our level of bias, ensuring that we do not control the study to the extent that it fulfills a predefined goal. Instead the study must be allowed to take its own course, ensuring that nothing is missed or ignored due to our preconceptions about the topic of study. For the informants this becomes more difficult as they were being interviewed about a system which they are responsible for. We suggest that the extent to which they would argue against their own system is reasonably small. The biases presented by the informants could be minimized with the aid of the documents provided to us from the hospital as any information provided could be checked against the findings of SoS for example. Arguably the fact that they provided us with these documents and the information could be a reason to consider the data to be bias. We however argue that due to the fact that the information given was obtained from official documents created for or by the responsible parts of the Swedish government which governs the context of the hospital the information should be considered accurate.

Due to the different user roles in the system that the informants have we must also look at the extent to which biases exist within different areas of the initial use of the DSS. We accounted for this by conducting the interview with the users of different user roles and comparing their answers against each other. In the places where we could see distinct differences we once again consulted the official documents provided to us. However, in addition to the official documents we also ensured that we asked follow-up questions during the interviews as well as after the interviews were completed. This allowed for us to gain a better understanding of why certain views were present and we could thus account for the extent to which a given statement was to be considered bias or not.

We must also be aware of any biases due to reactivity. We as interviewers do have a direct effect on the informants, their actions and answers might be altered due to our presence (Norris, 1997). This was an area that clearly proved difficult to account for as we needed to conduct the study even if it meant that reactivity biases were present. As such we aimed towards ensuring that the informants were not able to prepare any answers as they could be adapted to better suit the given study we were conducted. The fact that we did semi-structured interviews also aided in minimizing the reactivity biases from us as we allowed the users to answer the questions according to their own perceptions rather than us trying to provide possible answers for them to choose from. We can however not argue that we completely removed any biases due to reactivity as we can never be sure of exact extent to which the informants were affected by our presence.

We are also aware that the evaluation of biases becomes bias in itself as we are evaluating the biases of others (our informants) differently to how we evaluate our own (Ehrlinger et al., 2005). It is very easy to label something as potentially being bias; however there are no rules for judging the validity of a given domain of inquiry (Norris, 1997). As such, there is no way to fully eliminate biases and errors from our

side. Instead, we conclude that is quite likely that biases do exist within the study and that we must allow the readers to determine the extent to which they feel that this given study gives an accurate account of the situation and problem. We have therefore accounted for all our actions in the different sections of this chapter, allowing anyone to partake of the methodology used as well as our motivations for our actions within that methodology, in order to provide as much transparency as possible.

3.6.3 Reliability

To be able to argue that our study has high value to the research community we must demonstrate that our findings are based on a firm foundation of evidence and therefore we must also discuss the reliability of our study (LeCompte & Goetz, 1982). The external and internal reliability in this study is derived from the extensive descriptions of our research procedures, ensuring that if necessary the study can be replicated by using the exact same methodology. This did however require that the description of our procedures was structured and transparent to the reader, ensuring that no steps or actions were overlooked. Specifically for the external reliability this meant that if the procedure was replicated the same phenomenon would be studied as we limited the scope of the study both with our methodological choices as well as with our delimitations. Ensuring that researchers replicating our study would have one focus with the study from the start rather than having to guess which perspectives we studied. Furthermore, we have also made sure that the reasoning behind all decisive choices is well explained and motivated in this study.

The internal reliability is harder to achieve for our study as we are conducting a case study with qualitative interviews, meaning that the same data never can be guaranteed. We do however argue that if the context and the informants within that context remain unchanged, and if the same methodology and procedures we have used are also used, the findings of the study will also remain relatively unchanged. With regards to our interviews, one attempt to increase the internal reliability was by using five different devices to record the audio. This helped us to ensure that if one device failed to capture answers due to bad audio quality, another device would surely pick it up. These devices were all placed at different locations in the interview room to ensure optimal audio capture from different angles. We have also structured and tried to be transparent with our overall interview approaches, by constructing and providing interview guides and coding tables.

3.6.4 Validity

To assess the extent to which the empirical reality is represented by the conclusions of the study as well as determining the extent to which the constructs of the study actually measure the categories of the human experience that exists within the context we also have to discuss validity (LaCompte & Goetz, 1982). However, due to bias concerns as discussed above, validity should properly be checked by independent researchers (Jacobsen, 2002). We have still spent some efforts to increase validity; establishing prolonged contact with *Informant C* to build trust, conducting proof readings with external parties when possible, as well as doing member checks (Creswell, 2007). However, we were not able to invest time to build trust with all of our informants. At the same time we argue that due to the fact that we allowed the informants to have a higher hierarchal position, or at least a perceived higher position, the trust issue was somewhat diminished as the informant felt that they were in control of the answers given, not having to worry about how we would interpret the

data. They received this higher hierarchical position by us coming from a position of needing information from them. The fact that we also allowed the informants to look at the interview transcripts and tell us if there were any misunderstandings meant that the informants knew that any information given by them would not be used without their consent, increasing the trust between us.

Numerous sources have been used to derive our findings ensuring that the information used represented an accurate view of that of the research community. In few instances single sources have been used, but only when the credibility of those sources are as close to indisputable as possible to the research community. The credibility in these cases was checked by looking at what journal the sources were published in and what status those journals have in their respective field. The above discussed proof-reading was conducted by a total of seven individuals, all with academic backgrounds from a range of different subjects. The member checks have already been discussed to a certain extent; the informants were given the information collected from the interviews and were given a chance to correct any misunderstandings, ensuring that the data maintained a high validity from the perspective of the investigated context. It should also be noted that we are aware of the fact that allowing the informants to change their answers could lead to a decrease of validity as a whole. We do however argue that due to the fact that only small changes were made, mainly concerning personal statement not related to the study as such and censorship of names, we can assume that the validity was in fact increased by the member checks rather than decreased as a whole. To further ensure the validity we also conducted follow-up interviews per e-mail, asking the interviewees to further explain or clarify answers which were unclear or had multiple meanings. As such we can further argue that the validity was increased since we assured that any conclusions drawn were based on what we perceive to be accurate understandings of the answers given.

3.6.5 Interview quality

To ensure the quality of our interviews we have applied Kvale and Brinkmann (2009) six quality criteria. *Firstly*, the interviews conducted in this study rely heavily on the quality of the interview answers and it is thus important to ensure that they maintain a high quality throughout the entire process. In order to ensure that the answers were spontaneous we did not show the questions to the interviewees until right before the interview was initiated, ensuring that no specific answers could be prepared. The richness of the answers was not as easy to prepare in advance as it relies solely on the interviewees. In order to try to account for this we ensured that we had semi-structured interviews where we could control the length of a question by adding additional questions until a rich enough answer was provided in total. The importance of the answers being specific and relevant speaks for itself as specific information is needed about each question asked. For the purpose of our study this was also controlled by the use of semi-structured interviews as we could ask follow-up questions when necessary in an attempt to ensure that the specific answers needed were provided. After the interviews were conducted we realized that a few answers needed additional information in order to fully answer the stated question. We thus had follow-up interviews conducted via email in order to clarify any irregularities or confusion.

Secondly and thirdly, we asked additional questions in order to ensure that a full answer was given to the question and we can thus state that the overall information

collected from the interviewee far exceeds the initial question asked. We argue that since the interview were of a semi-structured nature additional questions were required from our side to ensure that the original question was answered. Follow-up questions were asked to receive longer answers, to increase quality, as well as to clarify any existing questions and make sure that any questions are answered in full (Kvale & Brinkmann, 2009).

Fourthly, we had to consider our ability to interpret the interviews (Kvale & Brinkmann, 2009). As we conducted an semi-structured interview we were required to interpret the answers as they were given since we needed to ensure that the original question asked was in actuality answered, meaning that we had to ensure that our understanding of the interviewees answers were accurate. This also relates to the *fifth* criterion where we had to verify our interpretations of the answers given (Kvale & Brinkmann, 2009), meaning that we sometimes repeated what the informants said to verify that we had understood what they told us.

Finally, we ensured that any uncertainties were cleared up throughout the interview by asking follow-up questions as well as restating our understanding of the answers given, allowing for us to achieve as high level of self-communication as possible with an semi-structured interview (Kvale and Brinkmann, 2009). Besides the question we also had copies of our research framework and theory printed out to ensure that we covered all of the aspects of our suggested evaluation method, in case something was overlooked when asking our questions.

3.7 Ethical considerations

Ethical conduct is essential in order to ensure that the informants of DO-SU as well as the context from within which they reside are protected (Israel & Hay, 2006). The context needs to be protected as it can be severely harmed by any distribution of information regarding the area of expertise within the organization (Israel & Hay, 2006). The importance of protecting the context does however take on a slightly different meaning within the scope of our study. As we are conducting our study within a field where knowledge is shared to the highest possible extent, as to best obtain information about the effectiveness of new treatments and so on, it is essential to understand that the context from which the objects of study originate is already exposed. In ordinary organizations the sum total of the internal knowledge can be converted directly to competitive advantages as knowledge will exist that is unknown to competitors, hence the act of exposing such knowledge can have devastating effects. Within the context of a hospital however it is essential that this information is shared. The contextual base we thus try to protect is that of the individuals employed within the general context and not the context itself. If a study does not follow a specified ethical conduct the findings of that research should be discarded as they will not depict an accurate image of the given situation. This study aims at improving human condition that exists within the context of the decision support system usage by the collection of data through interviews (Kvale & Brinkmann, 2009).

3.7.1 Analyzing ethical issues in our study

We have analyzed the ethical issues of our study based on Kvale & Brinkmann (2009) seven research stages: thematizing, designing, interview situation, transcription,

analysis, verification, and reporting. *Thematizing* within the context of Sahlgrenska translates to us conducting a study which aims towards improving the human situation by providing a better understanding of the implications of the use of the DSS. This allows us to obtain scientific evidence as well as ensuring that the lives of the objects of study are not negatively influenced, if not improved. With regards to *design*, obtaining a consensus is very important as the objects of study must fully understand the implications of partaking in a study in general as well as know how the data is to be handled as to ensure that they understand the possible implications of a certain answer. For us this meant that we needed to ensure that the objects of study were aware of the overall purpose of the study as well as any potential risks of partaking in the interviews. The overall purpose was explained before the start of the interview, an essential step in the research regardless as a semi-structured-interview needs to be steered in a given direction, which in our case was initially done by this presentation. The possible effects of participating in the study were discussed to a lesser extent as the possible negative implications were lowered by the fact that the interviews were of an semi-structured-nature, allowing for the interviewee to answer the questions to the extent they felt applicable as well as suitable. In order to ensure that the objects of study were comfortable with the information we used within the study we also ensured that the transcripts of the interviews were approved, allowing the objects of study to potentially remove offensive or negative answers.

Looking at the *interview situation*, we started our interviews by explaining how the information was going to be used and for what purpose, allowing the interviewees to take a stance regarding if they wanted to partake in the study or not. We did not go into detail about the levels of stress and potential changes in self image and so on as we did not intend to observe the objects of study for a long time, but simply had an interview with a pre-defined set of questions which were also presented before the start of the interviews. We argue that the extent to which the participants would feel stressed and similar can be neglected as we initially stated the length of the interview, and then planned the time and place of the interviews with the objects of study, allowing them to determine when it would cause the least amount of stress as well as other negative factors. Following interviews we have *transcription*. This is a very important step as the transcripts need to accurately depict the views expressed by our informants (Kvale & Brinkmann, 2009). For this study, as previously discussed, this meant that the interviewee was allowed to read the transcripts as to ensure that their answers, as understood by us, accurately depicted their reality. When we did the transcriptions and perform our analysis we found that some data was missing, which was why we had to perform follow-up interviews. Upon receiving answers to these follow-up questions we sent out copies of our transcripts to our informants to have them reviewed so that they can confirm that they are being quoted correctly. All our informants have approved our transcripts, with *Informant A* requesting censorship of a couple of names. We agreed to censor these as the names are not relevant to our analysis in any way.

Analysis in our study means that we must evaluate the extent to which data from a given interview can be applied to the study while constricting the extent to which the object of study itself is analyzed. It also means that a stance must be taken regarding the extent to which the objects of study are allowed to influence how a certain answer is to be analyzed. As previously discussed, this is done by allowing the respondents to verify the observations before they are used in the study. It should be noted that

information that is sensitive will not simply be removed from the study if the interviewee requests it; instead the information will be coded as to protect the identity of the interviewee. This is however only applicable if the information in itself allows for changes without distorting its meaning. Following analysis we also need to *verify* what we have gathered. For this study this means that all information collected needs to be verified. This is a very complex process as the observations of individuals might not directly correlate with the information about the context available to the researchers. In order to ensure that our collected information from the interviews had a high validity and reliability we collected official documents from the institution and verified the findings of the interviews by comparing them to the documents, to the extent that this was possible. We also ensured that our background knowledge of the system, or rather the platform on which the system is developed, was extensive as to be able to determine the validity of the statements given in the interview directly. This was merely a initial control allowing for us to define the parameters in which we would assume the answers should lie. This meant that we could question answers; or rather ask for clarifications of certain answers as to ensure that we understood what the interviewee was trying to communicate.

Finally, we have *reporting*. The way we present our study, with regards to structure, is beyond our control and is something that is defined by our research institution who wishes us to present our study using a general template. However, we do control what content is reported. We have consciously omitted two things: theory that we did not believe would add anything to our research framework through a logic process, and the name of our informants as they do not add any value to our study. Edited informant names are marked as *[informant]* in the transcript. Empirically, we have in our findings omitted data that is not relevant to our research framework analysis. However, this empirical data is still available in our interview transcripts for peer review.

4. Object of study

4.1 Sahlgrenska University Hospital

Sahlgrenska was founded on the 1st of January 1997 as a result of a merger between Sahlgrenska Hospital, Mölndal Hospital, and Östra Hospital in Gothenburg (Björck, 2008). Sahlgrenska is today one of the largest hospital in the north of Europe with an estimate of 2,300 beds and 17,000 employees, distributed across 165 departments (Sahlgrenska University Hospital, 2007a). Each day there are 25 babies born in the hospital, 400 emergency patients are emitted, 2431 ordinary checkups are conducted, 2036 patients are cared for, 800 X-rays are performed, 175 patients have serious surgery performed on them, and 18,567 laboratory analyses are conducted (Sahlgrenska University Hospital, 2007b).

4.2 The Department of Orthopedics at Sahlgrenska University Hospital

A document written by Department of Orthopedics at Sahlgrenska University Hospital (2008) says that DO-SU relocated in 2005-2006 which led to a decline in quality of service with extended waiting times, an increase in cancellations of surgical procedures, and an increase in post-surgical infections. The document further says that this lead to the initiation of a new project for follow-up and self-monitoring based on the regulations put forward by SoS. The project started the 1st of August 2007 with the objective to reach the quality goals set by the board of Sahlgrenska and DO-SU as well as follow the quality indicators set by SoS (Department of Orthopedics at Sahlgrenska University Hospital, 2008). The project included the implementation of a DSS called QlikView, which is used access a special care-quality-register (translated freely from Swedish[5]) for DO-SU as well as information and data from a range of other different databases (Department of Orthopedics at Sahlgrenska University Hospital, 2008). Routines for reliability verification were developed, procedures for analysis were implemented, and finally improvement procedures for problems deviating from set goals were developed (Department of Orthopedics at Sahlgrenska University Hospital, 2010a). The system has been in use since the spring of 2008 and is under constant development. When DO-SU conducted a comparison between the years 2007 and 2009 it became evident that the waiting time for patients had decreased with 10% for emergency patients (from arrival to the start of any surgical procedure), it also showed that complications (blister formations, fall-related injuries, pressure injuries, wound infections, re-surgeries, and urinal retentions) had decreased significantly between 20-75%, and overall the mean treatment times had been decreased by 17% (Department of Orthopedics at Sahlgrenska University Hospital, 2010a).

[5] Vårdkvalitetsregister

4.3 Presentation of the evaluated clinical DSS

The first view that the system presents is the *general medical unit view* (referred to as GMUV). It allows users to see all of the measurements from the care-quality-register as well as timing differences for specific medical units as seen in Figure 4.1. It also allows for filtering of data based on time periods, treatment type, surgery unit team, and so on (Department of Orthopedics at Sahlgrenska University Hospital, 2010b). For example, a filtering selection can be made to compare data between 2007-2009. From the GMUV users may navigate to sub views such as care volumes (translated freely from Swedish[6]), planning, execution, and results.

Figure 4.1. General medical unit view (Department of Orthopedics at Sahlgrenska University Hospital, 2010d).

Under the *care volume sub view* data is provided that may be used to plan the use of resources, direct actions, and see the results of treatments as seen in Figure 9.1 (Department of Orthopedics at Sahlgrenska University Hospital, 2010b). Figure 9.2 shows the *planning sub view* that allows users to see how resources are used based in terms of surgery times as well as ward usage times (Department of Orthopedics at Sahlgrenska University Hospital, 2010b). Finally, in the GMUV users can see cancellations, rebooking and timing differences under the *execution sub view* as seen in Figure 9.3. Specific measurements from the care-quality-register may also be selected and studied in detail under the *result sub view*. This includes infections, blister formation and mortality ratio as seen in Figure 9.4 (Department of Orthopedics at Sahlgrenska University Hospital, 2010b). Users may also filter this data based on teams, and even access details of specific patients (Department of Orthopedics at Sahlgrenska University Hospital, 2010b).

The other major view is the *general management view* (referred to as GMV) that also has several sub views. The general view shows overall information for care volumes, planning, execution, and results as seen in Figure 4.2. Through a few clicks users can

[6] Vårdvolymer

easily access the various sub views of the GMW that show how the prosthesis stocks currently look like (see Figure 9.5), how stocks have changed through time (see Figure 9.6), waiting times (see Figure 9.7), and time from arrival to surgery (see Figure 9.8), among other things (Department of Orthopedics at Sahlgrenska University Hospital, 2010b).

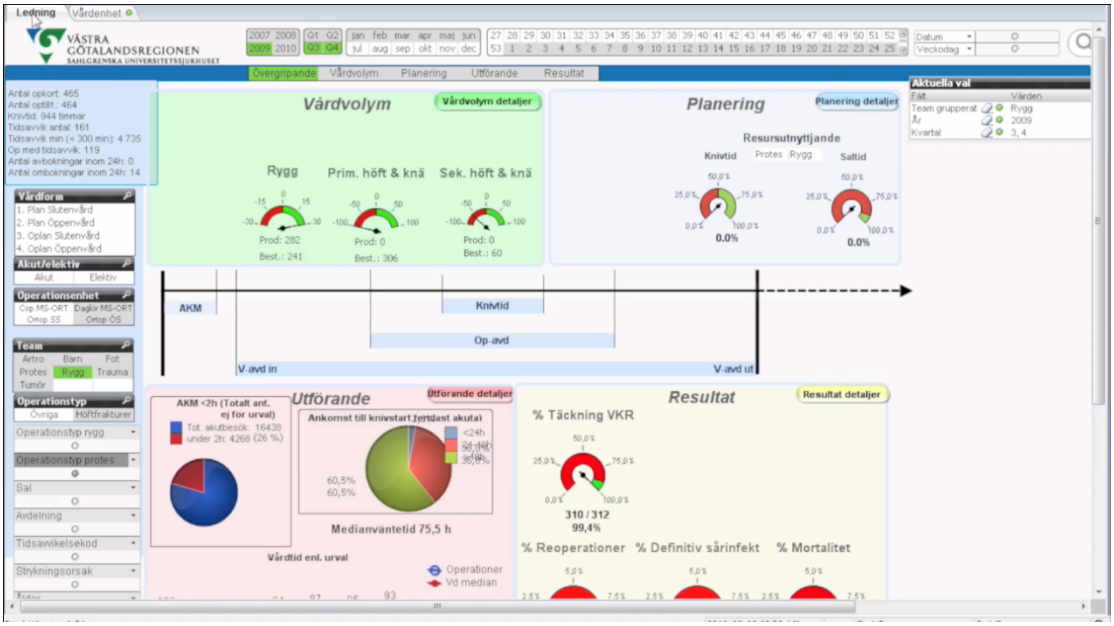

Figure 4.2. General management view (Department of Orthopedics at Sahlgrenska University Hospital, 2010d).

Västra Götalandsregion (2008) also provided a technical description of the system. The DSS access data from the statistical databases Operett, Pax, Melior, DO-SU and care-quality-register. The actual DSS is then updated with this data through a publishing client which can be scheduled to run every day, for example. There also is a server solution allowing for the DSS applications to be accessed through a network, and a client solution for web-browsers to access these network enabled applications. As such it is a typical three-tier architecture, with a data tier (databases), logic tier (DSS model base), and presentation tier (DSS client). Finally, it should be noted that during our study the informants told us that the system was still in a pilot phase, about to be rolled out full scale. This means that the system was only being used by a handful of users during our study. This also meant that we could interview all the users of the system, while at the same time making the measurement of some factors more difficult. These implications will be discussed in more detail in chapter 5 and 6.

All the missing figures referenced in this section can be found in Appendix 9. They have been excluded from this section to improve readability.

5. Empirical findings

5.1 Presentation of our informants

Informant A is an operations developer at DO-SU and has a background as a nurse. However, *A* has been a manager at different medical units for many years now and uses the system to develop the department.

Informant B is a nurse but since two years back *B* mainly works with administrative tasks at DO-SU, handling the care-quality-register. *B* works with something called outcome analysis (translated freely from Swedish)[7] where *B* looks at different parameters in the care-quality-register, for example looking at which patients have pressure wounds or blisters. The DSS then helps *B* to identify these patients in detail, and extract all relevant information that is related to these parameters. This extracted information *B* then presents to relevant personnel and physicians in form of reports. You could say that *B* is a part of the decision support since the system is still used on such a small scale that not all personnel has access to the it and therefore *B* acts as a link.

Informant C is an associate professor and chief physician, but with regards to DO-SU *C* is working as an operations developer because of *C* extensive experience in healthcare. *C* does not use the system but instead works as developer of if together with an external technical consultant.

In the following sections we will conduct our analysis and discussion together, based on our collected interviews, observation notes, and documents. They will be discussed from the three measurement variables of the general model of DSS evaluation (see Figure 2.4): decision outcome quality, decision-making process efficiency, and decision maker satisfaction. Each section will first start with our in-depth analysis and discussion, followed by a summary table of our informants' answers. Interviews are referenced to as (<InterviewA/B/C>, <SentenceNR>). A reference to Interview A, to the third sentence of the answer to the second question, would be referenced as: (A, 2.3). A reference to a follow-up question, such as question one of Interview B, is referenced to as: (B, FUP1).

5.2 Decision outcome quality analysis and discussion

5.2.1 The DSS provides recommendations

Recommendation provision is a key contribution area of clinical DSS. *Informant A* tells us that the DSS does indirectly provide recommendations and advice. When *Informant A* uses the system with groups the system becomes advising and recommending since it shows which areas are in a 'bad' state and which are in a 'good' state (A, 8.2). The DSS helps to identify problems along the whole chain of processes, which act as recommendations upon which the users then can take direct

[7] Utfallsanalys

action. However, it does not automatically provide these advice and recommendations to the user. Instead this information is seen when the users access the system.

Informant B does however not agree that the system provides recommendations as *B* feels that they still need to draw their own conclusions (B, 8.1-8.4). *Informant C* also tells the same as *Informant B* (C, 8.1-8.2). This discrepancy is probably a question of definition as to what a system recommendation or advice is. Even if the system did draw its own conclusions it would still be thanks to pre-programmed logic (rather than AI) and as such recommendations would not be 'true intelligent advice' but perhaps 'best' or 'common practice'. Also, as Davenport (2009) suggests an automated system that makes bad decisions can be very damaging for an organization. As Kohli and Piontek (2008) explain these indirect recommendations may be 'evidence-based medicine' implementations, where physicians draw upon large quantities of historical data to see which treatment works and which do not, which help to lead physicians' to desirable decision outcomes.

Another aspect of recommendations is the prototype DSS built by Zarling et al. (2008) that allowed for flagging of patients that are more prone to have complications. *Informant C* informs us that this is also possible with their system (C, FUP2). Therefore we argue that the indirect recommendations that *Informant A* speaks of are good enough and perhaps even optimal since it leaves the final judgment to the user. One could also argue that there is room for human judgment if the system provides full featured advice, where the judgment would be to act or not to act on the recommendations. However, we suspect that in such cases users would *not react* to system recommendations only if there was distrust to the system, and not because of intellectual reasons (human intelligence versus logical calculations). The system does provide indirect recommendations on which direct actions are based on, and there is a measurable improvement at DO-SU (Department of Orthopedics at Sahlgrenska University Hospital, 2008).

The DSS provides recommendations		
Informant A	**Informant B**	**Informant C**
• The DSS does indirectly provide recommendations and advice. When the system is used in groups the system becomes advising and recommending since it shows what areas are in a "bad" state and which are in a "good" state. (A, 8.2).	• *Informant B* does not agree that the system provides recommendations as *B* feels that *B* still needs to draw their own conclusions (B, 8.1-8.4).	• *Informant C* agrees with *Informant B* (C, 8.1-8.2).

Table 5.1. Summary of the DSS providing recommendations.

5.2.2 The DSS increases patient satisfaction

Patient satisfaction is an indicator of healthcare quality (Kohli & Piontek, 2008). It may be argued, that improved decision outcomes should lead to more satisfied patients; receiving correct treatment faster. Since DSS assist with increasing decision quality (Holsapple, 2008; Pick, 2008) it is also a factor we should measure in hospital context. All of the informants we have talked say that the question on patient

satisfaction is difficult to answer. *Informant A* chooses to discuss this with regards to available resources and decision-making time, patients are mainly dissatisfied with waiting times (A, 9.4). And in this case the DSS helps to monitor resources and what volumes these resources are able to treat, which helps DO-SU to argue for what capacity they actually have (A, 9.2) By increasing the efficiency of the department patients may experience reduced waiting times which could lead to higher satisfaction (A, 9.4).

Informant B tells us that the system itself, as well as the processes it is used for to increase quality, is so new that they probably don't have any impact on patient satisfaction yet (B, 9.2-9.4). However, *Informant B* does see potential in the future, as more effective processes will lead to more patient time for physicians as they won't have to act with the system for extended periods of time (B, 9.6). As Kawamoto et al. (2005) write a clinical DSS main focus should be to minimize physicians' efforts on using the system. *Informant C* also discusses this issue with regards to optimization of processes, working with reducing times.

Informant C does however not want to prescribe this optimization fully to the system. Rather it is only a part of it (C, 9.2). Therefore, at this point in time we do not have enough data to conclude if patient satisfaction has increased thanks to the DSS. However, there are indications that this might be the case. Also, considering bias, this factor should probably be measured from the patient side and not the medical staff.

The DSS increases patient satisfaction		
Informant A	**Informant B**	**Informant C**
• Patients are mainly dissatisfied with waiting times (A, 9.4). • The DSS helps to monitor resources and what volumes these resources are able to treat, which helps DO-SU to argue for what capacity they actually have (A, 9.2). • By increasing the efficiency of the department patients may experience reduced waiting times, which could lead to higher satisfaction (A, 9.4).	• The system itself as well as the processes it is used for to increase quality, are so new that they probably don't have any impact on patient satisfaction yet (B, 9.2-9.4). • There is potential in the future, as more effective processes will lead to more patient time for physicians as they won't have to act with the system for extended periods of time (B, 9.6).	• *Informant C* also discusses this issue with regards to optimization of processes, working with reducing times. However, *C* does not want to prescribe this optimization fully to the system. Rather it is only a part of it (C, 9.2).

Table 5.2. Summary of the DSS increasing patient satisfaction.

5.2.3 The DSS reduces hospital errors

Our findings in the literature review have shown that one of the major concerns regarding the implementation of clinical decision support systems is that of hospital errors. Leape et al. (1995) states that hospital errors are the most discussed risks within the hospital context. *Informant A* however suggest that due to the fact that the current version being used is a pilot they can merely see the potential of the decision support system reducing errors and increasing quality, but DO-SU have not yet reached their desired goals (A, 10.4).

Informant B on the other hand states that *B* has no direct knowledge regarding if the DSS has affected the amount of hospital errors (B, 10.2). This would suggest that the system is being implemented without the hospital errors being a major concern as they are aware that the system is not fully functional with regards to the mitigation of these errors but it is still in use. It should however be noted that due to the fact that the system is in its pilot phase it could be the case that the mitigation of the errors have simply not been implemented fully yet but should still be considered to be a vital part of the implementation.

However, when asking about the current state of the project and when they think they could be ready to release it to the users on a full scale (C, 13.31), *Informant C* answers that they can release it today if necessary, as they have almost completed the system and the only thing that is missing is the control of reliability in the system (C, 13.33). This would once again indicate that the system can be used even if all the components regarding the mitigation of hospital errors are not in place.

Based on this we can conclude that the system being implemented at Sahlgrenska does not need to ensure that all hospital errors are removed, the system can be used even if it is not always totally accurate. This does however not answer the question if the amount of hospital errors has been reduced at all as a result of the implementation of the system. *Informant A* stated that they have not yet reached their goals (A, 10.4), not indicating the extent to which these stated goals regarding hospital mitigation had been achieved as of right now. Due to *Informant B's* position within the pilot project as a user, we asked if *B* had noticed any differences in errors within *B's* own work as a result of using the system (B, 10.3). To which *Informant B* answered that the current system being used *[QlikView]* initially had problems with the extent to which the data being presented by the system was correct. They were forced to conduct checks against the old systems to determine if the information they were collection could be considered accurate or not (B, 10.4). *Informant C* however, when asked if the amount of hospital errors had been reduced answered that the errors had decreased, arguing that it is something they give a lot of attention by discussing deviations in groups of doctors as to find better or alternative solutions for the future (C, 10.2). *Informant C* however also states that the system does not show this directly on the users screen today *[it has to be discussed in groups]* but it should in the future (C, 10.2).

From this we may therefore conclude that the system does affect the amount of hospital errors within the hospital. It does however need to be noted that the system is used to collect and manipulate the information and then produce the findings in various reports. The system is not being used to directly warn practitioners of errors they are about to commit, and so on. The system does decrease the amount of hospital errors conducted in the hospital as deviations from the norm are discussed within special groups in an attempt to find better procedures or solutions. The system is however mainly used to collect the data regarding the errors and does not conduct the actual analysis of the errors and potential solutions itself. This means that since the system in fact does improve the decision outcomes as a results of the discussions conducted in groups we can state that the implementation of the system has lead to a decrease in hospital errors while ensuring that the quality of the decisions has increased, even though the system in itself has not yet fully implemented the necessary methods to catch these errors instantaneously.

The DSS reduces hospital errors		
Informant A	**Informant B**	**Informant C**
• Due to the current version being used is a pilot they can merely see the potential of the DSS reducing errors and increasing quality, but they have not yet reached their desired goals (A, 10.4).	• *B* has no direct knowledge regarding if the DSS has affected the amount of hospital errors or not (B, 10.2). • The system initially had problems with the extent to which the data being presented by the system was correct so they were forced to conduct checks against the old systems to determine if the information they were collecting could be considered accurate or not (B, 10.4).	• The system is ready to be released today, the only thing that is missing is the control of reliability in the system (C, 13.33). • The amount of errors has decreased, it is something that they give a lot of attention by discussing deviations in groups of doctors as to find better solutions for the future (C, 10.2). • The system does not show the information directly on the users screen, it has to be discussed in groups, but it should in the future (C, 10.2)

Table 5.3. Summary of the DSS reducing hospital errors.

5.2.4 The DSS allow decision makers to learn from the steps taken when using the system

Kohli and Piontek (2008) argue that the DSS allows the decision makers to learn from their steps taken when using the system so that they can make better decisions in the future. They further suggest that the quality and efficiency of the decision is partly increased as a result of the learning process. When asking about if *Informant A* obtains any new knowledge from using the system, *Informant A* states that you learn all the time and that you constantly develop your skills with new information (A, 11.2). Regarding the administrative knowledge it is, according to *Informant A*, mainly gained from the work on developing the applications, which is always informative but it also gives them better insight into the specific organization of DO-SU (A, 11.2). When asked if the system has taught the informant anything about their own work related tasks (A, 11.5) *Informant A* thinks so. *Informant A* gets a better overview of the parts in DO-SU, which gives a general overview rather than seeing just parts of the reality, arguing that each component or part becomes valuable, because if all the parts are not represented then the system will never be a success (A, 11.6).

Informant B similarly states that *B* have probably learnt something from the system but is uncertain of what exactly, arguing that you always learn something from a new system (B, 11.2) Lastly, *Informant C* says that when knowledge needed to be transferred to the system it had to be structured, which lead to *Informant C* learning a lot (C, 11.2). When asked if the system can be used to learn more about one's own work process, *Informant C* states that it is already possible to do so with the current system, but they have however not reached their full potential yet due to a limited amount of users and capability (C, 11.6).

This means that we can see a clear pattern regarding the system's ability to provide its users with information as all the informants agree that some knowledge has been obtained by all of them. It is however not knowledge about the interaction with the

system as such but more about the daily work in the hospital. *Informant B* does however state that the version currently being used is a pilot, and *B* did not get any education on how to use the system and was forced to learn by trial and error (B, 1.2). Since the informant did not get any training in how to use the system but had to learn everything from scratch we could argue that the system does allow the users to learn from the steps taken. This is further confirmed by *Informant B* statement in response to the question whether or not *B* has to repeat a set procedure every time the system is used.

It is stated that *B* has to repeat a given procedure every time QlikView is used, which involves changing the settings and generally adapt the program (B, 1.8). Hammons et al., (cited in Kohli & Piontek, 2008) suggests that insufficient training creates risks in itself as it leads to malfunction and misuse. *Informant B* answer however disconfirms this to a certain extent as *B* has been able to use the system correctly. *Informant B* shows that *B* have learnt how to conduct as certain task based on repetitious usage, suggesting that the system is capable of allowing the decision makers to learn from the steps taken when using the system, meaning that the decision outcome quality is increased as well. We can however not distinctly state that the views of Hammons et al. (cited in Kohli & Piontek, 2008) can be disproven as future users may differ from existing ones. On a final note, the informants do agree that the system does contribute with knowledge about both general matters as well as more specifically about their work process. Therefore, we can state that the DSS does assist in improving the decision outcome quality as the system allows its users to learn how to conduct certain tasks in a more efficient manner.

The DSS allow decision makers to learn from the steps taken when using the system		
Informant A	**Informant B**	**Informant C**
• You learn from the system all the time, you constantly develop your skills with new information (A, 11.2). • The administrative knowledge is mainly gained from the work on developing the application, which is always informative. (A, 11.2). • You get a better overview of the parts in DO-SU, which gives a general overview rather than seeing just parts of the reality. If all the parts are not represented the system will not be a success (A, 11.6).	• Has probably learnt something from the system but is uncertain of what exactly, arguing that you always learn something from a new system (B, 11.2).	• Has learnt a lot because when *C*'s knowledge needed to be transferred to the system it had to be structured which lead to *C* learning a lot (C, 11.2). • It is possible to learn about one's own work process with the current system, they have however not reached their full potential yet due to a limited amount of users and capability (C, 11.6).

Table 5.4. Summary of the DSS allowing decision makers to learn from the steps taken when using the system.

5.3 Decision-making process efficiency analysis and discussion

5.3.1 The decision support is automated

Studies done by Kawamoto et al. (2005) show that automated DSS improve reliability and consistency by minimizing processes that are labour intensive and error prone. *Informant A* tells us that the system itself is quite automated in the sense that it is point-and-click based (A, 1.1). Only a few clicks are necessary to access any information within the system (A, 1.1) and as such no extensive labour is required during the intelligence phase. However, *Informant A* tells us that there is distrust from *A* side to the information that the system presents, mainly because problems have existed before with the validity of the data (A, 1.2). Therefore when working with the DSS *Informant A* also consults the databases from which the DSS access data, and compares the outputs manually (A, 1.2). So even if the decision support does make the intelligence phase more efficient by automating information gathering, the decision process itself is made more complex since it requires redundant actions to be performed to ensure data consistency.

Informant B shares another point of view on this, telling us that the system does not save any information regarding settings or snapshots of the workspace meaning that every time *Informant B* starts the DSS *B* has to manually set up the settings and workspace again (B, 1.8). Also, some of the work done requires *Informant B* to interact with other software, moving data from the DSS to the external software manually (B, 1.8).

Informant C also tells us that they do not have the total transparency and effortless DSS they wish to have yet, suggesting that this is a time issue rather than development problem (C, 1.2). *Informant C* also highlights the issue of data consistency that *Informant A* speaks about saying that some users assume that the output from the DSS is correct, which is not always the case (C, 1.12). Therefore it seems to be a necessity to run parallel systems together with the DSS to ensure that correct data is presented, making some of the automation efforts futile as it simplifies and automates some parts of the process while making other parts more complex and tedious.

However, DO-SU makes use of more than 4 systems and over 14 databases (C, 4.4) and the DSS connects and links all of them together, something that is not possible with existing systems (A, 5.4). Automating the access to all of these systems and databases from the single DSS has greatly reduced a previously labour intensive process. A gain we argue is greater than the smaller addition of doing manual data consistency checks. We therefore argue that the decision support is indeed automated to a great extent making the decision-making process more efficient.

The decision support is automated		
Informant A	**Informant B**	**Informant C**
• The system is quite automated in the sense that it is point-and-click based (A, 1.1). • Few clicks are necessary to access any information within the system (A, 1.1). • Distrust exists, controls information against existing databases. (A, 1.2).	• The system does not save any information regarding settings; B has to manually set up the workspace every time (B, 1.8). • Has to interact with other software as well, moving data from the DSS to the external software manually (B, 1.8).	• The DSS is not as transparent and effortless as they would want yet, suggesting that it is a time issue rather than a development problem (C, 1.2). • There are problems with data consistency. Some users assume that the output of the DSS is correct, which is not always the case. (C, 1.12).

Table 5.5. Summary of the DSS being automated.

5.3.2 The decision support is provided just-in-time

As both Kohli and Piontek (2008) and Kawamoto et al. (2005) write, just-in-time support is essential for DSS. It helps physicians to access the right data at the right time, exactly when they need it. Just-in-time support is also the premise for system recommendations, discussed later on. *Informant A* informs us that the decision support is provided instantly, exactly when it is needed (A, 2.4-2.6), and *Informant B* (B, 2.9-S2.10) as well as *Informant C* (C, 2.3-2.4) confirms this functionality. This support is mainly provided in form of information which *Informant A* argues is the most important as orthopedics is a specialty and as such they need to have extensive information exchange with their suppliers as well as surgery units (A, 3.2). Also, what makes the current DSS special is that it provides information just-in-time and 'as-is', compared to other systems which require report generation (A, 3.2).

Informant B informs us that the information provided is basic information such as patients civic registration number (translated freely from Swedish[8]), surgery data and surgery codes and so on (B, 3.1-3.4). The system also helps to link this information together. Users at DO-SU were previously only able to see bits and pieces of the larger view (if a patient is late or gets an infection, for example) while they now can see everything in the same place, and more importantly how it all adds up (what variables are linked to patients being late or getting an infection?) and how it progresses through time (C, 3.6). It is therefore clear that the decision-making process has become more efficient by progressing through the intelligence phase much faster through just-in-time support. This also proves Teutsch (2003, cited in Kohli & Piontek, 2008) statement that users are moving to a situation where they need to find the best information at the right time, helping users to access large sets of information that assist with evidence-based medicine (Kohli & Piontek, 2008).

[8] Personnummer

The decision support is provided just-in-time		
Informant A	**Informant B**	**Informant C**
• The decision support is provided instantly, exactly when it is needed (A, 2.4-2.6). • Information is important as orthopedics is a specialty and they need to have extensive information exchange with their suppliers as well as surgery units (A, 3.2).	• Confirms that the decision support is provided instantly (B, 2.9-2.10). • The information provided is basic information such as patient's identity number, surgery data and codes and so on. (B, 3.1 - 3.4).	• Confirms that the decision support is provided instantly (C, 2.3-2.4). • Users at DO-SU could previously only see parts of the large picture but can now find everything in the same place. (C, 3.6).

Table 5.6. Summary of the DSS providing just-in-time support.

5.3.3 The DSS reduces costs

One of the primary motivators for using a clinical DSS is to monitor and enhance financial performance (Kohli & Piontek, 2008). Costs may be reduced during the decision-making process, which helps to reduce complications as well as treatment time (Kohli & Piontek, 2008). However, Kohli and Piontek (2008) discuss the cost question from a perspective of profit, which is not applicable in this case. Swedish hospitals are not allowed to make any profit and therefore we have to at cost from a perspective of efficiency rather than profit margins.

Informant A informs us that cost reductions are not evident yet as the system has not been run long enough to see cost benefits (A, 4.4). So far DO-SU has paid the initial costs for the software as well as for the technicians to set it up and as such the overall costs for the department has increased instead (A, 4.4). However, *Informant A* tells us that they already can see cost benefits on a longer term due to the way the DSS helps them to aggregate information. For example, the DSS shows them how many prosthetics they have and how many they need to produce, this detailed information then helps them to better plan their production efforts, which allows for cost savings with regards to production as well as work time for people who need to coordinate these efforts (A, 4.6-4.12). Costs for manual efforts range beyond 50,000 SEK per month, that the system can automate and save (Department of Orthopedics at Sahlgrenska University Hospital, 2010b). *Informant A* informs us that the production planning is a lot of work and the DSS reduces this work to a few clicks in the system, meaning that manpower can be saved.

Informant B also acknowledges that the DSS has reduced working time (B, 4.1-4.2). *Informant C* also says that they can see cost reductions in terms of lowered complications, more efficient processes, and so on (C, 4.2). However, *Informant C* does not want to solely thank the system for this, instead the system is just a part of making things more efficient (C, 4.2). Among other things, the system helps to reduce infections, where a single infection may cost up to 500,000 SEK (A, 5.5). While the system implementation has cost DO-SU around 3-4 million SEK so far (C, FUP5), meaning that there is great potential for saving costs in the future and in relation to the investment.

As we initially suspected with our research framework, cost reductions are connected to making the decision-making process more efficient. In the case of DO-SU the DSS has made the decision-making process more efficient when gathering decision data,

which has reduced working man-hours, which then reduces costs. Finally, we can also see here that cost reduction is more strongly connected to making processes more efficient, rather than to making profit. We can in our study see that this process efficiency in relation to cost is in fact present at DO-SU, thanks to the DSS.

The DSS reduces costs		
Informant A	**Informant B**	**Informant C**
• Cost reductions are not evident yet as the system has not been used for long enough to see any such benefits (A, 4.4). • DO-SU has paid the initial costs for the software as well as for the technicians to set it up, and as such the overall costs for the department has increased (A, 4.4). • Cost reductions will however be seen in the future. The DSS helps them to better plan their production efforts, allowing for cost savings (A, 4.6-4.12).	• Acknowledges that the DSS has reduced working time (B, 4.1-4.2).	• They can see cost reductions in terms of lowered number of complications, more efficient processes and so on (C, 4.2). • Can however not accredit this solely to the system, the system is just part of making things more efficient (C, 4.2).

Table 5.7. Summary of the DSS cost reduction.

5.3.4 The DSS increases efficiency

One of the main purposes of DSS is to support the decision-making process (Holsapple, 2008; Pick, 2008). It allows for resources to be used more efficiently, reducing time for decision-making (Udo & Guimares, 1994), and for PAIRS (see Figure 2). In a hospital context it is primarily costs that force hospitals to make their processes more efficient (Kohli & Piontek, 2008). DSS help with making these processes more efficient by making all of the phases in the decision-making process more efficient, or more commonly; specific phases (Ang et al., 1995). In the case of DO-SU it is primarily the intelligence phase that is supported (A, FUP1; C, FUP3), and the DSS has helped to primarily provided transparency for the whole organization. As mentioned before the DSS links a number of systems together, which is not possible with any other existing system (A, 5.4). The DSS then allows for DO-SU to follow-up on their care-quality-register, production, and status of patients through time (A, 5.4). The efficiency gains have therefore been mainly with regards to deep analysis of situations and better problem classification in the intelligence phase, allowing for inefficiencies in processes to be fixed (A, 5.4). One example is patient infections, which have been reduced thanks to quality analysis through the DSS (A, 5.5). As such, the quality of treatment has also increased, suggesting that the link between quality issues being associated with cost and efficiency outcomes exists as stated by Kohli and Piontek (2008).

Informant B also agrees that it is mainly information gathering that has become more efficient (B, 5.2) and *Informant C* says the same as *Informant A*; that new information has allowed for other processes to become more efficient. With regards to context, as Holsapple and Whinston (1996, from Hall, 2008) discuss it, decisions here are made

in a cross section level as *Informant B* uses it on a more operational level while *Informant A* uses it on a more managerial level, and both of them have noticed efficiency gains. The DSS has therefore not only made the decision-making process more efficient, but also provided the foundation for optimizing other workflow processes at DO-SU. Also, as suggested by Kohli & Piontek (2008), this factor is connected to cost reduction as discussed in section 5.3.3, but not from a profit perspective.

The DSS increases efficiency		
Informant A	**Informant B**	**Informant C**
• In the case of DO-SU it is primarily the intelligence phase that is supported (A, FUP1). • The DSS links a number of systems together, which was not possible before (A, 5.4). • The DSS allows for DO-SU to follow-up on their care-quality-register, production, and status of patients through time (A, 5.4). • The efficiency gains have mainly been in deep analysis of situations and better problem classification in the intelligence phase, allowing for inefficiencies in processes to be fixed (A, 5.4). • This has led to a cost reduction, as a single infection may cost up to 500,000 SEK (A, 5.5).	• Agrees that it is mainly information gathering that has become more efficient (B, 5.2).	• New information has allowed for other processes to become more efficient so the DSS has not only made the decision-making process more efficient, but also provided the foundation for optimizing other workflow processes at DO-SU (C, 5.2).

Table 5.8. Summary of the DSS efficiency increase.

5.3.5 The DSS is functional

Hammons et al. (2000, cited in Kohli & Piontek, 2008) suggest that insufficient maintenance of the DSS may lead to malfunction. If a widely adopted and integrated DSS malfunctions then it is likely that the decision-making process efficiency will be decreased. Regarding the functionality of the system the informants give a divided view. When we for example asked about if the system has ever stopped working, *Informant B* answered that it goes down all the time and that they also had some issues with the updates in the system being that the system did not update every day as intended but sometimes after a week or two. *Informant B* also states that the system collects the wrong information in certain cases, but argues that this is due to it being the pilot and state that it is part the job to actually identify these problems and report them back to the other users (B, 6.2). Hammons et al. (2000, cited in Kohli & Piontek, 2008) suggest that operator training is essential for a DSS to be functional, and it is clear that *Informant B* received no formal training in using the system (B, 13.4). Without proper training, a system may be used improperly and not being functional, which might be the case here (Hammons et al., 2000, cited in Kohli & Piontek, 2008)

Informant C however simply states that the system has never stopped working (C, 6.2) and when we ask if the system has provided faulty information or similar we got the same answer (C, 6.8). One possible explanation for this is that the questions were understood differently. *Informant C* states that the system is very stabile and has never crashed completely (C, 6.4). From this statement we can make the assumption that the informant understood the question as being directed towards if the system had completely stopped working and not concern the details of potential bugs in the system and similar. It can also be explained by the fact that the two informants use the system very differently, suggesting that certain aspects of the system are less operational than others. *Informant A* supports the view of *Informant C*, saying that *A* has not experienced any problems with the system not being operational (A, 6.2). When asked if they had experienced any other problems it was stated that it was mainly the application itself that was a problem, various tools did not represent the data accurately and it was only small details that needs to be overlooked, the system in itself never fails. (A, 6.4)

Reilly and Evans (2006) have already discussed the threat of false positives with regards to widespread DSS adoption, and it is clear that the system gives *Informant B* false positives some times while *Informants A* and *C* have not experienced this to any great extent. This means that there might be a case of perceived restrictiveness with regards to the system and this will affect the evaluation negatively from the viewpoint of the users (Parikh et al., 2001). From this we can conclude that the different informants clearly express different views regarding the extent to which the DSS is functional. *Informant B* suggests that there are various problems with the system retrieving faulty information and similar, also suggesting that the system does not update as frequently as it is supposed to. *Informants A* and *C* however suggest that the system is fully functional; they have never seen the system be non-operational. This would then suggest that various parts of the system are not as operational as others. We can thus conclude that the system is functional to a certain extent but there are known issues that hold the functionality back. This also means that the efficiency of the decision-making process is affected differently; two of the informants have a positive effect on the efficiency as the system is aiding them without interruptions, but one has a negative due to faulty information and similar.

The DSS is functional		
Informant A	**Informant B**	**Informant C**
• Has never experienced any problems with the system not being operational (A, 6.2). • The application in itself can be a problem, tools do not represent the data accurately but its only small details that need to be overlooked (A, 6.4). • The system itself never fails (A, 6.4).	• The system goes down all the time; there are issues with updates not being conducted daily as it should. (B, 6.2). • The system collects the wrong information in certain cases (B, 6.2).	• The system has never stopped working (C, 6.2). • The system does not provide any false information (C, 6.8). • The system is very stabile and has never crashed completely (C, 6.4).

Table 5.9. Summary of the DSS functionality.

5.3.6 The DSS is adapted to regulation

We have suggested that regulation may have an effect on the decision-making process, limiting decision-making time and emphasizing quality. It is likely that such regulation also affects the decision support that supports the decision-making process. If regulation has a negative effect on decision support then it seems likely that the decision-making process efficiency will also be affected negatively. When asked what laws and regulations are important in relation to the DSS *Informant A* answered that SOC 2005:12 was an important law which controls the quality of care within the hospital suggesting that it is a law like that that serves as the foundation for the entire hospital (A, 7.2). *Informant B* is uncertain of the names and numbers of the laws but argues that the system must follow the same laws that apply to the hospital in general regarding disclosure and so on (B, 7.2). *Informant C* states that it is mainly the health- and healthcare law that is important, but also all laws regarding confidentiality in general (C, 7.2). Lastly, *Informant A* also discusses the introduction of treatment guarantee explaining that the law will determine how long waiting time a patient should expect before receiving care and if the hospital cannot give them care within that time they must send them somewhere else (A, 7.2). When we asked if the system assisted in ensuring that these laws were followed (A, 7.3; B, 7.3; C, 7.3) *Informant A* answered that it will as they will get an overview of what they can and cannot do. They can also see exact information about how long waiting time the patients are experiences. (A, 7.4) suggesting that the system will aids the users in ensuring that the laws and regulations are followed but is not currently doing so. *Informant C* states that they had experienced some problems with maintaining the confidentiality needed due to the project being in its initial stages. *Informant C* further explains that they had had some searchers conducted that should not have been allowed, possibly violating these laws (C, 7.4-7.6). This would then indicate that the laws are not implemented in the system and the security discussed by the informants relates more to the internal security of the system and not the extent to which the system specifically follows the laws stated.

Since *Informant C* states that there have been problems before with searchers being conducted while *Informant A* states that a security protocol is in place, even if arguably only for the internal security of the system, we asked the informants a follow up question regarding the actual extent to which the system has implemented the laws and regulations directly into the software itself. To this *Informant C* simply answers that the laws are not implemented in the version they are using today (C, FUP4). Due to the fact that only *Informant C* actually discusses the extent to which the laws are implemented and, *Informant B* as well as *Informant A* actually discuss the internal security of the system, we draw the conclusion that the system does not implement the laws acting upon it. Instead the users are expected to follow the general laws which apply to the entire hospital. We also draw the conclusion that the laws are a major issue for the system since, as *Informant C* suggests, they have experienced problems in the past, indicating that they are aware of the importance of these laws. *Informant A* also indicates that the laws set by SoS must be followed and the system aids in doing that by illustrating the extent to which desired goals and measurements have been obtained. This is however simply a representation of data and no actual implementation restricting the users from breaking or deviating from these laws exist. As for the decision-making process efficiency, regulation issues do not seem to have had any negative or positive effect.

The DSS is adapted to regulation		
Informant A	**Informant B**	**Informant C**
• SOC 2005:12 is an important law which controls the quality of care, serving as a foundation for the entire hospital (A, 7.2). • The introduction of treatment guarantee is a new law that determines how long a patient should expect before receiving care (A, 7.2). • The system will assist in following these laws as it gives an overview of what they can and cannot do. (A, 7.4) • They can also see exact information about how long waiting time the patients are experiences. (A, 7.4).	• Informant B is uncertain of all the names and numbers of the laws but explains that the system must follow the same laws as the hospital in general (B, 7.2).	• *Informant C* states that it is mainly the health- and healthcare law (translated freely from Swedish[9]) that is important, but also all laws regarding confidentiality in general (C, 7.2). • The system does follow the laws but they have experienced some problems with maintaining confidentiality needed due to the project being in its initial stages. (C, 7.2). • They have had searches conducted that should not have been allowed (C, 7.2).

Table 5.10. Summary of the DSS adaptation to regulation.

5.4 Decision Maker Satisfaction analysis and discussion

5.4.1 The DSS improves physicians' practitioner performance

Garg et al. (2005) state that clinical DSS improves physicians' practitioner performance, which we argued leads to an increase in the decision maker satisfaction. When looking at the interviews we can see a clear trend regarding the uncertainty of the extent to which the system contributes to an increase in performance. *Informant A* states that it is hard to determine, saying that it is a question that should come in 5 years and it is too early to determine right now (A, 12.2). *Informant B* gives a similar answer, indicating that the potential benefits are just starting to show now, stating that the last time was the first time they got any real feedback from the doctors regarding the outcome analysis. (B, 12.2). *Informant C* also argues that it is too early to have noticed any direct effects on the practitioners' performance as of yet by stating that they are uncertain of the benefits as not enough doctors are using it yet (C, 12.2).

We therefore assume that the system has not yet lead to any improvements in the practitioners' performance. It does however need to be considered that the fact that the system does provide the practitioners with information regarding their overall performance could be seen as a starting point for the improvement of the physicians' performance. For as *Informant B* states, the physicians have received exact figures regarding things such as infections, which led to feedback from the physicians, which they had never gotten before (B, 12.2), indicating that the doctors become more aware of the situations. This is also supported by *Informant C* that states that they have been meeting in groups for the last three years and in that time they have gone through a lot of information. This arguably means that the physicians go home from these meetings with knowledge obtained from the system, meaning that the general care is affected in

[9] Hälso- och sjukvårdslagen (1982:763)

some sense. *Informant C* is however unaware of the exact effects (C, 12.4). Lastly, *Informant C* states that they can see improvements when they are conducting measurements, but for the measures to be of scientific quality they have to be more thorough (C, 12.6).

Therefore, based on the answers given in the interviews we conclude that at this given point in time it is not possible to exactly measure the extent to which the system has affected the practitioners' performance. We can however see that the system is improving in this area as it is first at this given point in time that feedback from the physicians is coming in, as *Informant B* explained. We can also see that the system indirectly improves the practitioners' performance through the evaluation of procedures and methods in teams of physicians. It does however need to be noted that the system is merely used as an information processing tool by the groups and is not used by the individual doctors as such. Regarding the extent to which this affects the decision-maker satisfaction due to the fact that the information is analyzed in groups of doctors, whom try to identify patterns and new solutions, it could be argued to affect it. We can however not draw that conclusion based on the information provided to us at this point, as the groups of physicians are actually not using the system themselves as of right now (they are interacting with it through *Informant A* and *Informant B*).

The DSS improves physicians' practitioner performance		
Informant A	**Informant B**	**Informant C**
• It is hard to determine, it is a question that should come in 5 years because it is too early to determine if the practitioners performance has been improved (A, 12.2).	• The potential benefits are just starting to show, last time *[that the analysis was handed out]* was the first time any feedback was given about the outcome analysis (B. 12.2). • The doctors get exact figures regarding things such as infections that lead to the doctors giving feedback via email, which had never happened before (B, 12.2).	• It is too early to early to have noticed any direct effects on the practitioners' performance as of yet as not enough doctors are using it (C, 12.2). • Have been meeting in groups for the last 3 years and have in that time gone through a lot of information, which means that the doctors gain knowledge obtained from the system and in that sense the general care is affected (C, 12.4). • They can see improvements when they are conducting measurements, but for the measures to be of scientific quality they have to be more thorough (C, 12.6).

Table 5.11. Summary of the DSS improving physicians' practitioner performance.

5.4.2 The DSS overcomes any change and implementation resistance

Kohli et al. (2001) suggest that DSS implementations are usually met with resistance, as they require decision makers to change their behavior. We suggest that resistance might have a negative effect on mainly decision maker satisfaction as it might disrupt the morale among decision makers. *Informant B* resisted the system initially before *B*

had learnt how to use it, due to the fact that it was not user friendly, but is unaware of any resistance presented by others (B, 13.4). *Informant C* however initially suggests that there has been no resistance to the system (C, 13.2), but when asked about the IT-council (Appendix 3, Observation notes 1) *Informant C* stated that the council did not present any resistance but single individuals in higher positions have (C, 13.4).

Informant A however presents a different view explaining that the system has received resistance from the hospital. Stating that due to the costs involved with purchasing the previously used system Cognos the hospital or perhaps more specifically the decision makers within the hospital are automatically against any system that aims to solve the same issue (A, 13.4). This suggests that the hospital in itself has resisted the system due to there being an alternative system already in use. From this we can see that there clearly has existed resistance from both the users as well as higher personnel and arguably also from the hospital itself. Looking at what *Informant A* state we can also see that potential users could resist the implementation due to them being responsible for large investments in other similar systems. The users resisting the system are clearly a problem as their level of satisfaction will decrease. *Informant A* explains that the hospital has shown resistance towards the system, perhaps not explicitly stated in official documents but there is definitely a form of resistance due to a commitment to Cognos, the alternative system in use.

Informant B also confirms that there has existed resistance towards the system, as *B* also resisted the system initially. As Kohli & Piontek (2008) suggest, this type of resistance is normal when decision makers have to change their behavior. *Informant C* initially suggested that there had been no resistance, but then later suggested that some individuals in higher positions have expressed resistance towards the system. Overall we can conclude that the system has received various forms of resistance, the decision makers satisfaction does not seem to have influenced *Informant B* as they still use the system. This could however also be due to the fact that *Informant B* now has learnt the system. *Informant A* however suggests that the decision-makers satisfaction is definitely affected especially for those with an economic interest in other projects. Since the users at DO-SU have chosen to use QlikView over Cognos, resisting resistance, and still use QlikView they are obviously more satisfied with the current solution than the old.

The DSS overcomes any change and implementation resistance		
Informant A	**Informant B**	**Informant C**
• Due to the costs involved with purchasing the previously used system Cognos the hospital, or perhaps more specifically the decision makers within the hospital, are automatically against any system that aims to solve the same issue. (A, 13.4).	• Initially *Informant B* resisted the system, before *B* learnt how to use it because it was not user friendly at first (B, 13.4). • *Informant B* is however uncertain of what resistance might have been shown by others (B, 13.4).	• There has been no resistance to the system (C, 13.2). • The IT-council did not present any resistance but some individuals in higher positions have (C, 13.4).

Table 5.12. Summary of the DSS overcoming change and implementation resistance.

5.5 Conclusion on empirical findings

Table 5.4 shows a summary of our empirical analysis. From it we can see that the clinical DSS at DO-SU fulfills 8 of the 12 key contributions, while 1 is not fulfilled without any effect, and 3 are inconclusive. The implications of our inconclusive measurements will be discussed in greater detail in chapter 6, in relation to our research question and our purpose. From our analysis summary we can conclude that in several aspects the DSS allows for decision to be made more productively, with greater agility, with increased innovation, with greater reputability, and with higher satisfaction (PAIRS, see Figure 2.2) as suggested by Holsapple (2008).

Clinical DSS key contribution	Decision Outcome Quality	Decision-Making Process Efficiency	Decision Maker Satisfaction	Evaluated clinical DSS
The decision support is automated		X		Yes. Higher DPE.
The decision support is provided just-in-time		X		Yes. Higher DPE.
The DSS provides recommendations	X			Yes. Higher DOQ
The DSS reduces costs		X		Yes. Higher DPE.
The DSS increases efficiency		X		Yes. Higher DPE.
The DSS increases patient satisfaction	X			**INCONCLUSIVE**
The DSS reduces hospital errors	X			Yes. Higher DOQ.
The DSS improves physicians' practitioner performance			X	**INCONCLUSIVE.**
The DSS allow decision makers to learn from the steps taken when using the system	X			Yes. Higher DOQ.
The DSS is functional		X		**INCONCLUSIVE.**
The DSS overcomes any change and implementation resistance			X	Yes. Higher DMS.
The DSS is adapted to regulation		X		No. No effect on DPE.

Table 5.13. Summary of the evaluated clinical DSS.

6. Conclusions

6.1 Answering our research question

At the beginning of this study we posed the question:

- How should one evaluate the clinical decision support system within the context of the Department of Orthopedics at Sahlgrenska University Hospital?

By combining theory on the decision-making process, together with clinical DSS key contributions (see Table 2.1 and section 2.5.1), and the general model of DSS evaluation (see Figure 2.4), we have created a research framework that makes it possible to evaluate the effectiveness of clinical DSS within a hospital context (see Table 2.2). The framework examines if a clinical DSS fulfills a set of clinical DSS key contributions and what influence these key contributions have on decision outcome quality, decision-making process efficiency, and decision maker satisfaction. This framework has then allowed us to evaluate the clinical DSS within the context of DO-SU at Sahlgrenska, using a qualitative approach. As such we have answered our research question, and also fulfilled our purpose of creating a research framework that is able to evaluate the clinical DSS being used at DO-SU at Sahlgrenska (see Table 5.13).

6.2 Discussion of our findings

The region of Västra Götaland (VGR) has been using Cognos as the primary decision support system for the last few years. DO-SU participated in the use of Cognos during 2007, but the users at DO-SU experienced that Cognos was exceptionally difficult to manage and work with. Therefore, with the creation of the new action plan DO-SU decided to use QlikView instead. DO-SU argue that QlikView has helped them reach the quality indicators formulated by SoS as well as Sahlgrenska in an easier, more efficient, and user-friendlier manner than with Cognos (Department of Orthopedics at Sahlgrenska University Hospital, 2008). Follow-up SoS evaluations have shown that the DO-SU is of great success also, and it does comply with the requirements put forward by SoS (C, 11.7). Our analysis also shows that the clinical DSS has in fact improved several parts of the DO-SU organization. However, during our study we have faced a number of problems with regards to our analysis.

6.2.1 Inconclusive factors

Firstly, when we visited DO-SU it was clear that the clinical DSS was not being used in full scale. Instead it was only in a pilot phase which instantly meant that we were going to have issues with measuring long-term factors such as patient satisfaction, physician performance, and to some extent also extensive functionality. Obviously, a pilot project is deemed to have inconsistencies and bugs, and even though we are given future indications of what might be we as researchers can only draw conclusions on ‘what-is’. We had the problem of assessing if the DSS is functional or not, for example. Two users tell us it is, while one doesn't quite agree. Closer investigation showed that this is a problem isolated to specific areas of the system, meaning that some parts work as they should and some don't. These different

accounts and investigations mean that we can't really answer if the clinical DSS is functional or not, as we would then have to assess what constitutes a functional clinical DSS. What degree of functionality is needed at the minimum to draw a conclusion that the DSS is functional? This is not something that previous scientific theories assess nor does our study and as such we have to deem this factor as inconclusive. A similar argument also applies for the other inconclusive factors. The extent to which the system increases the patient satisfaction was the first key contributor that we could not measure due to the fact that the system was being used in combination with a number of changes to the organization as a whole, meaning that any improvements measured could not solely be accredited to the use of the system. The extent to which the system improves the practitioners' performance could also not be determined, mainly due to the fact that not enough physicians had been using the system. Indications existed that the system aided the physicians in improving their performance but there was not enough evidence to accredit it fully to the system as it currently is not being used by them directly.

This outcome poses an even more important question. As Rhee & Rao (2008) suggest, a DSS may be considered effective if the expected results in the DSS criteria are ensured. However, if we are not able to ensure all of the criteria, can we then assess if the clinical DSS at DO-SU is effective or not? What we need to consider here is if some factors weight more than others, and how does this affect the overall evaluation? For example, if a DSS does not reduce cost but does increases efficiency, can it still be assessed as effective? The cost may be a factor that is worth paying for, since the efficiency gain is so great that the cost factor becomes obsolete. In our case we have been able to asses 8 factors as positive, 1 as neutral, and 3 as inconclusive. The majority of the factors are therefore positive, is overall system effective then? The problem here is that no previous theory nor our study has assessed whether the factors are equally important, or if some factors are more important than others. As such, it is not clear how the evaluation is balanced overall due do this. Even though we would like to assess the DSS as being effective overall, due to the majority of factors being positive, this dilemma makes it difficult to do so. This also poses the question if a re-evaluation should be performed at DO-SU at a later stage, when the system has been rolled out to a larger number of users and been used for a couple of years (at least the number of years to see the expected ROI, for example). Also, when a larger number of users are using the system perhaps a quantitative study could be done using our framework, ensuring a more objective mathematical foundation for the reasoning logic, instead of just a subjective and qualitative one based on human reasoning. However, we can still draw the conclusion that the DSS at DO-SU is effective at increasing decision outcome quality, decision-making process efficiency, and decision maker satisfaction to various extents in at least some parts of the decision-making context, thanks to it fulfilling 8 of the 12 key contributions in our framework.

Even though the clinical DSS is not fully implemented yet, it is so close to being so that we still argue that this has been a successful case study. Due to the high-level of cooperation from DO-SU we have gained a unique insight to study how clinical DSS may affect a regulated hospital organization in-depth. A possibility that might not have been available in a hospital environment that is profit and competitive driven, for example, where such evaluation information as we have retrieved may be considered being a competitive advantage.

6.2.2 Findings

One of the findings we made is that, as we suspected, laws do matter with regards to the implementation of clinical DSS. However, this should be quite obvious. So the question then is why haven't laws been prominent in current theory? One reason may be that laws do differ between countries to such an extent that it is not generalizable to any extent at all. Still, the concept of laws should be addressed in a general matter, even if not with any specifics. Another reason may be that laws play a different role in different countries. While in Sweden the hospitals are tightly regulated, also affecting clinical DSS use, such regulations may not be as prominent in other countries and not affecting clinical DSS use. Swedish law does not allow profit making for hospitals for example, while other countries may allow this.

Another finding we have made is the one on the graphical interface. However, this has already been addressed several studies in human computer interaction research (Myers, 1996), but not in clinical DSS research specifically as far as we have been able to find Our study shows to some extent that graphical interface is important for the DSS to be functional at all, and as such it should probably also be a part of our evaluation framework as well. This is only a matter of detail though, as information system research in general has been aware of the graphical interface issue for quite some time (Myers, 1996). We just want to point out that our study shows that this is also an important variable to measure when evaluating clinical DSS. Gatian (1994) has for example show that there is a link between user satisfaction (or decision maker satisfaction in our case) and user productiveness in terms of data processing correctness, report generation, and distribution timeliness. While our study shows that there is a link to user satisfaction and graphical interface, as very explicitly expressed by one of our informants.

Our interviews also indicate that the DSS may be used to supervise the performance of individual physicians (C, 13.5-13.19). This raises a lot of questions. How will this affect physician performance if they know that they are being monitored by the decision support? What effects will this have on service quality and physician decision quality if they know that all of their actions are being monitored and measured? With regards to our framework we also need to address how this factor should be measured; is it a positive thing that physicians may be monitored, or is it a bad thing? What effect will it have on decision maker satisfaction?

Another finding we have made is that DO-SU does not have any measurement variables (C, 13.29). While Rhee & Rao (2008) suggest that when DSS development is based on evaluation criteria, one can often expect high performance. Does that mean that DO-SU cannot? Even if they cannot, our study still shows that there have been improvements at DO-SU thanks to the use of clinical DSS, even if the system development has not been based on decisional guidance. Instead it has been built on experience provided by at least one of the informants (which then may have functioned as measurement variables).

6.3 Generalizability of our study

Due to the fact that this was a case study, meaning that a single case was used to obtain the information for the study, it could be argued that the generalizability is

relatively low as different context could vary to a large extent. We would however argue that due to the similarities that exists within the healthcare context in Sweden, due to extensive government control, we can still state that the possibility of our framework to be applicable at another Swedish hospital remains relatively high. The laws and regulations that exist to control the healthcare have such influences that the contexts of different hospitals will be very similar with regards to the factors and key contributors discussed in our framework.

We would also argue that the generalizability is increased due to the fact that the framework is based on specific literature for clinical DSS as well as DSS in general. Mainly because we argue that the key contributors obtained from the literature about general DSS evaluation are applicable to any DSS as proven by the theory, however also because the key contributors which were created for a clinical DSS were also grounded in solid theory which specifically deals with the use of clinical DSS.

6.4 Our contribution to research and practice

This study has aimed towards contributing to the research regarding the evaluation of clinical DSS. It has done so by creating a framework specifically designed for the context of a clinical DSS based on literature about both general DSS evaluation as well as clinical DSS. It was our intention to assure that the applicability of this study would be apparent when looking at the question asked in combination with the purposes and delimitations as to aid any potential future research in clearly understanding the purpose of the study as well as the extent to which our findings answer the given question.

If looked at from the perspective of the users of this framework we believe that it will assist decision makers in evaluation the clinical DSS they are currently using. We could also argue that through the identification of the key contributions to the evaluation of a clinical DSS it would be possible to extend the use of this framework or at least the key contributions to also be used during the initial planning stage of a clinical DSS implementation, as the contributions can serve as indicators of what to focus ones attention on in order to achieve the best possible implementation within a given context. Our theory development has helped to formulate the key contributions while our empirical case study has helped to provide evidence that they do exists, that they do matter, and that they do affect different parts of decision making.

If looked at from the perspective of the users of the systems we would argue that the use of this framework can improve all three evaluation factors, hence improve the overall view of the system from the perspective of its users.

Appendices

Appendix 1 – Interview guide (English)

The purpose of this interview is to collect data regarding the clinical decision support system at you institution. To keep the interview semi-structured, in order to collect as open answers as possible, the questions for this interview have been formulated around three main topics; *Decision-Making Process Efficiency, Decision Outcome Quality* and *Decision Maker Satisfaction,* in relation to decision support systems. Our questions function mainly as guidance within these three topics to keep the discussion within relevant boundaries.

Information about the informant

Title
System user role

Decision-Making Process Efficiency

1. How much effort is required by you to use the decision support system during the decision making process?
2. When is the decision support provided?
3. What type of support does the decision support system provide?
    a. Information
    b. Tools
    c. Other
4. Has the use of the decision support system lead to any cost reductions?
5. Has the decision support system made any processes more efficient?
6. When was the last time the decision support system malfunctioned?
    a. How did the decision support system malfunction?
    b. How was it solved?
7. Which laws and regulations are important with regards to the decision support system?

Decision Outcome Quality

8. Does the decision support system provide recommendations and/or advice?
9. How do you think the patient satisfaction been affected by the decision support system?
    a. Do you know of any complaints that have been issued by the patients?
    b. Has the complaints ratio been affected by the decision support system?
10. Has the decision support system had any impact on errors in the hospital
    a. Hospital errors
    b. Clinical errors
11. Have you gained any additional knowledge since you started using the decision support system?
    a. Administrative
    b. Clinical
    c. Other

Decision Maker Satisfaction

12. What impact has the decision support system had on physicians' practitioner performance?
13. Has there occurred any kind of resistance against the decision support system that you know about?
    a. What type of resistance?
    b. From who?

Appendix 2 – Interview guide (Swedish)

Syftet med denna intervju är att samla information om det kliniska beslutstödssystemet som används vid ert institut. För att hålla intervjun semi-struktuerad och samla in öppna svar har frågorna i denna intervju formulerats utifrån tre huvudområden för beslutsstödsystem: *Beslutsfattningsprocessens effektivitet*, *Kvalitén av beslutsutfall* samt *Beslutsfattarnas tillfredställelse*. Frågorna fungerar huvudsakligen som riktlinjer inom dessa tre huvudområden för att hålla samtalet inom relevanta avgränsningar.

Information om informanten

Titel
Typ av användare i system

Beslutfattningsprocessens effektivitet

1. Hur mycket ansträngning krävs av dig för att du ska kunna använda beslutstödsystemet under beslutfattningsprocessen?
2. När tillhandahålls beslutstödet?
3. Vilken typ av stöd ger beslutstödssystemet?
    a. Information
    b. Verktyg/Hjälpmedel
    c. Annan
4. Har användningen av beslutstödssystemet lett till minskade kostnader?
5. Har beslutstödssystemet effektiviserat någon/några processer?
6. När var senaste gången beslutstödsystemet fallerade?
    a. Hur fallerade beslutstödsystemet?
    b. Hur löstes problemet?
7. Vilka lagar och bestämmelser är viktiga i relation till beslutstödssystemet?

Kvalitén av beslutsutfall

8. Ger beslutstödssystemet rekommendationer och/eller råd?
9. Hur tror du att patienternas tillfredställelse har påverkats av beslutstödssystemet?
    a. Har några klagomål från patienterna förekommit?
    b. Har antalet klagomål påverkats av beslutstödssystemet?
10. Har beslutstödssystemet haft någon påverkan på misstag i sjukhuset?
    a. Administrativa fel
    b. Kliniska fel
11. Har du lärt dig något av beslutstödsystemet sen du började använda det?
    a. Administrativt
    b. Kliniskt
    c. Annat

Beslutfattarnas tillfredställelse

12. Hur har beslutstödssystemet påverkat läkarnas/sjuksköterskornas medicinska prestationer?
13. Har det enligt din uppfattning förekommit något motstånd mot beslutstödsystemet?
    a. Vad för typ av motstånd?
    b. Av vem har motståndet visats?

Appendix 3 - Observation notes (Swedish)

Observation notes 1
05/05/2010, 11.00am-12.30pm

- Hur kontaktade ni Qview. 99/2000 åkte *[Informant C]* till malmö och såg Qview in action och blev impad
- När han *[Informant C]* kom tillbaka efter sjukdom så insåg han att utvecklingen av cognos inte gått framåt
- 15-20% av slangar i huvudet blev infekterade
- Styrde upp så att tvätt av händer = mindre infektioner
- "Hur kan en maskin ersätta *[Informant C]*" -> Qview ger allerts / ist. för honom
- Alla chefer kontrollerade på golvet + pekade vem som skulle fixa vad (tidigare)
- Sen växte sjukvården
- Chefer byts ut mot Qview
- *[Informant C]* övervakade alla operationer etc.
- Qview fixade ordning etc hur man skulle genomföra operationer etc
- Är Just nu på Mölndal och de hade ortopedklinikerna utspridda mellan olika sjukhus (2005)
- Blev ingen ordning pga fördröjningar/komplikationer SOC säger att det inte fungerar och det måste fixas
- Drog igång Qview på Mölndal för 3 år sedan
- Presenterade projektet för högsta chefen -> Ja kör på o se vad som händer -> beslut fattas i regionala IT-rådet
- Det finns så många chefer/mellan chefer som är jätte bra men som inte har hängt med.
- It-chefen hade beslutat att cognos skulle köras *[Informant C]* sket i det
- Cognos-tekniken är inte dåligt men presterar inte lika bra som Qview.
- Qview pga Cognos = läkare måste kunna SQL
- Utvecklar inte själva har en på Sudnit IT för utveckling

Observartion notes 2
05/05/2010, 11.00am-12.30pm

- Ortopedi ville ha QlikView & *[Informant C]*
- Sammanslagning gav problem
- Hiearki, chefer sitter kvar men hänger inte med
- "Vad ska vi säga till SoS?"
- Cognos = Stora kostnader = mycket prestige
- När Cognos kan mäta sig mot QlikView så byter man
- Inga problem om akademiker var med enligt *[Informant C]*
- Problemet är organisation
    - PARADIGMSKIFTE: Från chef till system som bestämmer
- Utbildningsproblem att rulla ut system
- SOS 2005:12
    - Kopia tack
    - PowerPoint också
- Läkare ska kunna SQL
- *[edited]*, Sundit AB
- Qlikview
    - Ledning vy
    - Vårdenhet vy
    - Kan se hur länge man måste vänta
    - Vårdgaranti?
    - Tid
- Saknar mellanchef kompetens

Appendix 4 – Interview A (Swedish)

Reference = Reference number to sentence
Code = Interview coding
- INF = Information about informant
- DPE = Decision-Making Process Efficiency
- DOQ = Decision Outcome Quality
- DMS = Decision Maker Satisfaction
- SIQ = Side-question

Interview = Interview transcript

Informant A - Operations developer/Nurse
05/05/2010, 13.00pm-14.00pm

Reference	Code	Interview
0.1		**INTERVIEWER:** Då börjar vi med det med lite informella, eller ja formella.
	INF	*Titel*
0.2		**INTERVIEWER:** Titel?
0.3		**INFORMANT:** Jag är verksamhetsutvecklare. Men jag är sjuksköterska i botten. Har varit chef i många år, både på operationsavdelningen och på vårdavdelningen.
0.4		**INTERVIEWER:** Ja.
0.5		**INFORMANT:** Kan man väl säga. Så jag kan vårdverksamheten ganska väl.
	INF	*Typ av användare av systemet*
0.6		**INTERVIEWER:** Yes. Okej. Nästa fråga… typ av användare av systemet. Det har vi egentligen redan sagt, verksamhetsutvecklare, antar jag egentligen.
0.7		**INFORMANT:** Mmm.
0.8		**INTERVIEWER:** Så vi behöver egentligen ingenting mer på den va?
0.9		**INFORMANT:** Mmm.
0.10		**INTERVIEWER:** Yes. Ja men då hoppar vi på frågorna direkt då.
0.11		**INFORMANT:** Mmm.
	DPE	*1. Hur mycket ansträngning krävs av dig för att du ska kunna använda beslutstödsystemet under beslutfattningsprocessen?*
1.1		**INTERVIEWER:** Ja. Fråga 1 då. Hur mycket ansträngning krävs av dig för att du ska kunna använda beslutstödsystemet under beslutfattningsprocessen?
1.2		**INFORMANT:** Det behövs ju inte särskilt mycket ansträngning. Utan det räcker att bara klicka sig fram i det här systemet för att få ut det som jag känner att jag vill ha. Det som däremot är en ganska stor uppgift ännu sålänge, det är att säkra systemet. Att det visar på det… Alltså, kan jag lita på siffrorna? Och det gör ju Operätt, som är ett annat stöd.
1.3		**INTERVIEWER:** Ja.
1.4		**INFORMANT:** Och det är så att även QlikView bygger på Operätt databasen så att säga. Men jag går in i Operätt databasen och ser då om jag får ut samma siffror från dem här två systemen. Jag har en hygglig tillit till systemen så att säga. Och den dubbelkontrollen, den håller jag på med fortfarande faktiskt. Det vet jag inte riktigt om det var svar på frågan, men?
1.5		**INTERVIEWER:** Jo, faktiskt. Det är det vi vill veta precis… hur ni känner mer… alltså vi vill inte tvinga er för mycket… gör ni detta, eller detta.
1.6		**INFORMANT:** Nej, juste.
1.7		**INTERVIEWER:** Utan mer förklara hur ni känner.
1.8		**INFORMANT:** Ja, precis.
1.9		**INFORMANT:** Sen kan man också säga det att… Det som det här systemet bygger på, det är applikationer som vi tillsammans skapar med teknikerna från QlikTech eller Sundit nu i detta fallet. Det bygger ju litegrann på att han är här, den här killen så att säga. Och att vi kan bygga applikationerna. Och sen kan det vara så att han är lite tidspressad och att vi kanske har lagt in lite för lite tid, så jag kan ju känna att det är en rätt så trög process ändå detta innan jag tycker att jag kommer vidare. Jag är ju mer liksom mer do'er så att säga. Jag tycker det tar en sån himla tid det här med tekniken måste jag säga. Men det kanske gör det. Fast jag inte har riktigt fattat det. Men vi blir ju liksom inte färdiga kan jag tycka. Fast det kanske man inte gör i IT-världen? Jag vet inte. Är det så?
1.10		**INTERVIEWER:** Det är väl lite fram och tillbaka, det beror på lite. Ni har ju lite motstånd och så där också.
1.11		**INFORMANT:** Ja, det är ju så. Ja, så är det.
	DPE	*2. När tillhandahålls beslutstödet?*
2.1		**INTERVIEWER:** Okej. Fråga 2 då. När tillhandahålles beslutstödet i själva…
2.2		**INFORMANT:** Processen?
2.3		**INTERVIEWER:** Mmm. Det är väl lite mer…
2.4		**INFORMANT:** Det gör det ju direkt kan man säga. Direkt när jag går in och klickar så får jag ju liksom också ett beslutstöd så att säga.
2.5	DPE	**INTERVIEWER:** Det är precis när du behöver det? Jag behöver ett stöd nu så går du bara in i systemet och hämtar det.
2.6		**INFORMANT:** Ja.
2.7		**INTERVIEWER:** Perfekt. Det svaret ville vi höra.
2.8		**INFORMANT:** Så är det.

	DPE	*3. Vilken typ av stöd ger beslutstödssystemet?*
		3a. Information
3.1		**INTERVIEWER:** Ah där. Vilken typ av stöd ger då beslutstödssystemet?
3.2		**INFORMANT:** Jo det är ju information. Alltså, jag får veta var vi står någonstans i dem olika frågorna. Alltså, hur mycket har vi producerat, när startar operationerna till exempel. Vilken utnyttjande grad har vi i förhållande till den totala tiden, när det gäller opererande. Vi jobbar väldigt mycket mot Anopiva eftersom det är vår största leverantör så att säga. För att vi ska få tillbaka patienter lagar och klara sig så att säga. Så det är ett väldigt nära samarbete mellan ortopedi och Anopiva, där Anopiva är motorn för vår verksamhet. Alltså, har vi inte operationsavdelningen så har vi inte så mycket va. En kirurgisk specialitet, som ortopedi är. Så att information det får jag liksom, också ger. Alltås, jag kan ju återkoppla till grupperna för att också få en direkt bild på; så här ser det ut just nu i denna minut. Och hur åtgärdar vi det? Alltså, kan vi ha det så här, kan det få se ut så här, vad finns det för idéer i grupperna om hur vi ska komma… och direkt så att säga va. Kommer det någon fråga från gruppen; och direkt in och klicka. Det kan jag nästan inte med något annat system, utan då får jag skapa lite rapporter och så. Men här kan jag direkt få upp det… I dem applikationer vi har gjort. Det här är ju så. Vi måste ha tagit fram rätt applikationer. Så är det ju.
	DPE	*3b. Verktyg/Hjälpmedel*
3.3		**INTERVIEWER:** Verktyg/Hjälpmedel? Vi vet inte exakt vad det är vi menar om vi ska vara ärliga. Men finns det några specifika verktyg i systemet, eller komponenter, som är skriva specifikt för att göra vissa delar i systemet idag? Vad du vet om?
3.4		**INFORMANT:** Det är en mer teknisk fråga tror jag? Eller vad tänker ni?
3.5		**INTERVIEWER:** Både och. Problemet är att QlikView i sig självt är ju ett verktyg, och det är ju det som blir lite problematiskt med den här frågan. Men vi tänkte mer ifall det var någonting annat som också… till exempel att ett planeringssystem ligger där samtidigt, som kopplas eller något sånt också.
3.6		**INTERVIEWER:** Någonting utöver informationen som ni får ut av systemet.
3.7		**INTERVIEWER:** Något speciellt verktyg för det eller något sånt…
3.8		**INFORMANT:** Nej. Vi försöker att koppla upp oss mot alla databaserna som är aktuella. Och sen är det vilka applikationer vi bygger utifrån dem databaserna, vad vi vill veta. Och det är klart… Det som är bekymret det är kvalitetssäkringen som jag ser det. Vi måste säkra utdataplattformen, att den håller. Jag vet inte om det var svar på frågan, men det var det jag tänkte.
3.9		**INTERVIEWER:** Ja men det fungerar.
3.10		**INTERVIEWER:** Om du säger att det inte finns något extra så är det ju ett svar liksom.
3.11		**INTERVIEWER:** Ja, precis.
3.12		**INFORMANT:** Ja, precis.
3.13		**INTERVIEWER:** Vi antog nästan att det inte fanns några specifika verktyg, men måste ändå fråga så att vi inte missar någonting.
	DPE	*3c. Annan*
3.14		**INTERVIEWER:** Är det någon annan typ av information eller annat typ av stöd du får av systemet?
3.15		**INFORMANT:** Nej. Inte vad jag kan komma på nu.
3.16		**INTERVIEWER:** Nej, men det behövs inte.
	DPE	*4. Har användningen av beslutstödssystemet lett till minskade kostnader?*
4.1		**INTERVIEWER:** Ja. Det här är då…
4.2		**INFORMANT:** Kostnaden, ja?
4.3		**INTERVIEWER:** Ja.
4.4		**INFORMANT:** Jag kan inte säga att det gjort det nu. Jag kan inte säg att så här är det. Utan jag skulle vilja säga att införandet av det här beslutstödet istället har ökat kostnaden initialt. Vi har köpt varan, och vi har också köpt tjänsten från Sundit med den här killen som bygger applikationerna. *[Informant C]* köper vi ju i någon mening, på halvtid så att säga. Och jag jobbar ju med så många andra frågor så jag kanske är inne i det här litegrann, 25-30 procent av min arbetstid lägger jag i QlikView. För det är ju så att, jag kan ortopedin. Så jag tittar mer på utformningen av applikationerna och sen jobbar *[Informant C]* och *[edited]* tillsammans då för att möta mig med det önskemålet. Och sen kan vi prata allihopa, att vi tar fram rätt saker genom att testa då. Det är så vi jobbar. Men jag kan inte se att det har blivit billigare.
4.5	DPE	**INTERVIEWER:** Men ser ni det på längre sikt?
4.6		**INFORMANT:** Jaja, absolut. En som sak som produktionsuppföljningen. Där har vi sex koordinatorer idag som var och en lägger in sin vara. Vi har en som koordinerar proteser till exempel. Och då är det så att vi har en produktionsplan, där vi ska göra 725 proteser, alltså primära proteser på årsbasis. Och då måste vi lägga in varje vecka, hur mycket måste vi göra? Och sen lägger hon in då; vad måste vi göra för att klara planen, vad har vi gjort varje vecka, vad har vi gjort VG kontra icke-VG. För vi för nämligen bara betalt för VG. Icke-VG får vi betalt på ett annat sätt. Och det är rätt mycket jobb för koordinatorerna, istället för att direkt gå och hämta detta med QlikView. Jag vet inte om ni har tittat på vårdvolymer? Där vi tittar på sluten vård, planerad, öppen, och akut. Alltså upplanerad, öppen och sluten vård så att säga.
4.7		**INTERVIEWER:** Ja, vi såg bara snabbt…
4.8		**INFORMANT:** Det är embryot lite grann till det. Där vi också lägger in målen per vecka. Och så VG och icke-VG. När vi kan få ut det i grafer så kan vi följa detta bra, och då gör varje person som har en chefsbefattning detta. Och följer sin egen verksamhet. Det är inte riktigt möjligt idag med dem system vi har. Utan det är igen, onlinefunktioner. Skit i alla rapporter, inte ens på en arbetsträff vill man ta ut en rapport. Utan visa systemet, så här ser det ut just nu. Det är ingen rapport som är så sen. Det har gått en halvtimma in på mötet, men så här har det ändrat sig denna halvtimman. Så här ser det ut just nu. Vi kan fånga ögonblicket. Och det kan

		vi inte göra med något annat system, på det enkla sättet.
4.9		**INTERVIEWER:** Nä, precis.
4.10		**INFORMANT:** Mmm. Men det har inte lett till minskade kostnader just nu. Men det kommer att göra det.
4.11		**INTERVIEWER:** Ni ser det i framtiden?
4.12		**INFORMANT:** Ja, vi kan spara in folk här. Det kan vi, ja.
	DPE	*5. Har beslutstödssystemet effektiviserat någon/några processer?*
5.1		**INTERVIEWER:** Fråga 5 har vi sparat på delvis. Men vi tar den ändå.
5.2		**INFORMANT:** Ajuste.
5.3		**INTERVIEWER:** Om det har effektivisterat några processer?
5.4		**INFORMANT:** Det som är med ett sånt här stöd är att vi får syn på vad vi gör. Och det kan man få i alla system också naturligtvis. Alltså, idag har vi inga utdataplattformar som kan kopplas ihop, där vi jobbar. Med ett utsökningsverktyg mot flera databaser. Dem finns inte. Vi kan gå in i en och en databas, men vi kan inte koppla dem. Och detta ger ju den möjligheten. Cognos är ju på väg också. Men om man håller på att kopplar upp sig mot Melior, det tror jag att dem kommer hålla på med i tio år. Så komplicerat är det, för Melior är inte byggt som en rapportgenerator. Så man kommer att behöva bygga om Melior innan man kan hämta ut hygglig information. Nu pratar jag om kvalitetsparametrar. Det här med produktion kan man få ut rätt så tjeckt, ur olika sorter. Men inte kvalitén. Alltså, hur många infektioner, hur många patienter re-operarar vi inom varje team? Det går inte att få ut ur något system. Men det kan vi få här, utifrån det kvalitetsregistret vi har. Produktionsuppföljningen är en ände där man kan se en viktig process som vi har effektiviserat. Vi följer upp kvalitén hos enskilda patienter. Vi följer upp för att se vad vi har för nuläge. Till exempel re-operationsfrekvensen, patienter som får infektioner som vin inte hade förväntat oss, för att titta, var ligger vi i varje team? Sen är det upp till varje team att analysera om man nu har fått 20 infektioner. Varför har dem fått infektioner för? Och det är den djupanalysen som ska till. För att sedan återkoppla detta mot dem som är aktuella i den processen, för att man ska göra på ett annat sätt eller optimera patienter för operation eller titta på operationsmiljön. Det kan vara precis vad som helst.
5.5		**INFORMANT:** Men varje infektion kan kosta upp till en halv miljon. Så mycket pengar är det vi pratar om, för varje patient som får en infektion. Det är väldigt mycket implantat inom ortopedi. Vi sätter in grejer, får vi en infektion så måste vi plocka ut det, och så måste dem gå utan grejer för att läka ut det under en längre tid, och så in med grejerna igen. Det här kostar jäkligt mycket pengar. Så där kan jag se ändå att vi kan fånga […] med det här systemet på ett lättare sätt.
	DPE	*6. När var senaste gången beslutstödsystemet fallerade?* *6a. Hur fallerade beslutstödsystemet?* *6b. Hur löstes problemet?*
6.1		**INTERVIEWER:** Ja, då hoppar vi vidare. Senaste gången systemet fallerade? Det vet jag inte om det gjort i och med att det inte varit uppe och snurrat på samma sätt men.
6.2		**INFORMANT:** Jag vet inte. Jag kan inte säga att systemet har fallerat faktiskt. Det kan jag inte. Att det går ner, eller att backupen inte fungerar. Inga såna saker har jag varit med om under den här testperioden.
6.3	DPE	**INTERVIEWER:** Har det varit några andra problem?
6.4		**INFORMANT:** Det har mer med applikationernas byggnadssätt att göra. Det stör mig oerhört när jag tar fram höftfrakturerna, så är dem 17 under denna vecka som har gått och så är vi väldigt intresserade just nu att titta på hur många av dem 17 höfterna är opererade inom 24 timmar. För det är ett regionalt mål. Och så är det 16 som är det, och så kommer det två små-små ränder i tårtbiten, och så står det en etta i varje, och det blir då 18 för mig. Det ska vara 17. Jag blir galen när jag ser det, för den rapporten går ut sen till alla avnämare. Cheferna och så här, och det ser väldigt illa ut och ha en cirkel som inte visar rätt siffror. Och det kan störa mig litegrann. Men man kan inte säga att systemet fallerar. Det är detaljer som behöver tittas på helt enkelt. Det fixar man kanske lätt dessutom.
6.5	DPE	**INTERVIEWER:** När ni har problem med applikationen då skickar ni det till den killen som är ansvarig, som utvecklar den?
6.6		**INFORMANT:** Precis. Då är det *[edited]* som kommer ångandes, eller så löser vi det på hemmaplan. Det går bra med ibland.
	DPE	*7. Vilka lagar och bestämmelser är viktiga i relation till beslutstödssystemet?*
7.1		**INTERVIEWER:** Sen nästa fråga. Vilka lagar och bestämmelser är viktiga i relation till beslutstödssystemet som du ser det?
7.2		**INFORMANT:** Alltså, Socialstyrelsen har ju 2005:12. Det är ett ledningssystem kan man säga, som framförallt styr kvalitén inom hälso- och sjukvården. Det är en sån lag som ligger i botten och styr hela hälso- och sjukvårdsfallet kan man säga. Som går in på alla dess delar. Vad måste vi göra för att kunna säga att vi upprätthåller en god vård. Sen är det så att vi har någonting som heter vårdgarantin som nu kommer med full kraft 1:a juli. Och där är det så att alla patienter ska ha fått ett besök och ha fått en remiss eller egenremiss inom tre månader. Och sen så ska man då få en operation, om det är det man anser då från besöket hos doktorn på mottagningen, är likförande. Och då ska patienten få opereras inom tre månader också. Och klarar vi inte det då så får vi skicka ut honom någon annan stans, och köpa vård så att säga. Men det blir ändå en tumme på oss att bli effektivare helt enkelt. Vi måste klara detta.
7.3	DPE	**INTERVIEWER:** Hjälper systemet er att hålla den här garantin då?
7.4		**INFORMANT:** Ja, vi följer då produktionen och kan se vad klarar vi, vad klarar vi för operation. Vi vet precis hur mycket. Jag kan se på varje kod i det här systemet, varje operationskod, vad tar den i knivtid? Jag kan titta på vad teamet opererar och dividera det med antalet operationer och titta på en sån sak som knivtid i en sån parameter. Läkarbunden tid på operation så att säga. Jag kan titta på vårddagar. Kan vi få upp en effektivitet så vi klarar ett

		flöde som är i förhållande till våra väntelistor och medicinska prioriteringar. Det kan jag då se. Det kan jag se med andra system också, men jag kan få en mer sammanhållen bild här för jag har alla delarna med mig här. Vårdtider, operationstider, och kirurgisk kompetens och så vidare.
	DOQ	*8. Ger beslutstödssystemet rekommendationer och/eller råd?*
8.1		**INTERVIEWER:** Då hoppar vi vidare. Ger beslutstödssystemet rekommendationer och/eller råd?
8.2		**INFORMANT:** Ja, det gör det ju. I den meningen att jag har ju grupper när jag visar detta systemet och det blir ju rådande och rekommenderande. Vi tittar på det och så ser vi nu är vi så här dåliga. Eller så är vi så här bra. Och utifrån då utfallet på en vecka parametrar så tittar vi då också på, vad ska vi göra? Kan vi göra någonting? Vad ska vi göra? Är det mer personal? Är det mer lokal? Är det mer instrument? Hela kedjan så att säga. Akuten, sköter dem inte sig? Väntar patienterna allt för länge där? Jag kan ju titta också på genomlöpstiden på akutmottagningen och se, rinner dem igenom inom hygglig tid? Nämligen den som vi har tänkt oss, under 5 timmar. Eller får dem vänta allt för länge där? Då blir det ju föreseningar i hela kedjan sen. Den ger beslutstöd och det utfaller i åtgärder helt enkelt. Hur bör man göra? Resonemang, det är också en process vet ni. Hur bör man göra i den här situationen?
8.3	DOQ	**INTERVIEWER:** Men som det ser ut idag så ger systemet ingen direkt feedback. Alltså säger till; nu har vi en operationssal som är tom som kan användas, eller liknande.
8.4		**INFORMANT:** Jag får inte upp en flagga i systemet. Utan jag får gå in och titta under veckan eller månaden, eller vad jag bestämmer mig för. Här har vi använt den här knivtiden, för vi hade ju faktiskt den här.
	DOQ	*9. Hur tror du att patienternas tillfredställelse har påverkats av beslutstödssystemet?* *9a. Har några klagomål från patienterna förekommit?* *9b. Har antalet klagomål påverkats av beslutstödssystemet?*
9.1		**INTERVIEWER:** Okej. Det här kan vara en lite svår fråga att svara på, fast vi vet inte riktigt. Hur tror du att patienternas tillfredställelse har påverkats utav att ni har implementerat beslutstödssystemet?
9.2		**INFORMANT:** Det här går nästan inte att svara på. Men på sikt kan vi svara på för vi kommer att kunna öka tillgängligheten genom att hålla koll på vad vi gör och hur lång tid det tar. Och vilka resurser som krävs. Och då kan vi också se, vilken volym klarar vi inom dem olika operationerna. Med nuvarande resurs så är det detta vi klarar. Ska vi klara med så måste vi ha denna resursen också. Vi kan få argumentationsstöd i detta.
9.3	DOQ	**INTERVIEWER:** Men ni har inte haft några klagomål från patienter uppenbarligen?
9.4		**INFORMANT:** Nej, inte så. Det går liksom inte att omsätta det på det sättet riktigt. Utan, det kommer ju klagomål. Att patienter vill komma hit så snabbt som möjligt, efter fattat beslut om operation. Och det klarar ju inte vården idag. Det kommer vara en väldigt svår fråga. Så det kommer finnas mer pengar för att köpa vård idag, för offentligheten klarar inte detta. I alla fall i ett övergångskede tills vi effektiviserar. Jag tror att det kommer bli som med vårdcentralerna. Kom igen nu, starta sjukhus så får vi se vilka som är bäst? Och som jobbar under minsta möjliga ekonomiska bas. Och dem som inte klarar den basen slås ut. Det är så man jobbat med vårdcentralerna. Sen om det är privat eller offentligt, det skiter man i. Bara man är effektiva. För det är vad vi har råd med. Och det vet jag inte om det är bra inom sluten vården. Inom öppen vården fungerar det uppenbarligen. Tandvården har gått igenom samma resa egentligen. Så då börjar offentligen bli ganska bra igen så man kan gå tillbaka dit igen. Fram till dess har man valt den privata tandläkaren, i alla fall jag. Det kan jag inte riktigt svara på.
	DOQ	*10. Har beslutstödssystemet haft någon påverkan på misstag i sjukhuset?* *10a. Administrativa fel* *10b. Kliniska fel*
10.1		**INTERVIEWER:** Det är helt okej. Fråga 10 då. Har beslutstödssystemet haft någon påverkan på misstag i sjukhuset? Och här tänker vi då felplaneringar, allt sånt.
10.2		**INTERVIEWER:** Eller infektioner.
10.3		**INTERVIEWER:** Och då kan vi börja med, har det varit några administrativa fel? Som det har påverkat?
10.4		**INFORMANT:** Jag kan inte säga det, för vi har inte. Det här är fortfarande en pilot kan man säga, det här systemet. Den som liksom inne är mest i det är org 16 på Sahlgrenska. Det är henne ni ska prata med sen. Och hon har jobbat mot vårt interna kvalitetsregister i första hand. Och där är det säkert så att hon möjligen kan säga något om detta. Det vet jag inte. Men jag kan säga att när det gäller kvalitetssidan så kan vi se en oerhörd potential men vi kan inte säga att vi har uppnått den nu. Det måste jag få ärligt säga.
	DOQ	*11. Har du lärt dig något av beslutstödsystemet sen du började använda det?* *11a. Administrativt* *11b. Kliniskt* *11c. Annat*
11.1		**INTERVIEWER:** Sen fråga 11 då.
11.2		**INFORMANT:** Där är det så att, det gör man ju hela tiden. Det är det som är så härligt. Man utvecklas helt enkelt. Och det gör man ju med nya saker. Det här är ett nytt system. Jag bygger ju då tillsammans med *[Informant C]* och *[edited]* dem här applikationerna. Nu har det inte varit så många andra användare egentligen. Vi har varit ganska ensamma. Vi har ju inte vetat om vi får lov att införa. Detta är ju lite häftigt. Vi har ju inte vetat om vi får införa det eller inte. Vi har jobbat utifrån någon slags tro om att det inte är så mycket som slår det här, så det här kan dem inte neka oss. Mer så. Att det sen växer underifrån och upp, om dem inte har fattat där uppe så får vi jobba på ett annat plan. Och då har vi fått det så långt ännu att vi får köpa in det. Men administrativt är det att vara med i byggandet av applikationer, det är ju alltid lärande.

		Och också få mer insikt i sjukhusets, alltså ortopedins egen inre organisation. Det ger också faktiskt den kunskapen.
11.3	DOQ	**INTERVIEWER:** Har det gett några kunskaper inom dina egna arbetsuppgifter?
11.4		**INFORMANT:** Vad sa du?
11.5		**INTERVIEWER:** Har det gett dig någon nya kunskaper i dina egna arbetsuppgifter?
11.6		**INFORMANT:** Ja, jag tycker det. Jag får ett mer sammanhang på ortopedins delar. Från delar till helhet i någon mening. Och att varje del blir oerhört värdefull. För har vi inte alla delarna med oss så når vi ju aldrig framgång. Och det är också det som är svårigheten när det gäller sjukvård på det här sättet i offentligheten. Det spretar åt alla möjliga håll. Läkare är ett gäng individualister. Om alla gör precis som de vill efter eget huvud så blir det svårt att hantera det. Det här stödet kan också visa på att det blir mycket roligare om vi försöker gå åt samma håll.
	DMS	*12. Hur har beslutstödssystemet påverkat läkarnas/sköterskornas medicinska prestationer?*
12.1		**INTERVIEWER:** Kanon. Vi hoppar vidare. Har det påverkat läkares/sjuksköterskors medicinska prestationer?
12.2		**INFORMANT:** Det är svårt också. Det är en sån fråga som ska komma om fem år. Den är för tidigt ställd känner jag.
12.3		**INTERVIEWER:** Sen vi tänkte på det här med att *[Informant C]* visa oss minskade intentioner och liknande.
12.4		**INFORMANT:** Jag kan inte säga det.
12.5	DMS	**INTERVIEWER:** Tror du att det finns potential att påverka prestationer?
12.6		**INFORMANT:** Alla dem här delarna är ju så att vi kan återkoppla på ett lätt sätt. Och kan man återkoppla resultaten på ett lätt sätt då blir det också ett intresse hos dem som är ute på golvet. Och då ökar medvetenheten hos dem så att dem gör rätt. I förhoppningen då, genom att uttrycka oss att det blir bättre på detta sättet. Vi provar åtminstone att göra på detta sättet och så ser vi om det blir bättre utfall, till exempel. Så kan det vara. Den här utdataplattformen har en
12.7		jättepotential alltså.
12.8		**INTERVIEWER:** Det känner vi med.
		INFORMANT: Så är det.
	DMS	*13. Har det enligt din uppfattning förekommit något motstånd mot beslutstödsystemet?*
13.1		**INTERVIEWER:** Motstånd mot systemet har vi förstått har varit en del?
	DMS	*13a. Vad för typ av motstånd?*
13.2		**INFORMANT:** Vad är det för typ av motstånd? Sjukhuset har bestämt sig att köpa in Cognos och det har säkert kostat en jäkla massa pengar. Det tror jag. Av det skälet också att Sjukhuset har Cognos när det gäller ekonomin. Och så vill nu man då jobba på kvalitetssidan med Cognos på sidan. Och, där är det ju så att om man nu satsat så oerhört mycket pengar på ett system så finns det en motvilja mot andra system som jobbar med samma fråga. Och det får vi kanske förstå någonstans. Eller? Sen kan jag ju tycka att det finns en stelbenhet. Om nu inte Cognos har visat att dem gör vad dem har sagt, eller vem det nu är som inte gör det, eller vem det är som inte säger. Om vi ändå klarar att visa det, då kanske man kan få det här som ett sidoinstrument. Så kan jag tycka.
13.3	SIQ	**INTERVIEWER:** Men det handlar ju trots allt om att lösa uppgiften på bästa sätt?
13.4		**INFORMANT:** Ja, precis. Men där finns det motstånd. Det är ju så. Och det har ju med pengar att göra. Det är två system som kostar pengar, när man helst hade velat ha ett som man bestämt sig för. Och så kommer detta uppstickandes. Sen kan jag tycka att det finns en stelbenhet hos dem som bestämmer. Istället för att se att det här skulle mycket väl kunna komplettera Cognos. Jobba med Cognos på andra delar. Låt detta få sköta kvalitetssidan. Man kan bestämma sig för en sån enkel sak helt enkelt. Och så lägg produktionen och ekonomin i Cognos. Eller vad man nu gör. För vi behöver ha ett system som snabbt visar var vi står. Vi kan inte hålla på och laborera med en massa teknik som är gammal, för det är ju Cognos.
13.5	SIQ	**INTERVIEWER:** Vad är det specifikt ni inte gillar med Cognos som QlikView kan tillföra?
13.6		**INFORMANT:** I Cognos kan man bygga olika kuber. Sen ska man utifrån dem kuberna få någon slags resultat där nere. Det är krångligt. Det är så oerhört krångligt. Det går inte att jobba med det. Det blir så tråkigt också. Det är så himla tråkigt kan jag säga. Det är lite roligt att få flashiga bilder ändå. Eller hur? Vi ska ju ändå väcka gänget som sover här! Man ska tycka att det är lite kul. Man kan inte sitta och titta på Cognos. Det går bara inte. Inte som det ser ut nu. Det kan bli bättre, inte vet jag. Men vi ska se till att få ut detta. Vi klarar oss inte utan QlikView, punkt. Så kan dem få jobba med vad dem vill, dem andra. Så tror jag att det kommer att bli faktiskt.
	DMS	*13b. Av vem har motståndet visats?*
13.7		**INTERVIEWER:** Vad det gäller motstånd. Vem har visat mest motstånd?
13.8		**INFORMANT:** Dem som har pengarna och *[edited]* är ändå en som person som sitter i strategiska IT rådet. Men har inte varit här och tittat på detta nu. Det är ju en signal, om vad hon tycker om detta egentligen. Samtidigt har hon nominerat detta till SU:s kvalitetspris, så jag fattar ju ingenting. Men jag bryr mig inte om det. För vi jobbar med frågan så kommer den att leva av sig själv så att säga.
13.9		**INTERVIEWER:** Ni struntar i politiken och kör på vad som är bäst för patienterna istället?
13.10		**INFORMANT:** Precis, precis. Så är det faktiskt.

Appendix 5 – Interview B (Swedish)

Reference = Reference number to sentence
Code = Interview coding
- INF = Information about informant
- DPE = Decision-Making Process Efficiency
- DOQ = Decision Outcome Quality
- DMS = Decision Maker Satisfaction
- SIQ = Side-question

Interview = Interview transcript

Informant B – Administrative nurse
05/05/2010, 14.00pm-15.00pm

Reference	Code	Interview
	INF	*Titel*
0.1		**INTERVIEWER:** Vad skulle du sätta din titel som?
0.2		**INFORMANT:** Alltså jag är ju sjuksköterska, sjuksköteskeutbildad men sen 2 år tillbaka så har jag administartiva uppgifter och jag jobbar då mest med, som *[Informant C]* säkert har förklarat för er, vårkvalitetsregistret. Och sen jobbar jag med lite forskning, ja lite annat smått o gott på avdelningen iallafall, jag har kontorsarbete.
	INF	*Typ av användare i systemet*
0.3		**INTERVIEWER:** Vilken typ typ utav användare skulle du själv säga att du själv är i systemet? När du använder QlikView, vad är det för typ av arbetsuppgifter du gör om jag säger så?
0.4		**INFORMANT:** Administativt arbete, det är nog säkrare att jag förklarar i ord vad jag gör jag vet inte riktigt annars.
0.5		**INTERVIEWER:** Ja förklara gärna
0.6		**INFORMANT:** Jag gör ju någonting som heter, jag använder QlikView till något som heter utfallsanalyser och då är det så att vi tittar på olika parameterar i kvalitetsregistret, tex vem är det som har fått trycksår o vilka som har fått blåsor och sådana saker. Och då kanske jag får fram att det är 15 patienter i ett kvartal, och då hjälper QlikView mig att på ett enklare sätt få fram personnummer och operationsdatum och sådana saker. Det är så jag använder det och för att redovisa siffror sedan för personal och läkare, dom är ju ioförsig personal också, då plockar jag ut om man säger bilder, eller dom här mätarna i QlikView och vi har ju bara QlikView på en dator på jobbet och så då lägger jag dom i dokument som personalen ska sen kunna se att den månaden såg det ut så, och den månaden såg det ut så.
	DPE	*1. Hur mycket ansträngning krävs av dig för att du ska kunna använda systemet under beslutsfattningsprocessen?*
1.1		**INTERVIEWER:** Då går vi på frågorna direkt. Hur mycket ansträning krävs utav dig för att du ska kunna använda systemet under beslutfattningsprocessen? Och då menar vi egentligen, hur mycket tid och energi krävs det för att använda systemet eller vad man ska säga?
1.2		**INFORMANT:** Ja nu, ja, det är en lite svår fråga egentligen för nu är det lite annorlunda som vi har, vi har det som pilot hos oss så jag fick ingen utbildning på det när jag började med det så jag fick liksom sitta och gissa mig fram, så det tog ju egentligen... den grejen tog ju egentligen ett par dagar men det är egentligen inte det detta handlar om utan det är ju när jag startar det och sätter igång, och ska börja jobba. Då är det en hel del klickande innan jag får ordning på det, så som jag vill ha det, layout messigt och så.
1.3		**INTERVIEWER:** Ja
1.4		**INFORMANT:** I tid egentligen så tar det nog inte så mycket tid, det är nog mer att det kan kännas irriterande att inte mina egna. Eller dom inställningarna som jag vill ha sparas till nästa gång
1.5		**INTERVIEWER:** Ja
1.6		**INFORMANT:** För så tycker jag att det borde vara. Annars så, det tar nog egentligen inte mycket mer än några minuter skulle jag tro
1.7	DPE	**INTERVIEWER:** Så när du gör vissa inställningar, du får fram viss information, nästa gång du använder systemet så finns inte de kvar, du måste ta fram informationen och inställningarna igen?
1.8		**INFORMANT:** Ja, jag får göra om på samma sätt varje gång jag öppnar QlikView. Sen ioförsig liksom när jag ska göra anlyserna då, då gör jag liksom dom här vad man ska säga inställningarna eller hur man nu vill ha det och sen så mappar jag upp personnummrena och då måste jag exportera över det i excell för att kunna bearbeta dom eller göra, det jag gör är ju journal granskingar då går in i journaler, patientjournalerna för att läsa och så och det momentet tar nästan mer tid för att det inte är smidigare, att jag inte smidigare kan få över det i excell
1.9		**INTERVIEWER:** Ok
1.10		**INFORMANT:** Och det är ju nog så att det kanske egentligen går fast vi inte har fått ordning på det här.
1.11	SIQ	**INTERVIEWER:** Är det för att ni inte har kommit så långt i utvecklingsprocessen ännu?
1.12		**INFORMANT:** Det är mycket möjligt.

	DPE	*2. När tillhandahålles beslutstödet?*
2.1		**INTERVIEWER:** Ja kanon, men vi tar det som det är idag så får vi se hur det utvecklas senare. När tillhandahålles beslutstödet i systemet
2.2		**INFORMANT:** När jag fick det?
2.3		**INTERVIEWER:** Nej alltså när i processen av att använda det, när är det du får hjälp utav programmet om man säger? Är det hela tiden att den uppdaterar eller när är det....
2.4		**INFORMANT:** Alltså programmet uppdateras en gång per dygn vilket är för lite egentligen. Men jag använder det, det kan gå långa perioder där jag inte använder det alls, jag använder det bara när jag gör analyserna egentligen, det kan vara varannan månad eller var tredje månad eller någonting sådant. Men då kanske jag sitter flera dagar, en vecka eller 1.5 veckor i sträck och jobbar med det och då känns det ju välldigt jobbigt att det inte uppdateras men en gång utan bara en gång om dagen.
2.5	SIQ	**INTERVIEWER:** Men du använder bara QlikView till dom här utfallsanalyserna, finns det någonting annat du skulle kunna använda det till?
2.6		**INFORMANT:** Det vet inte jag just nu, vad man skulle kunna använda det till.
2.7		**INTERVIEWER:** Du har inget annat användningsområde som du har sett eller observerat.
2.8		**INFORMANT:** Nej inte så att jag har tänkt, det här vore förtjusande
2.9	DPE	**INTERVIEWER:** Ok, Men då är det alltså så i ditt fall när det gäller tillhandahållandet av beslutsstödet så kommer det i, när du ska hämta ut personnummer och liknande och det är då du fårhjälp av systemet så att säga?
2.10		**INFORMANT:** Ja
	DPE	*3. Vilken typ av stöd ger beslutstödssystmet?*
		3a. Information
3.1		**INTERVIEWER:** Kanon. Dessa frågorna kanske blir lite överflödiga i detta läget men vi tar de iallfall. Vilken typ utav stöd ger beslutstödssystemet i form av information till och börja med.
3.2		**INFORMANT:** Basinformationen
3.3		**INTERVIEWER:** Personnummer...
3.4		**INFORMANT:** All nödvändig basinformation, det är ju liksom personnummer operationsdata, operationskoder, allt det där, där jag var tvungen att titta på flera olika ställen innan jag fick detta. Så det tog hemskt mycket längre tid.
	DPE	3b. *Verktyg/Hjälpmedel*
3.5		**INTERVIEWER:** Finns det några verktyg eller andra hjälpmedel i systemet som du har hittat eller använder, som hjälper dig.
3.6		**INFORMANT:** Nej men jag tror inte jag kan systemet tillräckligt bra ännu. Jag tror det finns mycket mer funktioner än vad jag kan eftersom jag själv inte har fått någon utbildning utan bara har...
3.7		**INTERVIEWER:** Nej precis. Men tex, det fattades det här att exportera till excellfiler och liknande som du skulle vilja ha egentligen?
3.8		**INFORMANT:** Ja
	DPE	3c. *Annan*
3.9		**INTERVIEWER:** Är det någon annan form av stöd som du får av beslutstödssystemet? Som inte är i form av information eller verktyg eller andra hjälpmedel som du kan komma på?
3.10		**INFORMANT:** Nej, jag kan inte... nej
	DPE	*4. Har användningen av beslutstödssystemet lett till minskade kostander?*
4.1		**INTERVIEWER:** Finns det inga så finns det inga, och då hoppar vi vidare. Har användningen utav QlikView lett till minskade kostnader vad du vet, vad du kan se?
4.2		**INFORMANT:** Ska man... Ja man kan se det som att det är minskad arbetstid, det är klart det är det eftersom du tar... att det går fortare att få fram funktionerna... så det är klart. Jag vet inte... Om jag skulle jämnföra det tidsmässigt så har jag lite svårt att säga hur lång tid det tog innan.
4.3		**INTERVIEWER:** Men du upplever att det är lättare att få fram allting?
4.4		**INFORMANT:** Ja, alltså det är ju enklast att tänka så egentligen, skulle jag vilja bli av med det? Och det vill jag inte
4.5	SIQ	**INTERVIEWER:** Du vill inte ha tillbaka det gammla systemet?
4.6		**INFORMANT:** Nej jag vill inte gå tillbaka till det gammla.
	DPE	*5. Har beslutstödssystmet effektiviserat någon/några processer?*
5.1		**INTERVIEWER:** Har det effektiviserat några processer eller någon eller några processer utav ditt dagliga arbete?
5.2		**INFORMANT:** Ja det har det ju... ja.... och det är ju då insammlandet av informationen.
	DPE	*6. När var senaste gången systemet fallerade?*
		6a. Hur fallerade systemet?
6.1		**INTERVIEWER:** Yes, kanon... Har du varit med om att systemet någonsin har gått ner, havererat eller slutat fungera som det ska göra.
6.2		**INFORMANT:** Ja det gör det ju hela tiden....*[skratt]*...eller det har varit jätte problem med uppdateringarna, det har inte funkat en gång om dygnet ens ibland utan det har varit en gång i veckan. Och sedan så är det.... på vissa ställen som den sammlar in fel data men det är ju som sagt piloten detta och vi håller på och jobbar med vad det är som ska rättas till hela tiden... så mycket av mitt jobb handlar också om att försöka hålla ögonen öppna för fel jag hittar och prata med *[Informant C]* om de.
	DPE	6b. *Hur löstes problemet?*
6.3		**INTERVIEWER:** Löser man problemen löpande?
6.4		**INFORMANT:** Ja han *[Informant C]* har ju kontinuerlig kontakt med en kille som heter *[edited]*, han kanske ni ska träffa idag med eller?
6.5		**INTERVIEWER:** Nej. Vi har valt att inte göra det för vi vill inte gå in allt för mycket på den tekniska sidan, för då är det lätt att vi inte är opartiska längre ifall vi får för mycket från dom som jobbar med systemet. För då kommer dom berätta för oss hur bra allt är i systemet och då blir vi inte opartiska längre, så vi försöker undvika dom om vi kan...*[skratt]*.

	DPE	*7. Vilka lagar och bestämmelser är viktiga i relation till beslutstödssystemet?*
7.1		**INTERVIEWER:** Vilka lagar och bestämmelser är viktiga för detta beslutstödssystemet enlig dig? Som påverkar ditt dagliga arbete?
7.2		**INFORMANT:** Det måste vara samma lagar egentligen som liksom styr patientjournaler..., och secretess... jag vet inte i ärlighetens namn vad dom har för nummer och siffror men det måste vara samma så att det är lika säkert
7.3		**INTERVIEWER:** Det är samma som gäller för sjukhuset i allmänhet?
7.4		**INFORMANT:** Ja, patientjournallagen, secretess, PUL etc.
	DOQ	*8. Ger beslutsstödssystemet rekomendationer och/eller råd*
8.1		**INTERVIEWER:** Ok då går vi in lite mer i kvaliteten av beslutsutfallen. Ger beslutstödssystemet rekomendationer och råd på det du gör?
8.2		**INFORMANT:** Nej det gör det inte
8.3		**INTERVIEWER:** Du måste dra dina egna slutsatser och liknande?
8.4		**INFORMANT:** Ja.
8.5	SIQ	**INTERVIEWER:** Skulle du vilja att systemet gav dig råd?
8.6		**INFORMANT:** Ja det hade inte varit dumt , om det hade liksom varit mer som en vanlig web-applikation som man är van vid när man sitter och surfar och så va. Det hade jag tyckt, jag menar det är det folk är
8.7		vana vid.
8.8		**INTERVIEWER:** Ja.
		INFORMANT: Meningen är ju väll, vad jag har förstått det att vi ska ha ut QlikView till alla
8.9		avdelningarna på ortopeden iallafall och då måste det vara lättanvänt.
8.10		**INTERVIEWER:**mmm
8.11		**INFORMANT:** Det är ju inte riktigt det ännu då.
8.12		**INTERVIEWER:** ok
8.13		**INFORMANT:** Så visst, typ hjälpfunktioner, ja..
	SIQ	**INTERVIEWER:** Vad är det du har svårt med, för eller med användningen, som du inte är helt 100 på, typ det där med inställningarna och det?
8.14		**INFORMANT:** Nu har jag gjort det så pass många gånger så nu är det inte svårt, nu är det bara mer att det är en jäkla massa klick, och det handlar tex om saker som, ja ni har ju sett hur det ser ut, att jag inte får göra om färgerna på listboxarna, jag vill ha andra färger där, för att det ska vara mycket lättare för mig att se och jobba, att det är krångligt när man ska exportera en skärmdump och liksom sådana saker där jag liksom får sitta och gissa mig till hur jag ska göra. Nu vet jag inte om det var det ni frågade efter?
8.15		**INTERVIEWER:** Jodå det finns inga felaktiga svar, vi tar all information vi kan få.
8.16		**INFORMANT:** Ja.
	DOQ	*9. Hur tror du att patienternas tillfredsställelse har påverkas av beslutsstödssytemet?*
		9a. Har några klagomål från patienterna förekommit?
		9b. Har antalet klagomål påverkats av beslutstödssystemet?
9.1		**INTERVIEWER:** Ja fråga 9 då. Hur tror du patienternas tillfredsställelse har påverkats av införandet av beslutstödssystemet?
9.2		**INFORMANT:** Än så länge så tror jag inte alls att det kommit patienterna till godo.
9.3		**INTERVIEWER:** Ok
9.4		**INFORMANT:** För det är ju även så att det här arbetet som vi gör med utfallsanalyser av händelser det är också ganska nytt egentligen. Så inte ens det har hunnit komma patienterna till godo, så det är inte förens man har gjort mer som man kan säga nått om det.
9.5	SIQ	**INTERVIEWER:** Ser du potential att det kanske kommer kunna hjälpa dom i framtiden? Är det det som blir målet eller vad man ska säga? Att det ska bli bättre eller ska man ligga på samma nivå fast mer effektivt bara eller vad är tanken?
9.6		**INFORMANT:** Alltså blir vi mer effektivta så tillsätter vi mer tid till patienterna egentligen. Så att man kan få mer patient nära tid. Tänker man då ur läkarsynpunkt om dom kan få in....jag vet att *[Informant C]* har pratat om att man kan få in både lab och röntgen och liksom sådana saker sammlat, och det vore ju välldigt bra om läkarna hade kunna få mer patienttid istället för att hänga vid datorerna
9.7		**INTERVIEWER:** Vi inser att det är lite svårt att svara på denna frågan för de flesta eftersom det inte varit ute bland patienterna på det sättet ännu så därför blir vi tvungna att fråga mer om framtidsvisionerna. Som sagt så får väll detta testas igen om 5 år för att få lite mer information.
	DOQ	*10. Har beslutstödssystemet haft någon påverkan på misstag i sjukhuset?*
		10a. Administrativa fel
		10b. Kliniska fel
10.1		**INTERVIEWER:** Har det haft någon påverkan på misstaken som görs i sjukhuset vad du vet, alltså administrativa fel och kliniska fel.
10.2		**INFORMANT:** Det har jag ingen aning om. Det vet jag inte.
10.3		**INTERVIEWER:** Om vi tar dina arbetsuppgifter har du.... nu vet jag inte om du gjort fel innan eller ...det kanske är känsligt att fråga...men i processen....innan detta systemt fanns, om man gjorde en viss process...och sen när systemet har kommit in i processen har det blivit mindre fel, mer fel? Tex om systemet ger fel data tillexempel så baseras ju beslut på fel data. Eller om du nu kanske behöver hitta mer information som man kanske inte hittade lika lätt innan.
10.4		**INFORMANT:** Alltså det var nog mer problem att QlikView inte hittar de patienterna, nej dom tog fram fel, QlikView tog fram fel patienter i början. Sådana som inte skulle vara med. Så vi fick sitta o dubbel kolla allting, ända tills vi kom på eller *[edited]* kom på hur han skulle skriva en kod för att det skulle bli rätt. Då körde vi liksom dubbelt under den tiden så det blev inga fel. Det var ju mer att vi upptäckte felen
10.5		då.
10.6		**INTERVIEWER:** Ni jämnförde QlikView....
		INFORMANT: Det gammla med det som QlikView plockade fram. Och så såg man att dom stämmde
10.7	SIQ	inte alls så och det gammla viste vi ju att det var helt korrekt.
10.8		**INTERVIEWER:** Använder ni det gammla fortfarande för någonting, för att dubbelkolla ibland eller....
		INFORMANT: Inte för att dubbelkolla dom uppgifterna, Jag använder det det gammla systemt för att

		göra andra saker. Var gör jag där...själva registreringen, den enskilda registreringen i systemet och det är
10.9	SIQ	nog allt jag har det till nu. Numera går jag bara in i QlikView.
		INTERVIEWER: När visste ni att det var säkert nog att använda? Det fanns någon övergångsperiod där du sa ”nu har vi kontrollerat, nu stämmer allt med det gammla systemet”, nu kan vi köra. Eller var det efter
10.10		koden hade blivit löst? Vad var det som gjorde att ni kännde er säkra?
		INFORMANT: Jo men efter han hade löst koden så kollade vi en gång till för att se om det nu var samma
10.11		namn och personnummer.
10.12		**INTERVIEWER:** Och då stämde det?
		INFORMANT: Ja då släppte vi det helt enkelt. Man vet ju alltid på ett ungefär ifall siffrorna ser rimliga ut som QlikView visar. Och gör dom inte det så dubbelkollar vi.
	DOQ	*11. Har du lärt dig något av systemet sen du började använda det?*
		11a. Administrativt
		11b. Kliniskt
		11.c Annat
11.1		**INTERVIEWER:** Har du lärt dig någonting av systemet sedan du började använda det?
11.2		**INFORMANT:** Det har jag nog säkert gjort men frågan är vad....jag vet inte vad jag har lärt mig...man lär ju sig alltid något när man håller på med ett nytt system. Det gör man ju.
11.3		**INTERVIEWER:** Har du lärt dig någonting utanför systemet som hjälper dig, tex du har lärt dig något i systemet som du kanske inte har gjort innan med arbetsprocesser och liknande?
11.4		**INFORMANT:** Det är inget jag kan komma på nu iallfall.
	DMS	*12. Hur har beslutstödssystemet påverkat läkarnas/sköterskornas medicinska prestationer?*
12.1		**INTERVIEWER:** Hur har beslutstödet påverkat läkarna/sköterskornas medicinska prestationer vad du
12.2		vet.
		INFORMANT: Inget alls än så länge. Denna gången var första gången jag fick ordentlig feedback från läkarna på dom här utfallsanalyserna för att då hade jag med hjälp av mätarna ställt samman då liksom, det teamet siffror såg ut så, det teamets siffror såg ut så bla bla bla. Och så fick ju läkarna se hur det såg ut med definitiva sårinfektioner etc och då fick jag mailfeedback tillbaka sen och det har jag alldrig fått innan och det var ioförsig bra för då känndes det som att de fick upp ögonen lite ”aha så vi har bara 2% av bla
12.3		bla bla bla” så jag hoppas ju att de ska bli mycket mer intresserade. Så jag ska fortsätta göra så iallafall.
		INTERVIEWER: Så kan man då egentligen kan man ju säga att du identifierar ifall det har begåtts
12.4		misstag, eller ifall någonting har missats och det är den feedbacken som läkarna får så får dom lära sig
12.5		från den?
		INFORMANT: Ja ungefär så
12.6	SIQ	**INTERVIEWER:** Då är egentligen systemet bara ett verktyg i processen, det är ju inte systemet i sig själv som lär ut till läkarna då?
12.7		**INFORMANT:** Nej
	DMS	*13. Har det enligt din uppfattning förekommit något motstånd mot systemet?*
		13a. Vad för typ av motstånd?
		13b. Av vem har motståndet visats?
13.1		**INTERVIEWER:** Har det enligt din uppfattning förekommit något motstånd mot systemet?
13.2		**INFORMANT:** Från mig eller från andra?
13.3		**INTERVIEWER:** Både från dig och ifrån andra.
13.4		**INFORMANT:** Nej, andra har inte....det är inte många som har sett det, om jag ska utgå ifrån min avdelning då. Det är kanske min chef och någon till. Jag hatade det verkligen i början, jag gjorde det. Det sa jag varje gång jag startade det, I hate QlikView. Men det får man inte säga till *[Informant C] [skratt]*. Men det var just innan jag hade lyckats lära mig hur jag skulle få fram uppgifterna. Jag kännde bara det.. .det här är inte användarvänligt...kännds det som.
13.5	SIQ	**INTERVIEWER:** Så en framtida rekomendation för när man introducerar detta för alla skulle kunna vara att man utbildar personalen så att de förstår hur det fungerar? Så att man slipper den initiella processen.
13.6		**INFORMANT:** Ja och sen så tror jag en annan layout bör användas för den är banemig inte rolig. Den är inte det
13.7	SIQ	**INTERVIEWER:** Har ni fått komma med någon feeback för gränssnittet?
13.8		**INFORMANT:** Ja jag har sagt till *[edited]* att jag vill ändra färgerna, men det går tydligen inte för så ska det vara, nått mummel om usa och så...
13.9		**INTERVIEWER:** Ok?
13.10		**INFORMANT:** Jag vet inte om det kommer från usa.
13.11		**INTERVIEWER**: Dom har flyttat sitt högkvater dit, det är allt vi vet
13.12		**INFORMANT:** Jaha
13.13		**INTERVIEWER:** Det låter konstigt för oss som användt QlikView.
13.14		**INFORMANT**: Men småsaker har de ändrat tex när man vill ha en låsknapp där o där istället för att göra si och så?
13.15	SIQ	**INTERVIEWER:** Men i QlikView finns ju funktionen att man kan flytta runt fönster och liknande lite som man själv vill. Ifall det hade sparats hade varit ok för dig då? Att du själv designar det i början och sedan låser det. Eller vill du att det ska finnas en färdig platform som är framtagen av sjukhuset?
13.16		**INFORMANT**: Jag tycker det ska vara flexibelt, ska kunna göra mina egna inställningar. Det tror jag att folk är vana vid när de sitter vid sina datorer, ändrar färger och typsnitt.
13.17		**INTERVIEWER:** Kör sin grej liksom?
13.18		**INFORMANT**: Ja precis
13.19		**INTERVIEWER:** Sen så behöver kanske inte alla exakt samma infromation
13.20		**INFORMANT**: Nej
13.21		**INTERVIEWER:** Ha fokus på det man själv behöver.
13.22		**INFORMANT**: Ja precis.
13.23		**INTERVIEWER:** Det var egentligen alla frågor vi hade just nu, har du något du själv vill fråga om eller tillägga?
13.24		**INFORMANT**: Nej, jag vet inte *[skratt]*

Appendix 6 – Interview C (Swedish)

Reference = Reference number to sentence
Code = Interview coding
INF = Information about informant
DPE = Decision-Making Process Efficiency
DOQ = Decision Outcome Quality
DMS = Decision Maker Satisfaction
SIQ = Side-question
Interview = Interview transcript

Informant C - Operations developer/Chief physician 05/05/2010, 15.00pm-16.00pm

Reference	Code	Interview
0.1		**INTERVIEWER:** Bakgrunden känner du redan till, till uppsatsen?
0.2		**INFORMANT:** Ja
0.3	SIQ	**INTERVIEWER:** Vill du att vi förklarar det en gång till? Vad vi egentligen utvecklar, eller vad vi egentligen gör? *[Respondenten missförstår frågan och tror att vi säger "Vad ni egentligen utvecklar..."]*
0.4		**INFORMANT:** Vi utvecklar ett verktyg för analys av verksamheten, där vi framförallt för att få en kontroll av vad vi gör, en så kallad egenkontroll. Dvs där vi sammlar data från hur man har planerat, resursplanering, från hur man har utfört saker och ting och vilka resultat det ger. Allt detta ställs samman och kollas, överstämmer de med vad man förväntar sig eller var finns avvikelserna? Och sedan återföra detta till dom som arbetar med det.
	INF	*Titel*
0.5		**INTERVIEWER:** Titel vad skulle du kalla din egen titel i detta?
0.6		**INFORMANT:** Min titel?
0.7		**INTERVIEWER:** Ja, i systemet eller i almänhet på sjukhuset?
0.8		**INFORMANT:** Jag är ju docent och överläkare, just nu har jag gått över till att arbeta som verksamhetsutvecklare. Bakgrunden är viktig, jag har ju lång erfarenhet som ni vet.
0.9		**INTERVIEWER:** Ja men det är bara för att vi har valt att inte använda namn i vår uppsats och därför ställer vi istället frågan om titel.
0.10		**INFORMANT:** Men ålder har ni med?
0.11		**INTERVIEWER:** Nej
0.12		**INFORMANT:** Det är ioförsig viktigt att veta hur lång erfarenhet man har.
0.13		**INTERVIEWER:** Det är kan ioförsig vara sant men.... det har vi inte med.
0.14		**INFORMANT:** *[Informant A]* och jag har ju jättelång erfarenhet. *[Informant B]* också för den delen.
0.15		**INTERVIEWER:**Så alla har 10+ år erfarenhet iallafall.
0.16		**INFORMANT:** Ja
	INF	*Typ av användare i systemet*
0.17		**INTERVIEWER:** Vilken typ utav användare är du i systemet? Är du mer av en administratör eller vad skulle du kalla dig själv i systemet? (Respondenten missförstår frågan)
0.18		**INFORMANT:** Nej, det är inte administratörer som ska använda det utan det är dom som är verksamma som exklutivt ute i verksamheten det är dom, antingen om de sitter i ledningen och ansvarar för dom delarna eller om de sitter som ansvariga för en enhet, det är dom som ska ha det.
0.19	SIQ	**INTERVIEWER:** Ja men vi syftar mer på vad du gör med systemet. Vilken titel skulle du ge dig själv i systemet?
0.20		**INFORMANT:** Utvecklare, just nu så är jag bara utvecklare.
	DPE	*1. Hur mycket ansträngning krävs av dig för att du ska kunna använda beslutstödsystemet under beslutfattningsprocessen?*
1.1		**INTERVIEWER:** Då börjar vi med att prata om effektiviteten av beslutsfattningsprocessen, hur det har påverkats av beslutstödssystemet...och då är frågan hur mycket ansträngning krävs av dig för att du ska kunna använda systemet.
1.2		**INFORMANT:** Ja, alltså vi siktar ju på...vi är inte riktigt framme som ni har förstått men jag är ju ansvarig för att utveckla det hela och det ska ju utvecklas till det att användarna inte ska behöva anstränga sig alls. Det är ett absolut avgörande mål för fixar man inte det då kommer det inte lyckas. Det ska vara genomskinligt, det ska vara lätt och det ska vara intuitivt. Det är helt nödvändigt, där är vi inte riktigt ännu. Vi måste lära upp användarna och just nu så lär vi upp dom i våra arbetsgrupper. Men imorgon dvs om 1 år eller 1.5 år så kommer de med lätthet själva kunna hämta den infromationen de behöver utan någon som helst ansträngning.
1.3	SIQ	**INTERVIEWER:** Är det bara träning ni gör för att förmindra ansträngningen eller är det också något ni tänker på när ni designar systemet?
1.4		**INFORMANT:** Jätte mycket med designen, jag är ju ansvarig för det så jag tänker hela tiden på hur jag ska utforma det så att det blir rätt i längden utan några manualer eller sånt, jag förväntar mig att alla programmen ska vara självstyrda, det tycker jag iallafall.
1.5	SIQ	**INTERVIEWER:** Sen när ni har den färdiga produkten, har ni då tänkt ha träning med användarna alls? Eller är det tänkt att det ska vara så pass transparant att man inte behöver

		någon träning överhuvudtaget.
1.6		**INFORMANT:** Vesentligen ska inte behöva någon träning alls.
1.7		**INTERVIEWER:** Det blir bara en snabb genomgång?
1.8		**INFORMANT:** Det som händer sammtidit här, om vi tittar över 10-15 år, den tiden går ju fort, då får vi användare som har en helt annan vana än dagens användare så det kommer inte vara några problem, det tror jag inte.
1.9	SIQ	**INTERVIEWER:**Hämtar du tex feedback från *[Informant A]* då? Om henns syn på gränssnittet etc
1.10		**INFORMANT:** O ja, *[Informant A]* lyssnar jag på. Jag håller ju fortfarande på att utveckla väldigt mycket och jag måste ägna en hel del tid åt alla kontrollerna, man tänker inte på hur viktiga de är, kontoll av tillförlitlighet och validiet är jätte viktigt. Har man inte koll på de sakerna, ja då blir det ju meningslöst kan man ju säga.
1.11		**INTERVIEWER:**Då finns det kanske inget att mäta heller?
1.12		**INFORMANT:** Välldigt många har inte som vana att kontrollera siffrorna från systemet, de antar att de är rätt, men så är det inte alltid.
	DPE	*2. När tillhandahålls beslutstödet?*
2.1		**INTERVIEWER:** När i beslutsprocessen får man hjälp av systemet? Ska man få det hela tiden eller när man gör specifika uppgifter.
2.2		**INFORMANT:** Vad jag tänker mig är att man har specifika uppgifter och saker som man ska jobba med och då tar man fram de uppgifterna i löpande arbete, så det ska gå oehört lätt, det ska inte vara något krångligt alls.
2.3		**INTERVIEWER:** Så man ska kunna komma åt det precis när man behöver det?
2.4		**INFORMANT:** Ja precis när man behöver det.
2.5	SIQ	**INTERVIEWER:** En liten sidofråga. I slutimplementeringen sen, så som ni ser det. Kommer alla att använda samma system eller kommer det var uppdelat i olika vyer så att säga
2.6		**INFORMANT:** Alla använder samma system fast de har olika behörigheter
2.7		**INTERVIEWER:** Ok
2.8		**INFORMANT:** Vanliga användare störs av information de inte behöver. Dom kan ha tillgång till informationen men de ska inte se den direkt. De ska ha tillgång till informationen de är intresserade av och det andra ser de inte direkt. Du kan plocka fram det ifall du vill för det har du rätt till, men du ser det inte initialt, du störs inte av det alltså.
	DPE	*3. Vilken typ av stöd ger beslutstödssystemet?*
		3a. Information
3.1		**INTERVIEWER:** Ok. Vilken typ av stöd ger det här beslutstödssystemet? Då har vi 3 underkategorier, Information, hjälpverktyg och annat.
3.2		**INFORMANT:** Vad var det första sa du?
3.3		**INTERVIEWER:** Information, vilken typ av stöd ger systemet när det gäller information att hämta ut och så vidare?
3.4		**INFORMANT:** Vad det är för typ av information?
3.5	SIQ	**INTERVIEWER:** Hur hjälper systemet dig att hämta ut information, kanske om man jämnför med hur det var innan? Vad är det som gör detta systemet annorlunda?
3.6		**INFORMANT:** Vanliga medarbetare ute i verksamheten har ingen möjlighet att se hela verkligheten, de ser bara fragment, dom ser att en patient kommer för sent, att en patient blir infekterad, men de får alldrig någon helhet av det. Cheferna kanske får lite mer helhet men egentligen inte dom heller. Här får du plötsligt allt ihopa rakt av. Vi ser varenda typ av komplikation, fallskador, uringvägsinfektioner etc. Och du ser hur det har förlöpt över tid.
	DPE	*3b. Verktyg/Hjälpmedel*
3.7		**INTERVIEWER:** Finns det några verktyg eller hjälpmedel som är utvecklade i QlikView eller liknande, som är gjorda för en specifik uppgift. Finns det några verktyg eller andra hjälpmedel som ni har tänkt ska finnas i implementeringen?
3.8		**INFORMANT:** Det har jag inte tänkt på. Så mycket har vi inte idag utan vi använder QlikView helt enkelt.
	DPE	*3c. Annat*
3.9		**INTERVIEWER:** Är det någon annan typ utav stöd som systemet ger, som inte är information eller verktyg.
3.10		**INFORMANT:** Nej, inget annat. Det kan jag inte säga, som jag kan komma på just nu iallafall
	DPE	*4. Har användningen av beslutstödssystemet lett till minskade kostnader?*
4.1		**INTERVIEWER:** Har användningen av beslustödssystemet lett till minskade kostnader?
4.2		**INFORMANT:** Jag uttrycker mig försiktigt med detta. Vi ser att, och siffrorna visar, tydliga förbättringar när det gäller genomflöde komplikationer och andra saker, men nu är det många saker som händer sammtidigt och att tillskriva sådana förbättringar bara till systemet, det vore felaktigt. När *[Informant A]* och jag sammlar personalen, även om vi inte hade haft systemet så hade vi hämtat den infromationen någonannanstans ifrån, vi vet ju också det att om man intresserar sig för ett problem så lyfter det nivån lite bara det faktiskt. Men när jag jämnför 07 och 09 så ser man; färre komplikationer, bättre genomgångstider etc, det ser man. Det är pga det sammlade arbetet på sjukhuset i vilket BI (QlikView) verktyget är en välldigt viktig del, utan tvekan. Meningen är att jag och *[Informant A]* ska kunna frigöra oss från det här ansvaret att instruera, utan personalen ska hämta informationen själva från systemet. De ska se hur många infektioner det var, så här såg det ut, det var den och den som hade infektion etc. Och det kan man ju säga, att *[Informant B]* som jobbar på golvet, varken jag eller *[Informant A]* gör det, hon gör ju detta, hon sitter med QlikView och tittar på komplikationerna och resultatet och återför det till den ansvarige, så tar man upp det gemensamt och bearbetar fråga efter fråga, och kör det löpande.
4.3	SIQ	**INTERVIEWER:** Ännu en sidofråga, men hur många databaser hämtar ni information ifrån?

4.4		**INFORMANT:** Det är så att att det finns sammanlagt 5 eller 6 system men antalet databaser är fler därför samma information ligger i flera databaser. Vårat journalsystem tex ligger i 15 – 20 databaser här på sahlgrenska. Vilket ioförsig är ett problem men det har blivit så under uppbygnaden att databaserna ligger verksamhetsvis, kanske inte världens bästa ordning, men så är det just nu, samma sak med operett där vi hämtar data från operationer där finns det också olika databaser, och det här är ett bekymer, vi måste ju koppla rätt. Så mycket insikt krävs så att man verkligen får rätt kopplingar förståss. Även om de är ”identiska” så är de ändå inte helt samma.
4.5	SIQ	**INFORMANT:** Kan man anta att det även är viktigt att de stämmer överens med varandra också?
4.6		**INTERVIEWER:** Ja det måste de göra. Men under utvecklingens gång så blir det såhär och sen så måste man organizera om det. Men det är säkert minst ett 20tal databaser som finns.
	DPE	*5. Har beslutstödssystemet effektiviserat någon/några processer?*
5.1		**INTERVIEWER:** Ok. Har beslutstödssystemet förbättrat någon eller några processer i hur ni arbetar?
5.2		**INFORMANT:** Ja... det har det gjort. Visst har det gjort det. Med den här gruppen....företrädande för de olika avdelningarna.... så går vi igenom avvikelserna, fördröjningar, tidsavvikelser, otilräckliga förberedelser, en massa saker och sedan kopplar vi tillbaka detta till verksamheten och jobbar med det. Så visst påverkar det, hela tiden. Samma sak med produktionssiffrorna de återkopplas hela tiden till de ansvariga så får de titta vilken avdelning det inte är som presterar som den ska göra, och vad det beror på
	DPE	*6. När var senaste gången beslutstödsystemet fallerade?* *6a. Hur fallerade beslutstödsystemet?* *6b. Hur löstes problemet?*
6.1		**INTERVIEWER:** Ok....Har systemet någonsin slutat fungera på något sätt?
6.2		**INFORMANT:** Nej...
6.3		**INTERVIEWER:** Eller gett felaktig information eller liknande?
6.4		**INFORMANT:** Nej det har det inte gjort, det är välldigt stabilt. Nej det har alldrig crashat helt och hållet.
6.5		**INTERVIEWER:** Har det varit några mindre problem?
6.6		**INFORMANT:** Med själva systemet?
6.7		**INTERVIEWER:** Ja
6.8		**INFORMANT:** Nej det kan jag inte säga. Det kan jag faktiskt inte säga. Ni vet kanske att vi uppdaterar systemet 1 gång om dagen?
6.9		**INTERVIEWER:** Ja det fick vi förklarat av *[Informant B]*. Ja detta är också en sido fråga egentligen men vi ställer den till dig eftersom du förmodligen är den som kan mest om systemet.
6.10		**INFORMANT:**Ja
6.11	SIQ	**INTERVIEWER:** I ett senare skede komnmer det att vara dagliga uppdateringar då också?
6.12		**INFORMANT:** Det kommer vara tätare. Det måste vara det. Det är välldigt att man får åtkomst snabbt och jag skulle gissa att man ligger i realtid inom en snar framtid. Man har ordnat alla databaserna så att de speglas direkt etc.
6.13		**INTERVIEWER:** Så ni siktar på att det ska bli uppdaterat i realtid?
6.14		**INFORMANT:** Absolut, mycket av vår verksamhet kräver att vi jobbar på det sättet. Då är vi tillbaka kan man säga, till den situationen som var före all dena tekniken kom. Där man fick påminelser på direkten, någon noterade en avvikelse och du görs uppmerksammad på ditt fel. Men då var det en människa som övervakade, nu får du istället få hur det lyser upp på skärmen. Jag är ju inne på att man ska, att man måste lägga in påminnelser på olika sätt. Du får tänka dig för hur du gör det men det måste göras. Och det finns ju massor av sådana system där man visar hur det fungerar, det är ju självklart. Men systemen måste vara väl genomtänkta så att användarna nytjar systemet också.
	DPE	*7. Vilka lagar och bestämmelser är viktiga i relation till beslutstödssystemet*
7.1		**INTERVIEWER:** Ja, Vilka lagar och bestämmelser är viktiga för detta beslutstödssystemet?
7.2		**INFORMANT:** För det första hälsosjukvårdslagen och sedan så är det alla lagar om PUL, säkerhet och sådant, så det är många lagar.
7.3		**INTERVIEWER:** Följer systemet dom här lagarna?
7.4		**INFORMANT:** Ja det skulle jag vilja säga, Alltså här finns ett problem, jag har insikt i det eftersom jag sitter centralt och har gjort det så länge, jag ser ju det mesta. Det finns svårigheter med sekretessen under ett uppbyggnadsskede därför att man måste bygga upp systemet på verkliga data. Jag har ju jobbat med det här med utveckling i 20 år. Man måste ha medarbetare runt sig som man vet att man kan lita på. Men däremot när vi nu bygger upp ett system som vi släpper ut då lägger man ju in det här med kontroller av tex säkerheten, den är ju betydligt uppskärpt faktiskt. Men vi har haft några incedenter också, händelser som involverade sökningar och så där.
7.5		**INTERVIEWER:** Sökningar som inte skulle ha gjorts?
7.6		**INFORMANT:** Ja som de inte skulle ha gjort. Hade man hängt med från början och gjort slumpvisa, systematiska sökningar så hade man kanske kunnat klarat av det ännu bättre. Men sådant kan man få ialla sådana här system, men man måste se upp med det.

	DOQ	*8. Ger beslutstödssystemet rekomendationer och/eller råd?*
8.1		**INTERVIEWER:** Ok, Ger beslutstödssystemet rekomendationer och råd? Till den som använder det?
8.2		**INFORMANT:** Nej, det gör det ju inte idag, det var det jag byggde upp på nevrokirurgen, men där är vi inte idag. Det är min övertygelse att det kommer behövas, men det är en ganska svår sak.
8.3		**INTERVIEWER:** Men det är inte någonting som.....
8.4		**INFORMANT:** Där är vi inte med detta systemet idag. Det är vi inte.
8.5	SIQ	**INTERVIEWER:** Är det planerat att det ska komma in?
8.6		**INFORMANT:** Man kan inte säga att det är planerat. I mitt huvud är det planerat.
8.7		**INTERVIEWER:** Ok men inte på papper eller vad man ska säga?
8.8		**INFORMANT:** Nej
	DOQ	*9. Hur tror du att patienternas tillfredställelse har påverkats av beslutstödssystemet?*
9.1		**INTERVIEWER:** Denna frågan vet vi inte om du kan svara på men hur tror du patienternas tillfredställelse har påverkats av systemet?
9.2		**INFORMANT:** Det är ju possivit i så fall. Utan att de vet att det kommer från systemet. Jag menar det är ju possitivt att vi jobbar med väntetider, operationstider. Men att tillskriva det helt och hållet till systemet det är omöjligt. Systemet håller på att införas och används sedan 1.5 år tillbaka i ökande grad, och det är det som påverkar, det är det som ger de direkta effekterna bakom procent siffrorna. Det finns all anledning att tro att systemet har bidgragit till effekterna.
9.3	SIQ	**INTERVIEWER:** Så ni kan se att när systemet är fullt implementerat så kommer ni kunna minska väntetider etc.
9.4		**INFORMANT:** Absolut.
9.5		**INTERVIEWER:** Vi visste inte ifall det skulle gå att svar på denna frågan eftersom det inte finns så mycket patienter i systemet.
9.6		**INFORMANT:** Vad? Det finns ju 4 år inne i systemet.
9.7		**INTERVIEWER:** Jaha det var bra att du förklarade det för det hade vi missförstått i de tidigare intervjuerna.
9.8		**INFORMANT:** Det är från den 1 januari 07, ja så det är ju 3 hela år. Vilket är ungefär 90 000 operationer, vilket då är fler patienter.
	DOQ	9a. *Har några klagomål från patienterna förekommit?*
9.9		**INTERVIEWER:** Det har inte förkommit några direkta klagomål från patienter eller liknane.
9.10		**INFORMANT:** Nej de har ingen aning att systemet ligger bakom.
	DOQ	9b. *Har antalet klagomål påverkats av beslutstödssystemet?*
9.11		**INTERVIEWER:** Kan ni se att antalet klagomål i allmänhet har minskat sedan ni införde systemet?
9.12		**INFORMANT:** Nej det kan vi inte se, det påverkas av så många andra saker också.
9.13		**INTERVIEWER:** Ja
9.14		**INFORMANT:** Det här med klagomål från patienter har inte påverkats mer än rent allmänt som vi pratade om, att det har varit possitivt, men att tillskriva det till systemet direkt...med förbättringar av processer och liknande så är det possitivt.
	DOQ	*10. Har beslutstödssystemet haft någon påverkan på misstag i sjukhuset?* *10a. Administrativa fel* *10b. Kliniska fel*
10.1		**INTERVIEWER:** Har systemet haft någon påverkan på misstag som görs i sjukhuset? Och då menar vi både administrativa fel och eventuella kliniska fel?
10.2		**INFORMANT:** Ja visst, vi jobbar mycket med detta. En del av det som vi kallar avvikelser, är misstag och sådant, där någon inte har skött sig, där får man ju direkt påverkan av systemet. Problemet diskuteras i gruppen man tar med sig det hem och jobbar med det. Imorgon (framtiden) då ser du det direkt på skärmen. Och det kommer upp omedelbart. Allt är övervaktat helt enkelt. Chefterna ser ifall du sköter ditt ansvar eller inte. Så kommer det bli.
10.3	SIQ	**INTERVIEWER:** Kommer ni då också ha...Den som är chef kan alltså gå in och titta specifikt på en läkare för att få en överblick.
10.4		**INFORMANT:** Ja men man måste vara lite försiktig med personuppgifter och liknande. Uppgifterna kommer finnas lagrade. De uppgifterna finns redan i andra system bara att vi inte har kopplat de till QlikView ännu.
10.5	SIQ	**INTERVIEWER:** Ok, då har jag ännu en sidofråga. I USA så rankas man som läkare och kirurg, man vet hur många lyckade operationer man har etc och får en plasering baserat på detta. Finns det i sverige idag?
10.6		**INFORMANT:** Nej, det gör det inte, det diskuteras men vi har inte kommit dit ännu, men om 10 år så kommer det tvingas fram av den ökade konkuransen från den privata sjukvården. Den existerar idag, i växande omfattning och det är ett rent hot, eller vad man ska kalla det mot vår personal. Idag köper vi proteser för 70 – 80 000 000 av privata företag pga att vi inte klarar av det själva. Vi klarar inte allt.
	DOQ	*11. Har du lärt dig något av beslutstödsystemet sen du började använda det?* *11a. Administrativt* *11b. Kliniskt* *11c. Annat*
11.1		**INTERVIEWER:** Har du lärt dig någotting av systemet sedan du började använda det. Och då menar vi först från ett administrativt perspektiv?
11.2		**INFORMANT:** Ja, jag lär mig mycket. När jag ska översätta min kunskap till systemet så måste jag strukturera det vilket leder till att man lär sig en massa, verkligen. Det är jag som sitter och utformar alla skärmar och sånt, hur det ska ut och hur det ska användas osv.

11.3		**INTERVIEWER:** Ja. Är det både kliniskt och administrativt då....
11.4		**INFORMANT:** Absolut.
11.5		**INTERVIEWER:** Kan man använda systemet för att lära sig saker om sin egna arbetsprocess också? Tex att systemet tillför viss information som kanske gör att man ser vissa saker i sitt eget arbetsflöde som man kanske inte såg innan.
11.6		**INFORMANT:** Ja ja, det kommer man i högsta grad kunna göra, ja det kan man göra redan idag men rent tekniskt så har vi kommit ut till användarna pga begränsad kapacitet. För så fort vi släpper det så skapas det ett väldigt tryck på oss att förklara en massa saker för användarna så därför släpar det efter hela tiden. Jag menar jag sitter ju här som utvecklare pga att socialstryrelsen tillsynsmyndighet var har och hade välldigt uttryckliga påpekanden och det var dom tvungna att fixa och då fick jag chansen så att säga.
11.7	SIQ	**INTERVIEWER:** Stödjer systemet de punkterna som socialstyrelsen tog upp?
11.8		**INFORMANT:** Ja direkt, vi har en lista på mått, hur många vikarier, infektioner etc. Och det hanterar systemet direkt.
	DMS	*12. Hur har beslutstödssystemet påverkat läkarnas/sköterskornas medicinska prestationer?*
12.1		**INTERVIEWER:** Hur har beslutstödssystemet påverkat läkarna/sköteskornas medicinska prestationer? Om de har gjort det överhuvudtaget ännu?
12.2		**INFORMANT:** Nej det är nog tveksamt. Det har inte kommit ut till tillräckligt många ännu.
12.3	SIQ	**INTERVIEWER:** Finns det potential.....
12.4		**INFORMANT:** Men det är klart i det här arbetet, där systemet är en del.....vi har ju suttit i 3 år i de här arbetsgrupperna och gått igenom diverse infromation, tidigare varje vecka faktiskt, det är ju klart att de går hem med kunskap de har fått tack vare systemet, det påverkar på det viset omvårdnaden. Men exakt hur det har gjort det i detalj är lite svårt att säga.
12.5		**INTERVIEWER:** Ja.
12.6		**INFORMANT:** Man ser ju också förbättringar när vi mäter, skulle jag ha sagt tidigare. Men för att det ska mätas på ett riktigt vetenskapligt sätt så ska man nog vara lite noggrannare.
	DMS	*13. Har det enligt din uppfattning förekommit något motstånd mot beslutstödsystemet?* *13a. Vad för typ av motstånd?* *13b. Av vem har motståndet visats?*
13.1		**INTERVIEWER:** Ja...Sen kommer vi då till frågan, har det förekommit något motstånd mot systemet?
13.2		**INFORMANT:** Nej, det kan jag inte säga att det har gjort här. Tidigare, jag har ju varit med länge, när jag skulle införa det nya journalsystemet, då var det uttalat motstånd. Jag är ändå en så pass stark person att man skojjar inte om det när jag är närvande så att säga utan det får de göra någon annanstans. Men då var det ganska mycket motstånd, protester, nu talar vi inte om det nuvarande systemet utan ett gammalt, nu har har de flesta fattat att det här med datorer inte går att undvika... och som jag brukar säga till de som gnäller. Varsågoda, finns det någon annan kan göra förbättringar i systemet så är de välkommna.
13.3	SIQ	**INTERVIEWER:** Vi pratade lite innan om IT-rådet *[före intervjun]* har dom visat något motstånd?
13.4		**INFORMANT:** Nej det kan man inte säga, det har de inte gjort. Man kan nog säga, inte rådet, men enskilda individer i högre possitioner har visat mostsånd, det har de gjort. Men det beror ju på att dom lever inte i den kulturen där man tar kritik, de ifrågasätter inte beslut, eller vissa så klart, De säger hela tiden ”*[Informant C]*, det är ju bestämt att vi ska ha cognos” och då svara jag ”var står det?” och då är det ingen som kan svara. Dom orkar inte ens läsa innantill, och tittar man noga på dom beslut som är fattade så står det att välldigt tydligt att cognos ska testas inte att det ska implementeras. Det gjordes en liten studie mellan diver och cognos eller liknande, men det skulle inte duga ur ett vetenskapligt perspektiv, enligt min uppfattning iallafall.
13.5	SIQ	**INTERVIEWER:** Jag har en fråga som egentligen återkopplar till en annan fråga...Det här med lagar och bestämmelser... vi pratade om det här att du kommer få statistik på läkarna.
13.6		**INFORMANT:** Jajamensan
13.7		**INTERVIEWER:** Hur de har presterat i operationer etc.
13.8		**INFORMANT:** Ja
13.9		**INTERVIEWER:** Det finns inga problem med lagar med det för att arbetsgivaren kanske inte får hålla reda på information om varför du är sjuk och liknande.
13.10		**INFORMANT:** Det finns arbetssäkerhet. Vi har fått i uppdrag att driva den här verksamheten på ett effektivt sätt. Men naturligtvis måste vi ta hänsyn.
13.11		**INTERVIEWER:** Om det skulle nu skulle visa sig att någon kirurg inte presterar särskilt
13.12		bra....
13.13		**INFORMANT:** Ja
13.14		**INTERVIEWER:** Är det då tillräkligt underlag för att säga upp den här personen?
13.15		**INFORMANT:** Nej nej nej, det sköts på ett helt annat sätt. Egentligen är det kanske, jag skulle nog påstå att i de flesta fallen idag, den där kirurgen är nog redan känd i hans omgivning. De vet vilka brister som finns, däremot så är det välldigt farligt att blint följa siffrorna från ett sånt här system för man får ju inte med alla faktorerna runtomkring etc.
13.16		**INTERVIEWER:** För att återkoppla till USA igen, det är vissa kirurger som vägrar att ta vissa operationer för att de innebär för hög risk.
13.17		**INFORMANT:** Ja ja.
13.18		**INTERVIEWER:** När det det tex kommer in en äldre människa som behöver en avancerad operation så säger dom nej för risken för att patienten ska dö är för hög och det skulle se dåligt ut på deras statistik. Är det något ni är oroliga för med införandet av systemet?
13.19		**INFORMANT:** Nej, men det finns ju en diskussion inom svenska läkarkåren om hur man ska

		sköta och hålla tillräkligt hög kvalite, och det nuvarande systemet är välldigt tufft för den som drabbas och anklags för fel. Och det har varit en hel del saker som inte har haft almän förståelse för om det är rätt eller inte. Och man har velat ha ett annat system likande de vid flyg, där man helt och hållet registrerar avvikelser och återför dom omedelbart till de ansvariga. Man kopplar loss de från den enskilde som begick misstaget för det får man sköta på ett annat sätt, men misstagen måste komma fram. Med mycket kort tidsfördröjning. Men det är en diskussion som pågår.
13.20	SIQ	**INTERVIEWER:** Ok bara ifall det var något som ni hade tänkt på i detta systemet.
13.21		**INFORMANT:** Nej
13.22		**INTERVIEWER:** Nej. En annan fråga, När ni har gjort egna mätningar på QlikView systemet, vad är det ni har tittat på då? Har ni tagit fram krav innan eller vad har ni tittat på?`
13.23		**INFORMANT:** Nej det kan jag inte säga att vi har gjort. När jag var ansvarig för hela sjukhuset för ca 10 år sedan då tittade vi på flera olika system, men jag hade inte resurser att göra det systematiskt, inte kompentens heller för den delen. Men det var för att enheten skulle göra en ordentlig utvärdering men det gjorde man alltså inte för det är en ganska krävande sak faktist, det kräver mycket kompetens och resurser att ens göra utvärderingen, så är det ju.
13.24		**INTERVIEWER:** Men ni har ändå gjort några utvärderingar på systemet som det ser ut idag? Eller?
13.25		**INFORMANT:** Vi har inte jämnfört det men vi har noterat skildnader och så. Vi har haft folk som har jobbat med både business objects och andra system, ett par tre andra system, och det har visat sig så uppenbart att dom har varit sämmre. Men vi har faktist ställt samman en del information det har vi gjort.
13.26	SIQ	**INTERVIEWER:** Men har ni baserat det på siffror då eller, att man kan se att det är mindre patienter....
13.27		**INFORMANT:** Ja med siffror
13.28	SIQ	**INTERVIEWER:** Men ni har inte tagit fram några egna mätvariabler eller liknande?
13.29		**INFORMANT:** Nej det har vi inte gjort. Jag tyckte att det var ett ansvar för regionen, att fixa det. Men det har inte blivit gjort.
13.30	SIQ	**INTERVIEWER:**Hur långt in i utvecklingsprocessen är ni?
13.31		**INFORMANT:** För att?
13.32		**INTERVIEWER:** Med QlikView innan ni....
13.33		**INFORMANT:** Kan släppa ut det till användarna?
13.34		**INTERVIEWER:** Ja
13.35		**INFORMANT:** Vi kan släppa ut det idag. Vi är nästan helt framme kan man säga. Det som fattas är kontrollen och tillförlitligheten. Vi tar ut systemen vi pratar om operett och andra statestikverktyg och jämnför det som vi får ut i ett system med de siffrorna vi får ut i det andra och då ser vi eventuella avvikelser. Men då är det inte alldels enkelt att förklara vad en avvikelse beror på. Idag så tror man ju att när man använder dom här i systemet vi har, att det är rätt och sant det som man får ut,så är det ju inte, det vet man ju ingenting om och vi är där just nu att vi har avvikelser och vi resonerar på det sättet att har vi avvikelser inom 1-2% så bryr vi oss inte för det tar för lång tid att gå igenom allt. Titta på SQL satserna, titta på definitioner etc etc. Det kan vi göra i QlikView, eller jag kan göra det, men däremot så kan vi inte så enkelt göra det i de gammla systemen, och precis just där sitter vi idag, att vi ser vissa avvikelser som är lite för stora och som är störande, och då kan det visa sig att det har släpat med skräp eller vad man ska säga, när man har utvecklat de här systemen därför att det inte har uppmerksammats att de kanske inte alltid har tillförlitlig data, det är klart att det har haft det allmänt.... Man kan göra på flera olika sätt. Ett sätt är att göra en jämnförelse mella system, men det säger inte vad sanningen är, det vet man forfarande inte, och det är inte säkert det är så lätt att nå sanningen.
13.36	SIQ	**INTERVIEWER:** Det var alla frågor vi hade, är det något mer du själv vill tillägga eller fråga om?
13.37		**INFORMANT:** Nej inte direkt, jag har pratat så mycket nu.

Appendix 7 - Follow-up questions (Swedish)

Informant A

Hej *[Informant A],*

Tack så mycket för att du tog dig tid att svara på våra frågor när vi var i Göteborg. Vi har dock ett par följdfrågor till dig om systemet för att förtydliga vissa aspekter.

1. Vilken del av beslutsprocessen stödjer system huvudsakligen? Är det (1) problemklassificering, (2) formulering av lösningar, eller (3) val av specifik lösning?
Problemklassificering

2. Kan systemet flagga patienter som är avviker på något sätt? Till exempel patienter som är extra känsliga för infektioner?
Vi har inte arbetet med frågan, det är möjligt att det går alldeles utmärkt

3. Är lagar som påverkar systemanvändningen implementerade på något sätt i själva systemet? Till exempel, kan en systemanvändare utan korrekta rättigheter titta på data som denne inte ska ha tillgång till (med PUL, PjL, patientsekretess, etc. i åtanke)?
Vi lägger olika behörigheter i systemet som ger olika tillgång till systemet

Tack ännu en gång för din hjälp. Vi återkommer med själva transkiberingen av intervjun så snart som möjligt.

Med vänliga hälsningar,
Joel & Robin

Informant B

Hej *[Informant B]*,

Tack så mycket för att du tog dig tid att svara på våra frågor när vi var i Göteborg. Vi har dock ett par följdfrågor till dig om systemet för att förtydliga vissa aspekter.

1. Hur pass viktigt är urformandet av gränssnittet för ditt arbetsflöde?
Jag tycker att gränssnittet är väldigt viktigt (om ni menar det grafiska?). Det tar så klart längre tid att jobba med QV (eftersom jag inte gör det varje dag utan det går perioder då jag inte öppnar det alls och sedan perioder när jag sitter varje dag) när det ser ut som det gör. Smått och plottrigt och inte alltid tydligt vad för urval man gör när man skall hämta data.. Det beror förstås på vilka som skall använda det. Men hos oss så talar man ju om att programmet skall ut till alla ort avd så att respektive avd själva skall bearbeta materialet. Det innebär att det är "vanliga" ssk som kommer att göra det (vilka i de flesta fall bara är vanliga datoranvändare). Som jag nämnde så bör det se ut mer som en vanlig websida med möjlighet till personliga inställningar som alltid sparas. Som QV ser ut nu så är det mer anpassat till läkare/forskare som är vana att läsa rapporter/forskningsresultat. Sedan är det ju ett problem att data inte uppdateras i realtid utan det tar ett dygn innan man kan se "färska" siffror. Nuförtiden (= datorisering) så är det alldeles för långsamt. Det är inte riktigt rimligt att man får pausa arbetet till dagen efter för att invänta uppdatering innan man kan jobba vidare.

2. Är lagar som påverkar systemanvändningen implementerade på något sätt i själva systemet? Till exempel, kan en systemanvändare utan korrekta rättigheter titta på data som denne inte ska ha tillgång till (med PUL, PjL, patientsekretess, etc. i åtanke)?
Som det är nu så är det inte möjligt för obehöriga att överhuvudtaget gå in i QV eftersom det bara är jag på på min avd som har programmet på min dator (vet ju inte hur det är på staben). Det är en test version vi använder med ett gemensamt lösenord (jag har alltså samma lösen som [Informant C] och [Informant A] använder (tror jag iallafall)) så det är ju egentligen mkt dålig säkerhet. Men hade det funnits tillgänligt på alla datorer så hade det räckt med lösenord för att nå känsliga uppgifter/sekretessbelagda. Det är ju namn, personnummer, koder till utförda operationer och uppgifter om komplikationer under vårdtiden . Uppgifterna i QV kan alltså berätta en hel del om enskild patient och det bör vara samma säkerhet som det är för den vanliga patientjournalen. Jag vet egentligen hur säkerheten ser ut i systemet eller hur lagarna är implementerade eller hur man har

tänkt framöver. Om lösenord/behörighet skall kopplas till samma behörighet man har i patientjournalsystemet (det är ju lite olika beroende på yrkeskategori) eller ej.

Tack ännu en gång för din hjälp. Vi återkommer med själva transkiberingen av intervjun så snart som möjligt.

Med vänliga hälsningar,
Joel & Robin

Informant C

Hej *[Informant C]*,

Först vill vi bara tacka för att du tog dig tid att prata med oss när vi var i Göteborg. Det var ett väldigt givande möte och vi uppskattar all den hjälp du ger oss. Vi har dock lite följdfrågor till dig om systemet för att förtydliga vissa aspekter.

1. Flaggar systemet om någonting är fel? (Meddelar systemet användaren vid datafel/procedurfel/etc)
Nej, inte idag

2. Kan systemet flagga patienter som är avviker på något sätt? Till exempel patienter som är extra känsliga för infektioner eller liknande?
Ja, och detta testade vi i i den inledande studien på neurokir

3. Vilken del av beslutsprocessen stödjer system huvudsakligen? Är det (1) problemklassificering, (2) formulering av lösningar, eller (3) val av specifik lösning?
1. p 1. problemklassif

4. Är lagar som påverkar systemanvändningen implementerade på något sätt i själva systemet? Till exempel, kan en systemanvändare utan korrekta rättigheter titta på data som denne inte ska ha tillgång till (med PUL, PjL, patientsekretess, etc. i åtanke)?
nej inte idag .. ingen kan gå in i syst utan behörighet , loggning sker

4.1 Om ja, kommer restriktioner att implementeras i ett senare skede eller ligger ansvaret hos användarna?
jfr ovan

5. Existerar det eller har det existerat något direkt motstånd mot systemet i form av officiella dokument, handlingar eller liknande?
Nej

Sedan så undrar vi ifall vi skulle kunna få de officiella dokumenten med kostnadssiffrorna för systemet. Vi skulle även uppskatta ifall vi kunde få de officiella dokumenten med de procentuella förbättringarna inom vården?
K kostnaderna är inte samman ställda - men mln tummen och pekfingr : 3 - 4 milj SEK idag
Förbättringar i % framgår av sammanfattningen

Med vänliga hälsningar,
Joel & Robin

Appendix 8 - Follow-up questions (English)

Informant A

1. What part of decision process does the system mainly support? Is it (1) the classification of the problem, (2) formulation of solutions, (3) Deciding what solution to use?
2. Can the system flag patients who deviate from the norm? For example patients that is extra sensitive to infections or similar?
3. Are the laws that affect the use of the system implemented in any way in the actual system? For example, can a user without the right access rights look at data which he/she should not be able to have access to?

Informant B

1. How important is the design of the user interface for your workflow?
2. Are the laws that affect the use of the system implemented in any way in the actual system? For example, can a user without the right access rights look at data which he/she should not be able to have access to?

Informant C

1. Does the system flag if anything is wrong? (Does the system notify the user of data errors/procedural errors/etc)
2. Can the system flag patients who deviate from the norm? For example patients that is extra sensitive to infections or similar?
3. What part of decision process does the system mainly support? Is it (1) the classification of the problem, (2) formulation of solutions, (3) Deciding what solution to use?
4. Are the laws that affect the use of the system implemented in any way in the actual system? For example, can a user without the right access rights look at data which he/she should not be able to have access to?
   4.1 If yes, will restrictions be implemented at a later stage or does the responsibility lie with the users?
5. Does it exist or has there existed any direct resistance towards the system in the form of official documents, records or similar?

Appendix 9 - Figures of evaluated clinical DSS

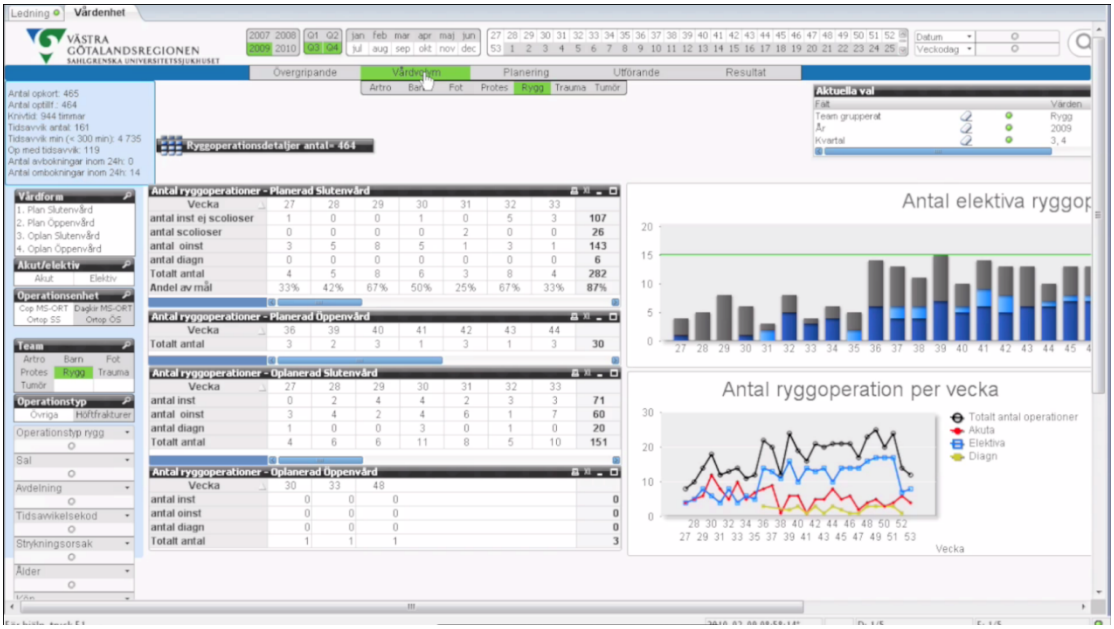

Figure 9.1. Care volume sub view of GMUV (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

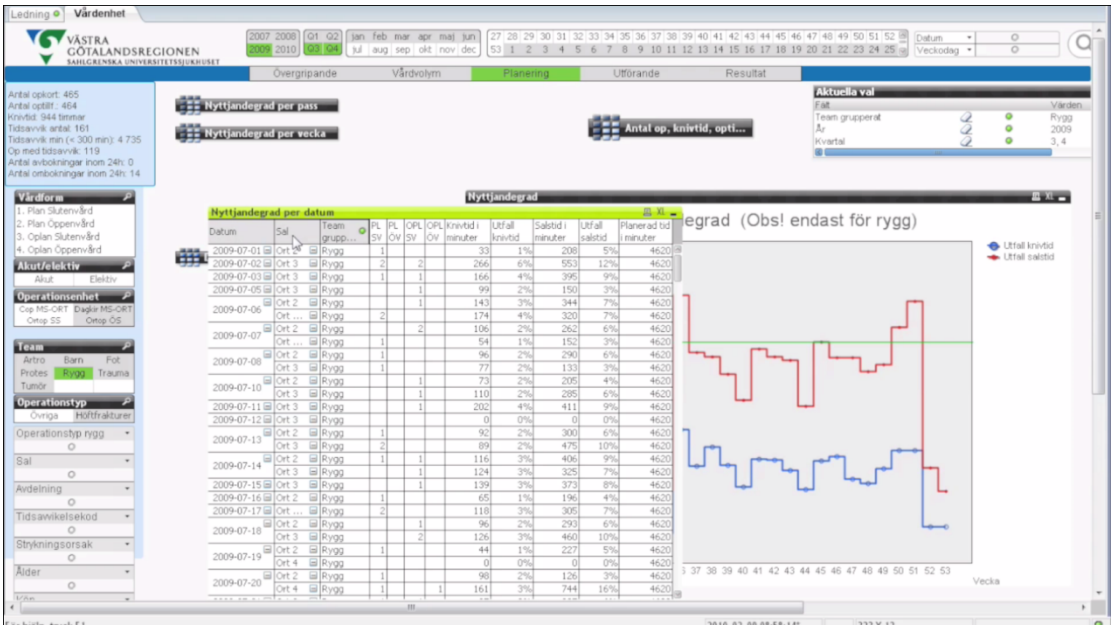

Figure 9.2. Planning sub view of GMUV (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

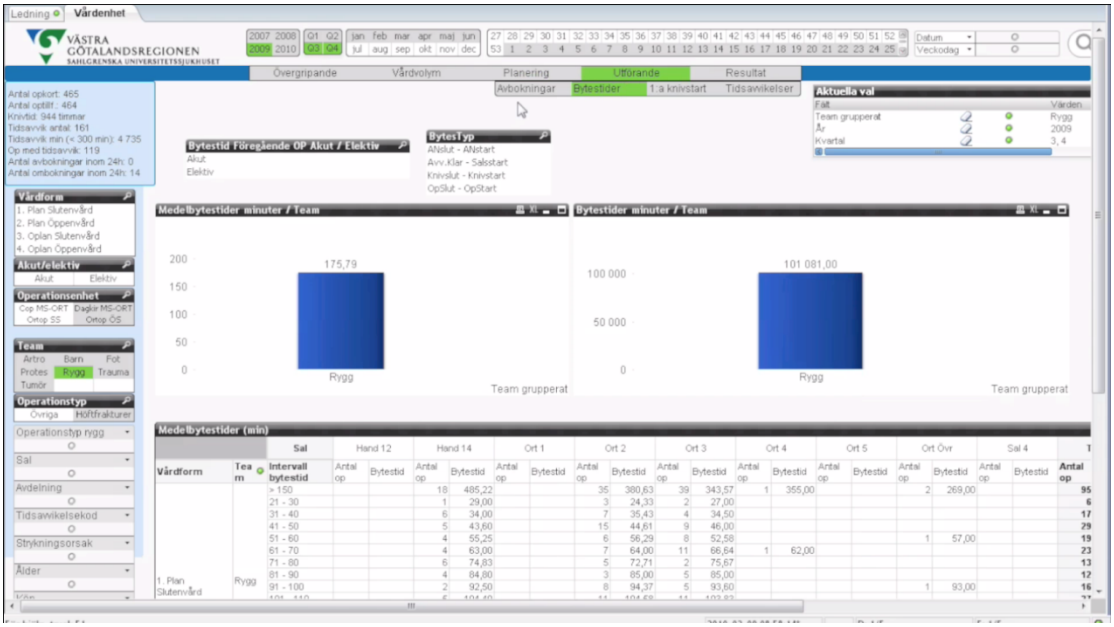

Figure 9.3. Execution sub view of GMUV (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

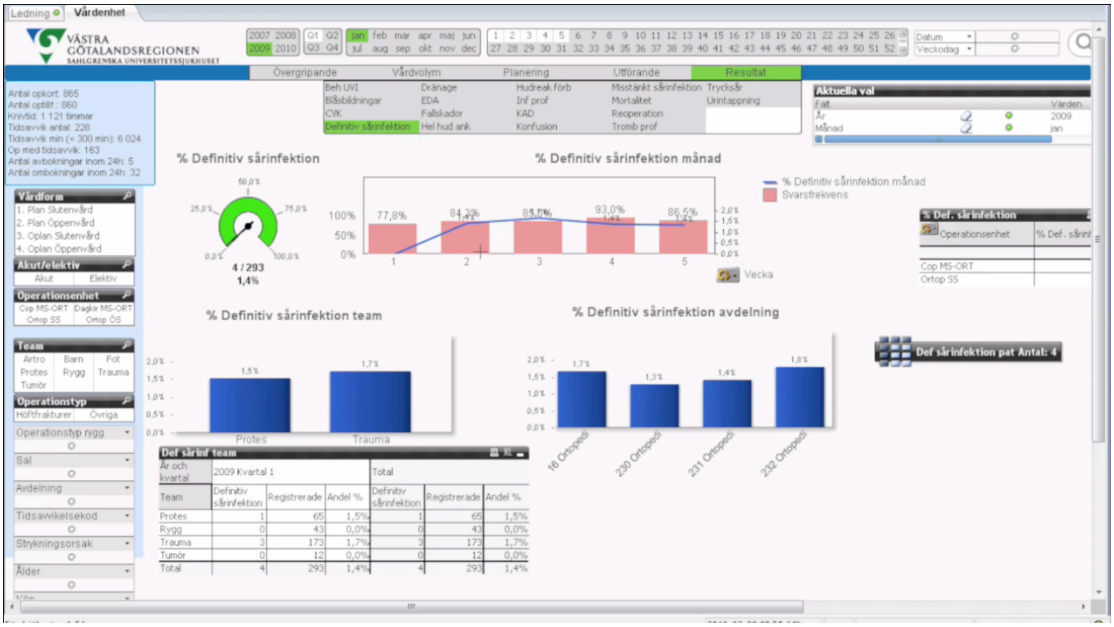

Figure 9.4. Result sub view of GMUV (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

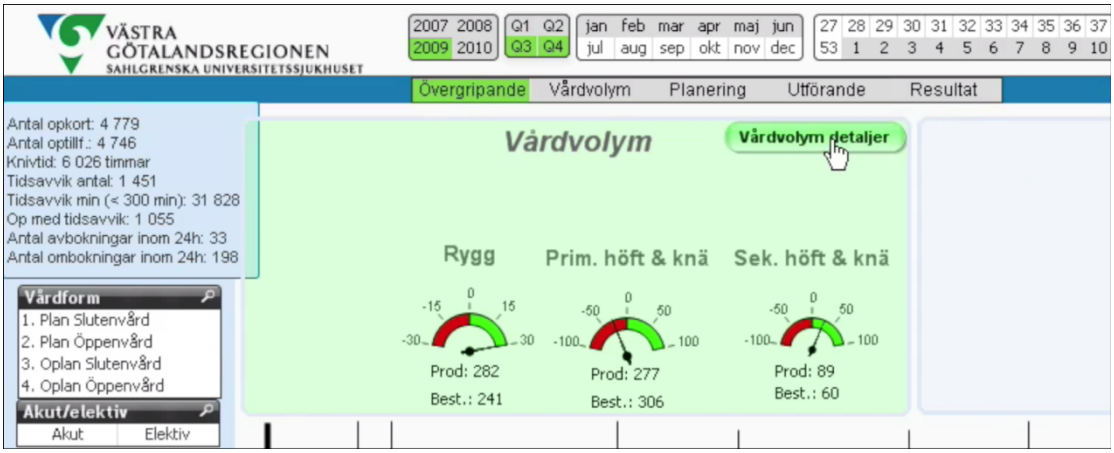

Figure 9.5. Prosthesis stocks (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

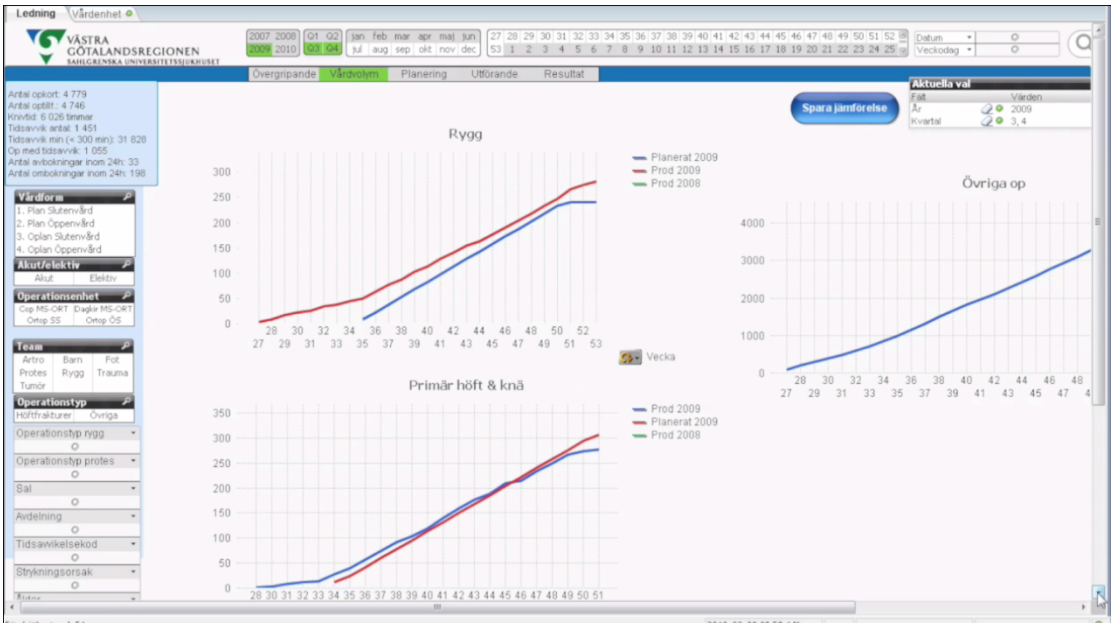

Figure 9.6. Prosthesis stocks through time (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

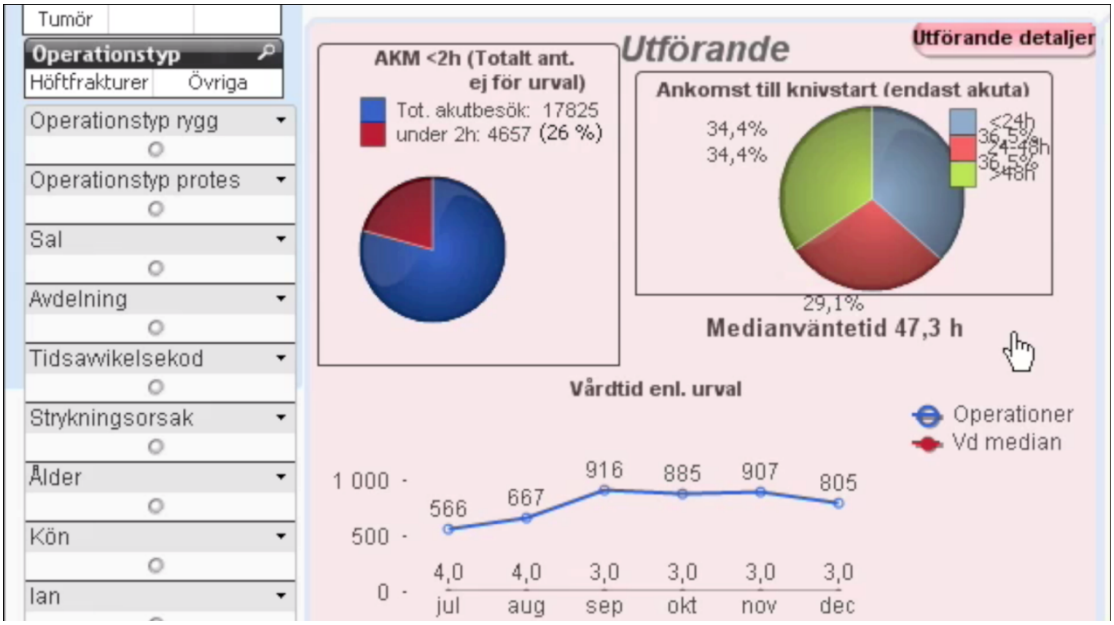

Figure 9.7. Waiting times (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

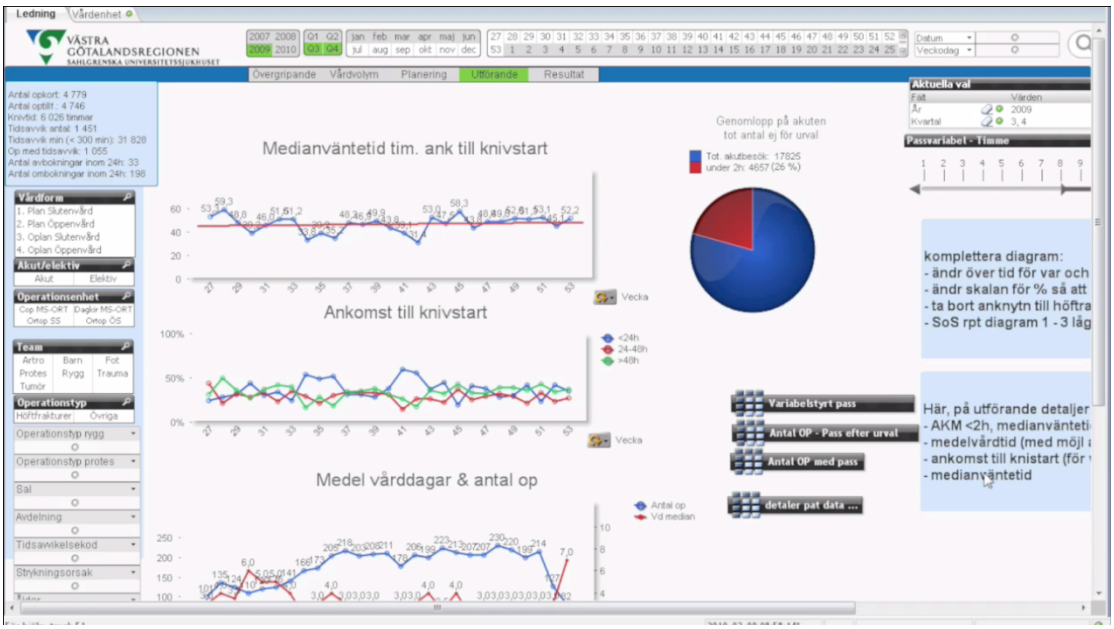

Figure 9.8. Time from arrival to surgery (Department of Orthopedics at Sahlgrenska University Hospital, 2010d)

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